List of Appendices

Appendix 1: Ecosystem Representation in the GMUG National Forest

Appendix 2: Annotated Bibliography on Economic Benefits of Protected Public Lands

Appendix 3: Sample reports from Headwater Economics EPS-HDT Application, available at http://headwaterseconomics.org/tools/eps-hdt

Appendix 4: Transportation Infrastructure and Access on National Forests and Grasslands: A Literature Review (May 2014)

Appendix 5: Survey conducted by Talmey-Drake Research & Strategy, Inc., a public opinion and market research firm in Boulder, Colorado

Appendix 6: Mountains to Mesas: Conservation Management Alternative for the GMUG (June 2005).

Appendix 1: Ecosystem Representation of Protected Areas in the GMUG National Forests

These comments address the role of ecosystem representation in the GMUG National Forests' land management planning process – particularly its evaluation of areas that may be suitable for inclusion in the National Wilderness Preservation System (NWPS). As explained below and illustrated by the accompanying maps and data, the GMUG National Forests hosts numerous ecosystem types that are poorly-represented in the NWPS both regionally and nationally. Given the central importance of ecosystem diversity to conserving biological diversity and satisfying the requirements of the 2012 National Forest System Land Management Planning Rule, 36 C.F.R. part 219, the ongoing wilderness evaluation and planning process presents a crucial opportunity for the GMUG National Forests to increase the diversity of ecosystems that are protected as part of the NWPS or through other special designations.

I. Ecological Importance of Ecosystem Representation in Wilderness and Other Protected Areas

Wilderness and other protected conservation areas are the cornerstones of most regional, national, and international efforts to conserve biological diversity and ecological processes of natural ecosystems (Bertzky *et al*. 2012). Research has shown that protected areas reduce the loss, degradation, and fragmentation of natural habitats (Bruner *et al*. 2001; Naughton-Treves *et al*. 2005) and slow the rate of extinction of threatened species that occur therein (Butchart *et al*. 2012). Conversely, federal public lands in the United States that are managed for a variety of uses including mining, logging, and motorized recreation – and not primarily for conservation purposes – do not have the same benefits. Recognizing the central importance of protected areas in conserving biological diversity, the International Convention on Biological Diversity recommends that at least 17% of the world's terrestrial areas be conserved by 2020 (Woodley *et al*. 2012). To that end, the NWPS already serves as the world's largest national system of highly-protected conservation areas.[1]

Wilderness and other protected areas, however, can help achieve biodiversity targets only if they are located in the right places – that is, if they are ecologically representative of terrestrial ecosystems. This "representation" approach assumes that for protected areas to conserve genetic, species, and community diversity – as well as the composition, structure, function, and evolutionary potential of natural systems – they

[1] The NWPS contains 21 million hectares in 690 units, covering nearly 1/5 of what the International Union for Conservation of Nature (IUCN) classifies as "category 1 areas," or the most natural and highly protected areas worldwide. By contrast, the IUCN classifies general Forest Service matrix lands as "GAP Status 3" – "Area having permanent protection from conversion of natural land cover for the majority of area. Subject to extractive uses of either broad, low-intensity type (eg. Logging) or localized intense type (eg. Mining)." – which is not considered a "protected" category for biodiversity purposes.

must encompass the full variety of ecosystems (Olson & Dinerstein 1998; Margules & Pressey 2000). In other words, protection of distinct ecological communities in turn protects the species that rely on them and the natural ecological processes that are characteristic of those ecosystems (Rodrigues *et al*. 2004; Bunce *et al*. 2013). According to the Convention on Biological Diversity, the percentage of terrestrial ecosystems protected by 2020 (with a target of 17%) is one indicator of how well ecosystems are represented throughout the global network of protected conservation areas (Woodley *et al*. 2012).

Despite its importance, our analysis of ecosystem representation in the NWPS (Dietz *et al.* 2015) – which is described in detail below – shows that the NWPS suffers from a significant under-representation of many ecosystems. Over 20% (117) of the 553 types of unique ecosystems occurring on federal lands in the contiguous United States are not included in the NWPS. Even more concerning is that less than half of those 553 ecosystems are more than nominally represented: only 244 ecosystem types have at least 5% of their federal land area protected in the NWPS. And at a more reasonable 20% target for biodiversity conservation purposes, that number falls to only 113 ecosystems with at least 20% of their federal land area protected in the NWPS. 95% of that diversity was achieved by 1994, and wilderness designations over the past 15 years have added only 1 new ecosystem type above the 20% threshold. Moreover, there is not a clear correlation between how rare an ecosystem is on federal lands and how well it is represented in the NWPS. We found that there are many ecosystem types that are common on federal lands (covering over 100,000 hectares) but are poorly represented in the NWPS.

With the Wilderness Act over 50 years old (signed into law on September 3, 1964), it is important to begin to remedy this under-representation of ecosystems in the NWPS. Human population growth, climate change, and pressure for development and extraction of natural resources make wilderness and other protected areas increasingly vital to conserve biological diversity. Given those pressures and stressors, we must establish a network of connected wilderness and other protected areas that represent the full expression of ecosystem diversity.

II. Regulatory Requirements to Evaluate Ecosystem Representation

Given the regional, national, and global importance of ecosystem representation in the NWPS and other protected areas, the 2012 National Forest System Land Management Planning Rule requires the Forest Service to evaluate and incorporate ecosystem representation into its forest assessment and planning processes. Indeed, protecting ecosystem diversity is a central purpose of forest planning under the Rule:

> Plans will guide management of [National Forest System] land so that they are ecologically sustainable and contribute to social and economic sustainability; ***consist of ecosystems and watersheds with*** ecological

> integrity and ***diverse plant and animal communities***; and have the capacity to provide people and communities with ecosystem services and multiple uses that provide a range of social, economic, and ecological benefits for the present and into the future.

36 C.F.R. § 219.1(c) (emphasis added).

To satisfy the 2012 Planning Rule's ecosystem diversity mandate, forests are first required to identify and evaluate existing designated areas, including wilderness, and the potential need and opportunity for additional designated areas as part of the assessment phase. *Id.* § 219.6(b)(15). In doing so, the assessment should consider, among other things, whether there are "specific land types or ecosystems present in the plan area that are not currently represented or minimally represented within the wilderness system or system of research natural areas." Forest Service Handbook (FSH) 1909.12, ch. 10, § 14 (Feb. 14, 2013 draft).

Next, during the plan development or revision phase, the Forest Service is required to "[i]dentify and evaluate lands that may be suitable for inclusion in the [NWPS] and determine whether to recommend any such lands for wilderness designation." 36 C.F.R. § 219.7(c)(2)(v). In evaluating potential wilderness areas, the agency must, among other things, "[e]valuate the degree to which the area may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value." FSH 1909.12, ch. 70, § 72.1(4); *see also* 16 U.S.C. § 1131(c)(4) (wilderness, as defined by the Wilderness Act of 1964, "may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value"). "Such features or values may include[r]are plant or animal communities or rare ecosystems," with rare being "determined locally, regionally, nationally, or within the system of protected designations." FSH 1909.12, ch. 70, § 72.1(4).

In addition to identifying and evaluating areas to recommend for wilderness designation, the 2012 Planning Rule also requires the agency to "[i]dentify existing designated areas other than [wilderness] and determine whether to recommend any additional areas for designation." 36 C.F.R. § 219.7(c)(2)(vii). Those special designations may include, for example, ecological areas, botanical areas, or Research Natural Areas (RNAs), which are designed to "[m]aintain a wide spectrum of high quality representative areas that represent the major forms of variability . . . that, in combination, form a national network of ecological areas for research, education, and maintenance of biological diversity . . . [and s]erve as a baseline area for measuring long-term ecological changes." Forest Service Manual 4063.02; *see also* 36 C.F.R. § 219.19 (Forest Service may designate RNAs as part of planning process).

Complementing the requirement to consider ecosystem representation in determining suitability for wilderness and other special designations, the 2012 Planning Rule directs that plans generally provide for ecological sustainability and integrity and "the diversity of plant and animal communities and the persistence of native species." 36 C.F.R. §§ 219.8-219.9. The Forest Service cannot satisfy those substantive mandates without adequately protecting ecosystem diversity in the plan area. For example, plans "must include plan components, including standards or guidelines, to maintain or restore the diversity of ecosystems and habitat types[, including r]are . . . plant and animal communities." *Id.* § 219.9(a)(2). With conflicting management and resource demands and human-caused stressors such as climate change that threaten ecosystem diversity and integrity, plans simply cannot restore or maintain the diversity of plant and animal communities absent a robust network of protected areas that adequately represent that diversity.

Collectively, these various procedural and substantive mandates commit the agency to a meaningful evaluation and consideration of under-represented and rare ecosystems, and to formulating and adopting plan components, recommendations, and designations that adequately protect and preserve the forest's diversity of plant and animal communities. In doing so, the agency is required to use "the best available scientific information." *Id.* § 219.3. As described in the methodology section below, we believe our analysis of ecosystem representation represents the best available scientific information, and we encourage the Forest Service to incorporate it into its wilderness evaluation and the broader planning process.

III. <u>Methods and Analysis of Ecosystem Representation</u>

We conducted an analysis of ecosystem representation in wilderness at the national- and forest-level scales to provide the best available scientific information for the ongoing wilderness evaluation and forest planning processes.

According to the U.S. Geological Survey (USGS), the contiguous United States contains 565 terrestrial, non-developed ecosystems. In this study, we analyzed representation of those ecosystems by comparing their areas in the NWPS with their areas on federal land at both the national and forest levels in order to calculate a percent representation:

> Equation 1: *(area of ecosystem in the NWPS/area of ecosystem on federal land)*100*[2]
>
> Equation 2: *(area of ecosystem in the NWPS on the* GMUG *NF/area of ecosystem on the* GMUG *NF)*100*

We conducted these calculations at the finest scale for which consistent, spatially-explicit vegetative land-cover data is available: the 6th level of the National Vegetation

[2] We used federal land, as opposed to all land, within the contiguous United States to better assess where ecosystems are under-represented on lands potentially available for wilderness designation.

Classification System (NVCS 2008).[3] That data is from the USGS Gap Analysis Program (GAP) national land-cover data version 2 at 30-meter resolution (USGS 2011).

We obtained spatial data of the NWPS from the University of Montana College of Forestry and Conservation's Wilderness Institute at wilderness.net, which maintains the most up-to-date spatial data on wilderness areas. To map federal land area, we used the U.S. Protected Areas Database (PAD-US) version 1.3 (USGS 2012), which includes geographic boundaries, land ownership, land management, management designation, parcel name, area, and protection category.[4]

We overlaid the NWPS and all federal lands with land-cover data in a Geographic Information System (ArcGIS 10.2) to calculate and compare the total area of each ecosystem within the NWPS and federal land. We then calculated the percent of each ecosystem within the NWPS based on all area occurring on federal land (Equation 1, above).[5] This was part of a national assessment that we conducted (Dietz *et al.* 2014 (*in revision*)).

We did the same calculations at the forest level. We extracted land-cover data and clipped it to the forest boundary, and then calculated the percent of each ecosystem within the GMUG's 10 existing wilderness areas based on all federal land area occurring on the Forest (Equation 2, above).

Next we classified representation for each scale into four classes (<5%, 5-9.9%, 10-19.9%, ≥20%) and mapped them across the entire national forest. We considered ecosystems with <19.9% of their total area in the NWPS as inadequately represented.

We then brought the Colorado Roadless Areas (CRAs) for the GMUG National Forest into Arc and created a new shapefile that included only the CRAs. This allowed us to focus our analysis on the areas that are potentially suitable for wilderness designation by tabulating the area of each ecosystem occurring within each CRA (see attached matrix, "Ecosystem Composition of Colorado Roadless Areas.xlsx"). Values within the matrix are the estimated acres of each ecosystem occurring within each CRA.

We used these data to calculate the proportion (%) of each CRA that is composed of ecosystems inadequately represented in the NWPS by each of the 3 lower

---

[3] The NVCS classifications are as follows: 1) Class; 2) Subclass; 3) Formation; 4) Division; 5) Macrogroup; **6) Group (a.k.a. ecological system, to which we refer in this study as "ecosystem")**; 7) Alliance; and 8) Association.

[4] The PAD-US is a national inventory of terrestrial and marine protected areas that are managed to preserve biological diversity and other natural, recreation, and cultural uses.

[5] For example, when we say "boreal aspen-birch forest has 19% representation in NWPS," we mean that 19% of all federal land encompassing that ecosystem type is protected as wilderness in the NWPS.

representation classes (<5%, 5-9.9%, 10-19.9%) and for both scales of representation. For example, we calculated that 99% of Calamity Basin is in under-represented ecosystem types.

IV. Results

Our analysis shows that a majority of the CRAs contain high proportions of inadequately represented ecosystems at both the forest-level and national scales (Tables 1 & 2; Maps 2 & 3). Additionally, all of the CRAs contain at least one underrepresented ecosystem. Out of the 76 CRAs on the GMUG, over half of the units are mostly (>50%) composed of underrepresented ecosystems on both forest and federal levels. Additionally, over 550,000 acres of the 898,819 acres of CRAs on the forest are underrepresented on forest and federal levels.

In many instances, the addition of one CRA would elevate particular ecosystems into adequate representation (Table 4). For example, adding Kannah Creek CRA into the NWPS would elevate the Inter-Mountain Basins Mat Saltbush Shrubland into adequate representation (>20% representation). Even one of the more prevalent ecosystems on the GMUG, the Colorado Plateau Pinyon-Juniper Woodland, could achieve adequate representation with the addition of 3 CRAs (Kannah Creek, Sunnyside, and Kelso Mesa). In addition to these ecosystems, 7 others could achieve adequate representation on the forest level with the addition of one CRA.

More broadly, our analysis found that only 11 of the 47 ecosystem types found on the GMUG are adequately represented in wilderness on the forest level (Table 3, Tabs 1 & 2). The story is even more extreme on the federal level, with only 7 out of the 47 ecosystems showing adequate representation (Table 3, Tabs 1 & 3) Underrepresented ecosystems on the forest level cover over 58% (1,718,474 acres) of the GMUG, with federally underrepresented ecosystems spanning over 41% (742,213 acres) of the forests.

Notably, many under-represented ecosystem types on the GMUG are also some of the most common (Table 3, Tabs 2 & 3). The most prevalent ecosystem on the GMUG, the Rocky Mountain Aspen Forest and Woodland, covers over 17% (524,280 acres) of the GMUG but is underrepresented on the both forest and federal levels. Four other ecosystems span over 100,000 acres of the forest but are inadequately represented on forest and federal levels and include the Rocky Mountain Gambel Oak-Mixed Montane Shrubland, the Rocky Mountain Lodgepole Pine Forest, the Inter-Mountain Basins Montane Sagebrush Steppe, and the Colorado Plateau Pinyon-Juniper Woodland.

The attached maps and tables depict these results in detail, showing the following:

Map 1 “CO Roadless Units, GMUG National Forest”: Depicts each unit (polygon) in CRA inventory, outlined in black with hash marks, and with the forest boundary shaded green.

Map 2 “Ecosystem Representation on the Federal Level”: Color depiction of the results of Equation 1 (above), showing the level of representation in the NWPS of each ecosystem type at the national scale. For example, areas shown in red depict ecosystems that are represented in the NWPS at less than 5% of all available federal land. [CRAs outlined in black with cross-hatching]

Map 3 “Ecosystem Representation on the Forest Level”: Color depiction of the results of Equation 2 (above), showing the level of representation in the NWPS of each ecosystem type at the forest level. [CRAs outlined in black with cross-hatching]

Table 1, Tabs 1 & 2 “GMUG CRAs Representation”: Proportion (%) and acreage of each CRA composed of under-represented ecosystem types on the GMUG National Forest based on forest-level (Tab 1) or national-level (Tab 2) representation. Representation of each ecosystem type was quantified based on all available area on federal land and the individual forest. All ecosystems with <20% representation in the NWPS at each scale were broken into 3 levels of representation (<5%, 5-9.9%, and 10-19.9%). This table allows one to prioritize CRAs by proportion of land area as well as acreage that is composed of underrepresented ecosystems, at three levels.

Table 2 “Ecosystem Composition of Colorado Roadless Areas”: Values within the matrix are the estimated acres of each ecosystem type occurring within each CRA. This table depicts the specific ecosystem composition of each CRA.

Table 3, Tabs 1-3 “GMUG National Forest Ecosystems Representation”: These tables depict which ecosystems are under-represented at the forest-level and national scales. Tab 1 shows a complete list of ecosystem types found on the GMUG National Forest, and the proportion of each type in the NWPS at the forest-level and national scales. Tabs 2 and 3 show representation breakdowns at the three levels (<5%, 5-9.9%, and 10-19.9%) at the forest-level and national scales.

Table 4 “CRA Analysis of Ecosystem Composition”: This table shows the estimated acres of each ecosystem type occurring within each CRA unit. This table also shows how many acres of additional protection are needed to elevate a particular ecosystem into adequate representation, and how many units would be needed (if applicable) to achieve adequate representation on the forest level.

V. <u>Recommendations</u>

Sufficient ecosystem representation in the NWPS and other protected areas is crucial to achieving ecological integrity of the diverse plant and animal communities found in the GMUG. As described above and depicted in the attached maps and tables, our analysis shows that under-representation of ecosystems in the NWPS is a significant problem on the GMUG. Our analysis also shows that the vast majority of lands in the CRAs contain under-represented ecosystem types. Thus, the ongoing wilderness evaluation and planning process presents the Forest Service with a critical opportunity to prioritize protection of ecosystem diversity and begin to remedy the under-representation of numerous ecosystem types in the NWPS.

To that end, we urge the GMUG to use the representation information in the attached tables and maps and described above to evaluate the importance of each inventoried area in achieving diverse ecosystem representation in wilderness at the regional and national scales.[6] In addition, the forest should use this information more broadly in its planning process and determinations whether to designate or recommend for designation other areas such as RNAs, ecological or botanical areas, etc. As described above, we believe that this information is the best available science on ecosystem representation, which the agency is legally required to use in its planning process.

If you have any questions about the analysis or data, or would like to have the data in another format, please contact Phil Hartger (phil_hartger@tws.org).

[6] For example, Region 5 has made exceptional efforts to incorporate our analysis into the wilderness evaluation processes for the Inyo, Sequoia, and Sierra National Forests. The Region's wilderness team prepared a data summary for each inventoried unit, ranked by percent composition of under-represented ecosystems, to assess the relative opportunities in each unit to enhance ecosystem diversity. Those summaries are attached hereto.

Literature Cited

Bertzky, B., Corrigan, C., Kemsey, J. *et al*. (2012). *Protected planet report 2012: tracking progress towards global targets for protected areas*. IUCN, Gland, Switzerland and UNEP-WCMC, Cambridge, UK.

Bruner, A.G., Gullison, R.E., Rice, R.E. & da Fonseca, G.A.B. (2001). Effectiveness of parks in protecting tropical biodiversity. *Science*, **291**, 125-128.

Bunce, R.G.H., Bogers, M.M.B., Evans, D. *et al*. (2013). The significance of habitats as indicators of biodiversity and their links to species. *Ecol. Indic.*, **33**, 19-25.

Butchart, S.H.M., Scharlemann, J.P.W., Evans, M.I. *et al*. (2012). Protecting important sites for biodiversity contributes to meeting global conservation targets. *PLOS ONE*, **7** (3): e32529, 1-8.

Dietz, M.S., R.T. Belote, G.H. Aplet, & J.L. Aycrigg. 2015. The world's largest wilderness protection network after 50 years: An assessment of ecosystem representation in the U.S. National Wilderness Preservation System. Biological Conservation, 184: 431-438. Available at http://www.sciencedirect.com/science/article/pii/S0006320715000944.

Margules, C.R. & Pressey, R.L. (2000). Systematic conservation planning. *Nature*, **405**, 243-253.

National Vegetation Classification System, Version 2, Feb. 2008. (2008). Vegetation Subcommittee, Federal Geographic Data Committee. FGDC-STD-005-2008.

Naughton-Treves, L., Holland, M.B. & Brandon, K. (2005). The role of protected areas in conserving biodiversity and sustaining local livelihoods. *Annu. Rev. Env. Res.*, **30**, 219-252.

Olson, D.M. & Dinerstein, E. (1998). The global 200: A representation approach to conserving the Earth's most biologically valuable ecoregions. *Conserv. Biol.*, **12**, 502-515.

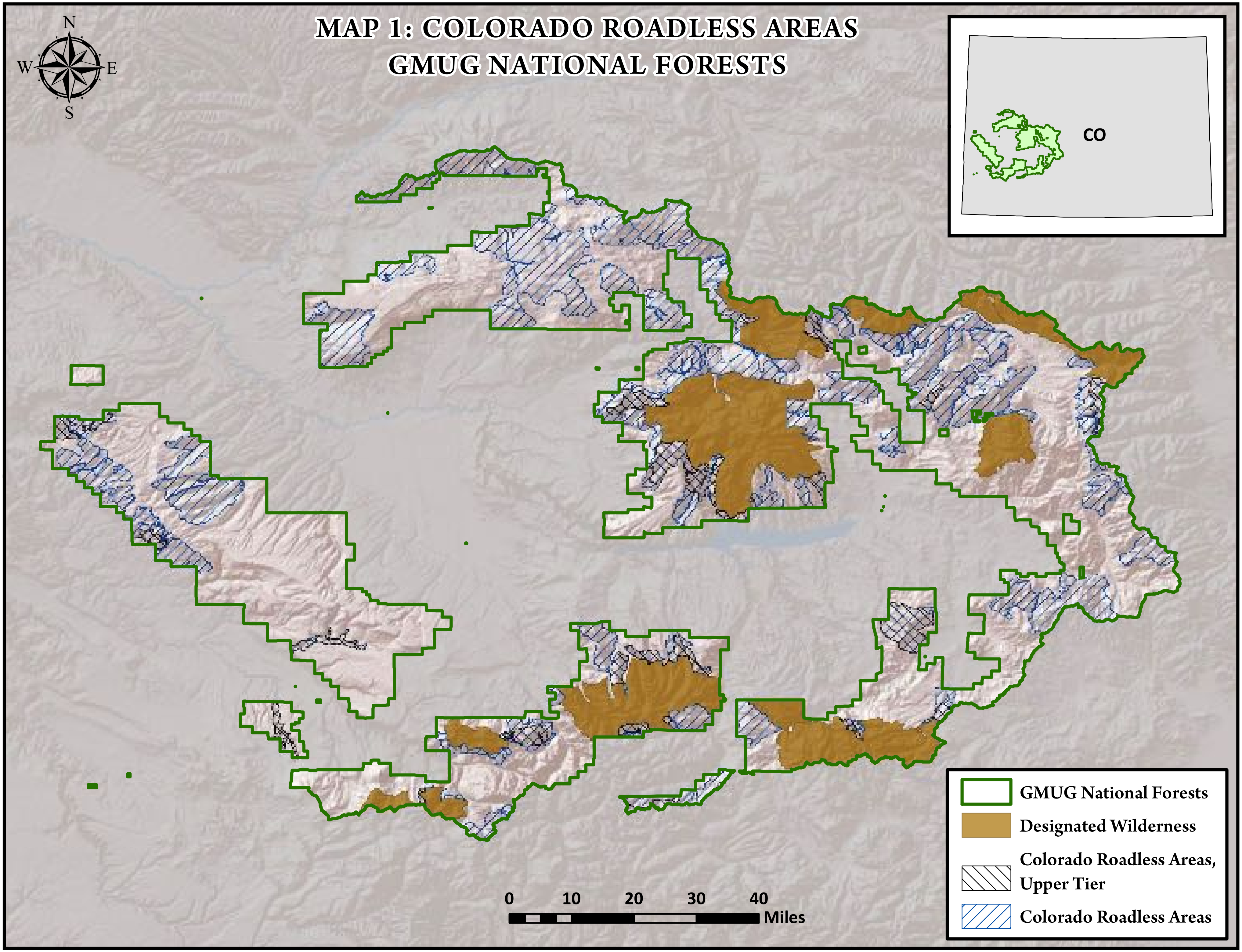
Rodrigues, A.S.L., Andelman, S.J., Bakarr, M.I. *et al*. (2004). Effectiveness of the global protected areas network in representing species diversity. *Nature*, **428**, 640-643.

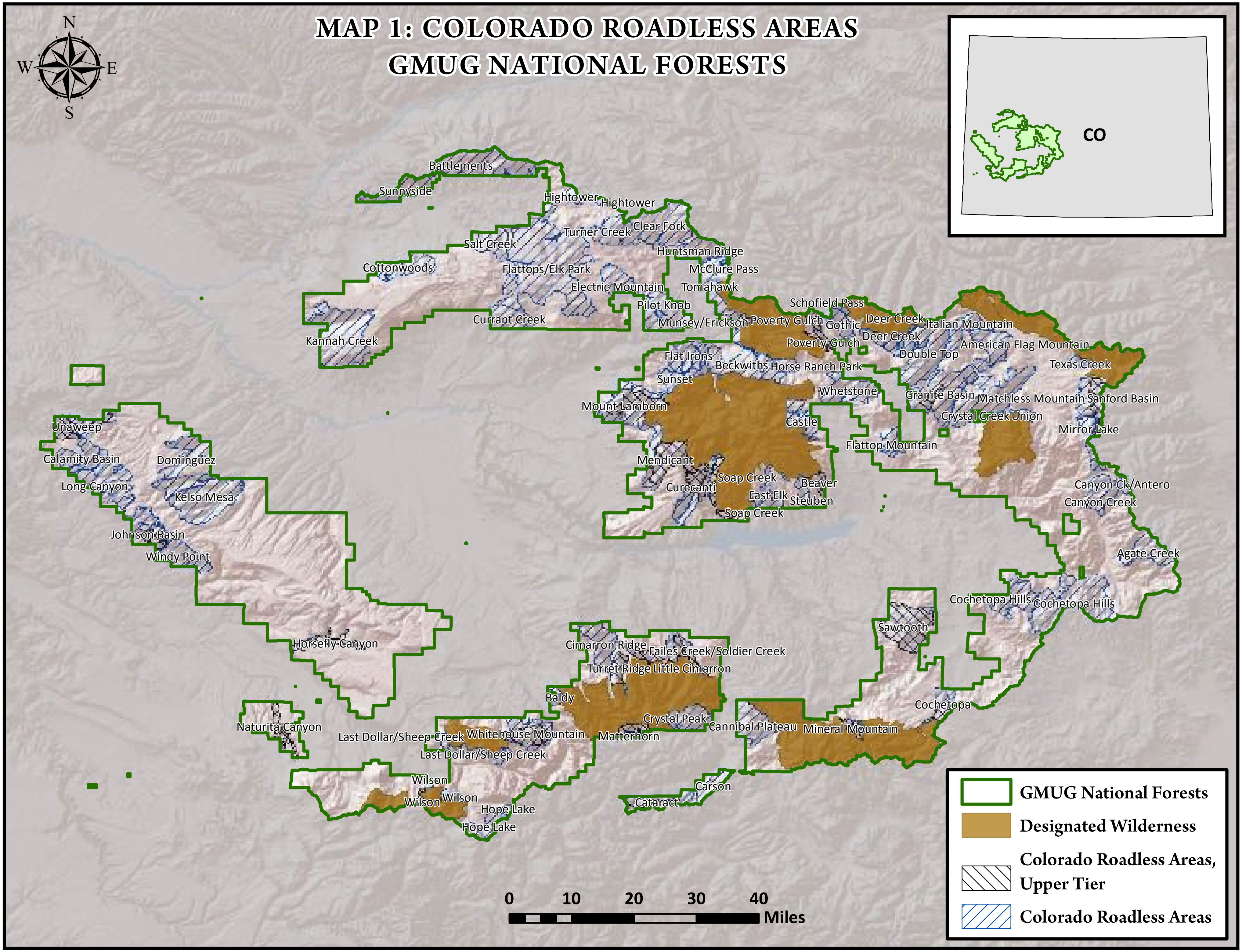
US Geological Survey, Gap Analysis Program (GAP). (2011). *National Land Cover*, version 2, August 2011. Accessed 15 January 2014: http://gapanlysis.usgs.gov.

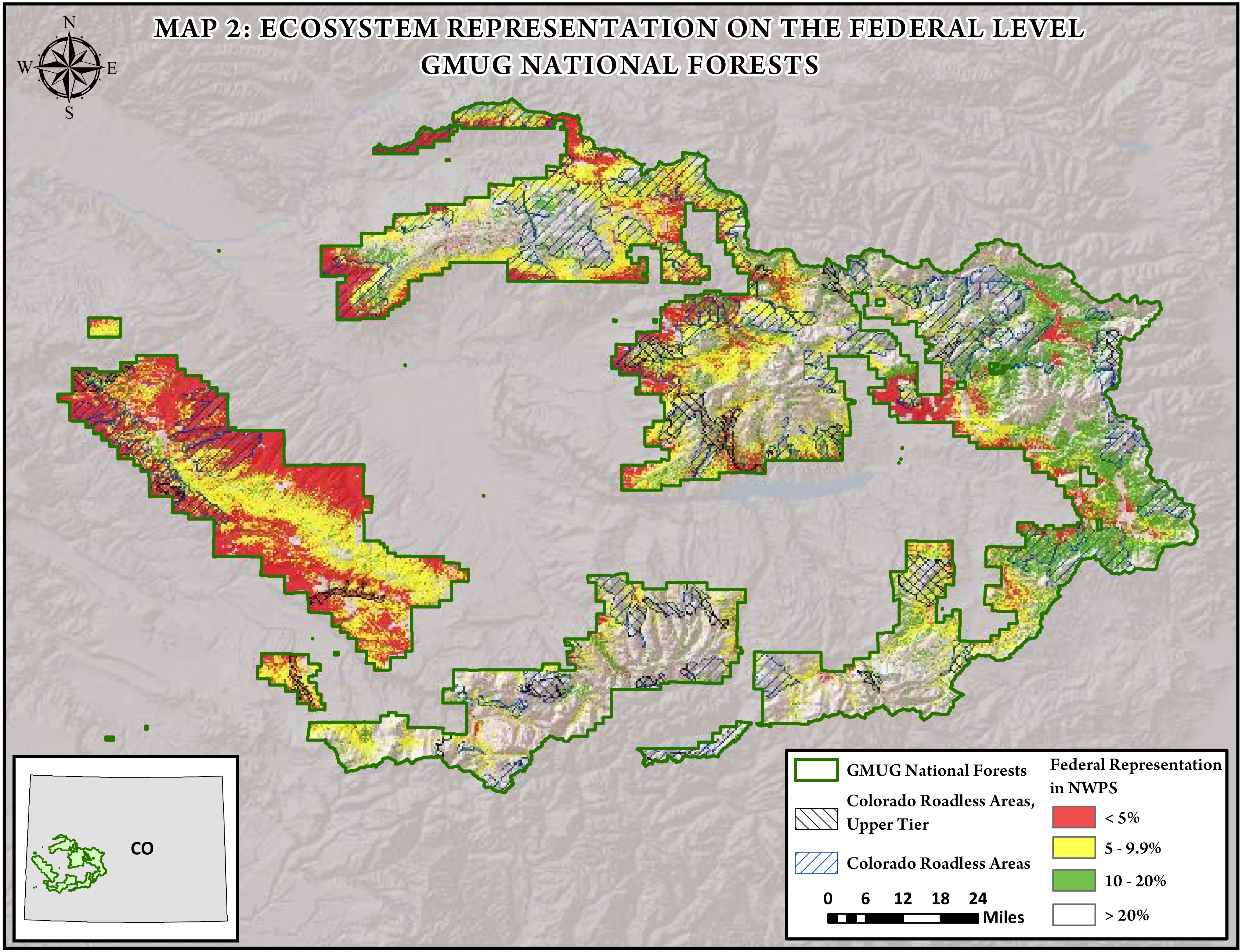
US Geological Survey, Gap Analysis Program (GAP). (2012). *Protected Areas Database of the United States* (PAD-US), version 1.3, combined feature class, Nov. 2012. Accessed 15 January 2014: http://gapanalysis.usgs.gov/padus.

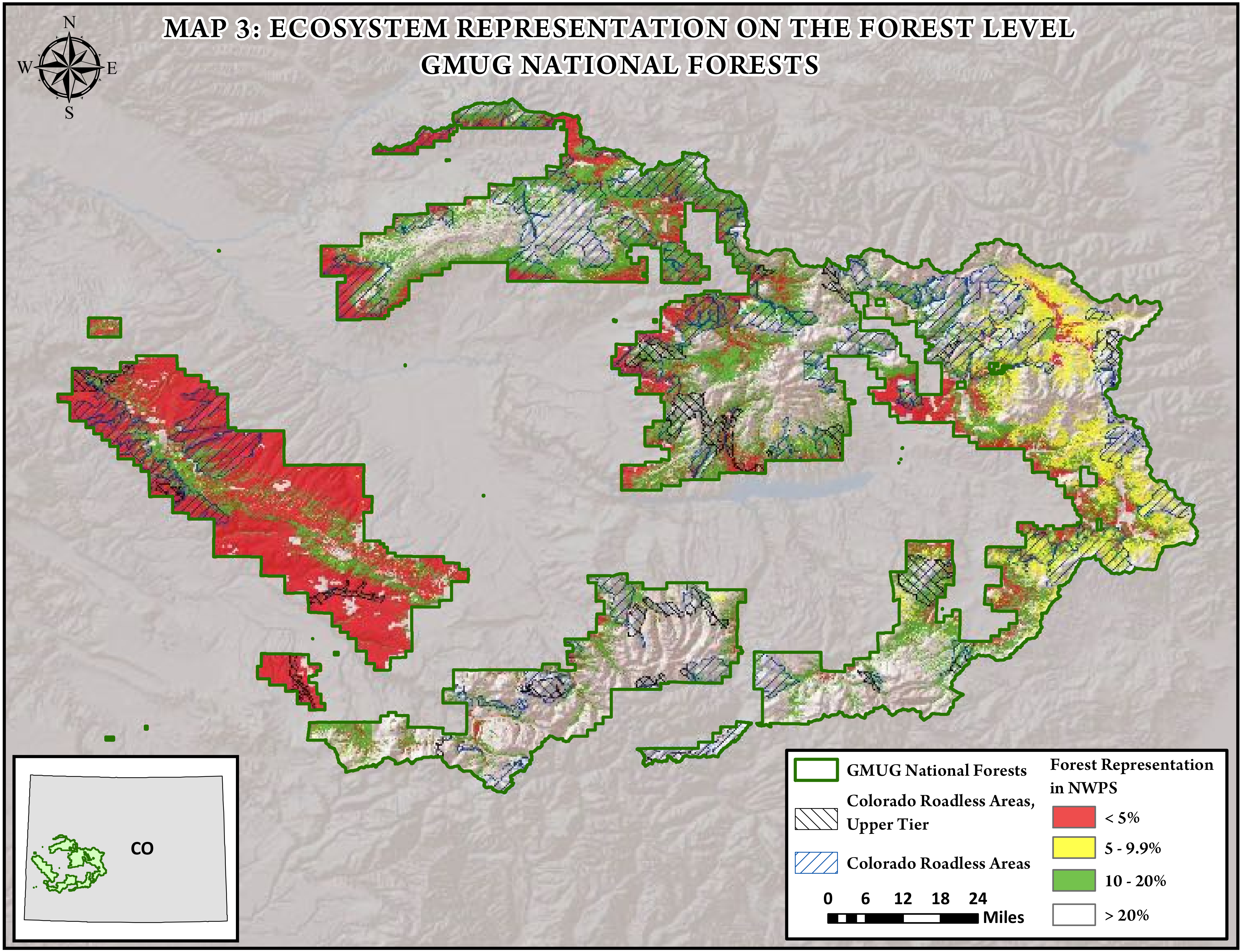
The Wilderness Act. (1964). Public Law 88-577, 16 U.S.C. 1131-1136, 88th Congress, Second Session, September 3, 1964.

Woodley, S., Bertzky, B., Crawhall, N. *et al*. (2012). Meeting Aichi target 11: What does success look like for protected area systems? *Parks*, **18**, 23-36.


MAP 1: COLORADO ROADLESS AREAS
GMUG NATIONAL FORESTS
N
W
E
S
CO
0
10
20
30
40
Miles
GMUG National Forests
Designated Wilderness
Colorado Roadless Areas, Upper Tier
Colorado Roadless Areas


MAP 1: COLORADO ROADLESS AREAS
GMUG NATIONAL FORESTS
N
S
E
W
CO
Battlements
Sunnyside
Hightower
Hightower
Clear Fork
Turner Creek
Salt Creek
Huntsman Ridge
Cottonwoods
Flattops/Elk Park
McClure Pass
Electric Mountain
Tomahawk
Pilot Knob
Schofield Pass
Currant Creek
Munsey/Erickson
Poverty Gulch
Gothic
Deer Creek
Italian Mountain
Kannah Creek
Deer Creek
Poverty Gulch
American Flag Mountain
Double Top
Flat Irons
Beckwiths
Horse Ranch Park
Texas Creek
Sunset
Whetstone
Granite Basin
Matchless Mountain
Sanford Basin
Mount Lamborn
Castle
Crystal Creek
Union
Unaweep
Mirror Lake
Flattop Mountain
Calamity Basin
Dominguez
Mendicant
Long Canyon
Soap Creek
Beaver
Curecanti
Kelso Mesa
East Elk
Steuben
Canyon Ck/Antero
Soap Creek
Canyon Creek
Johnson Basin
Windy Point
Agate Creek
Cochetopa Hills
Cochetopa Hills
Sawtooth
Horsefly Canyon
Cimarron Ridge
Failes Creek/Soldier Creek
Turret Ridge
Little Cimarron
Baldy
Cochetopa
Crystal Peak
Naturita Canyon
Cannibal Plateau
Mineral Mountain
Last Dollar/Sheep Creek
Whitehouse Mountain
Matterhorn
Last Dollar/Sheep Creek
Wilson
Carson
Wilson
Wilson
Cataract
Hope Lake
Hope Lake
0
10
20
30
40
Miles
GMUG National Forests
Designated Wilderness
Colorado Roadless Areas, Upper Tier
Colorado Roadless Areas


MAP 2: ECOSYSTEM REPRESENTATION ON THE FEDERAL LEVEL
GMUG NATIONAL FORESTS
N
S
E
W
CO
GMUG National Forests
Colorado Roadless Areas, Upper Tier
Colorado Roadless Areas
Federal Representation in NWPS
< 5%
5 - 9.9%
10 - 20%
> 20%
0 6 12 18 24
Miles



MAP 3: ECOSYSTEM REPRESENTATION ON THE FOREST LEVEL
GMUG NATIONAL FORESTS
N
S
E
W
CO
GMUG National Forests
Colorado Roadless Areas, Upper Tier
Colorado Roadless Areas
Forest Representation in NWPS
< 5%
5 - 9.9%
10 - 20%
> 20%
0 6 12 18 24
Miles

Table 1, Tab 1: GMUG National Forests, underrepresented Ecological Systems ("Ecosystems")

	Forest Representation % Coverage				Forest Representation Acreage				
Colorado Roadless Unit	< 5%	5 - 9.9%	10 - 19.9%	< 20%	< 5% (Acres)	5 - 9.9% (Acres)	10 - 19.9% (Acres)	< 20% (Acres)	Total Roadless Acreage
Agate Creek	0.5	34.4	5.0	39.8	54	4,065	592	4,710	11,832
Calamity Basin	92.2	0.0	7.4	99.5	11,478	0	916	12,394	12,451
Cannibal Plateau	0.3	0.1	13.5	13.9	49	8	1,963	2,020	14,497
Canyon Ck/Antero	0.0	0.2	10.0	10.1	0	2	159	162	1,595
Canyon Creek	0.5	24.2	4.6	29.3	53	2,611	496	3,160	10,797
Carson	0.7	0.0	5.7	6.5	43	2	341	386	5,966
Cataract	0.0	0.0	0.2	0.3	0	4	24	28	10,018
Cimarron Ridge	3.6	0.5	24.5	28.6	449	61	3,094	3,604	12,605
Cochetopa	2.6	1.5	52.9	57.1	173	101	3,504	3,778	6,622
Crystal Peak	0.0	0.1	18.8	18.9	3	7	2,169	2,178	11,513
Curecanti	16.2	0.2	42.9	59.4	2,011	28	5,315	7,354	12,378
Currant Creek	37.5	0.0	57.6	95.0	4,027	0	6,187	10,214	10,747
Deer Creek	2.8	0.8	64.3	67.9	264	72	6,068	6,404	9,437
Double Top	0.9	0.9	26.5	28.3	217	203	6,294	6,714	23,731
East Elk	10.5	0.6	46.3	57.4	630	36	2,784	3,450	6,010
Failes Creek/Soldier Creek	1.3	0.4	18.3	20.0	119	34	1,634	1,786	8,950
Gothic	0.2	0.6	19.1	19.9	12	36	1,103	1,151	5,772
Granite Basin	3.8	17.3	22.2	43.3	965	4,426	5,653	11,044	25,520
Hope Lake	0.0	0.5	2.3	2.8	0	38	189	227	8,127
Italian Mountain	0.0	6.3	4.4	10.7	0	558	395	953	8,914
Johnson Basin	71.1	0.0	28.4	99.6	8,473	0	3,388	11,861	11,911
Last Dollar/Sheep Creek	1.9	0.5	27.9	30.3	120	29	1,750	1,900	6,281
Little Cimarron	0.5	1.1	12.9	14.5	19	46	545	610	4,221
Matterhorn	0.0	0.3	7.9	8.2	0	9	279	288	3,533
Mendicant	11.6	0.2	38.9	50.6	2,211	42	7,422	9,674	19,102
Mirror Lake	0.0	2.1	3.1	5.3	0	128	187	316	6,004
Naturita Canyon	92.2	0.0	7.8	100.0	4,237	0	358	4,595	4,595
Pilot Knob	29.3	0.1	69.2	98.5	5,045	11	11,909	16,965	17,218
Salt Creek	5.6	0.0	60.4	66.0	508	1	5,428	5,937	8,993
Steuben	18.8	1.1	66.7	86.6	646	37	2,296	2,979	3,440

Sunnyside	84.2	0.0	2.1	86.3	8,966	3	220	9,189	10,648
Texas Creek	0.0	64.5	1.0	65.5	0	1,700	26	1,726	2,634
Battlements	26.6	0.2	49.7	76.5	6,485	58	12,139	18,682	24,421
Hightower	29.4	0.0	69.7	99.1	1,053	0	2,493	3,547	3,579
Kelso Mesa	79.7	0.0	20.3	99.9	28,248	0	7,185	35,433	35,458
Turret Ridge	5.0	1.8	6.3	13.0	271	98	343	712	5,460
Union	0.0	30.5	3.4	33.9	0	476	53	529	1,560
Whitehouse Mountain	1.2	0.3	6.5	8.0	164	42	922	1,128	14,164
Horsefly Canyon	82.6	0.0	17.4	100.0	5,141	0	1,083	6,224	6,224
Baldy	28.9	0.0	50.1	79.0	624	0	1,080	1,704	2,159
Wilson	12.4	0.1	17.8	30.2	326	2	467	794	2,627
Windy Point	80.9	0.0	19.0	99.9	10,295	0	2,424	12,719	12,727
Matchless Mountain	7.5	37.0	14.5	59.1	2,030	10,003	3,919	15,953	27,000
North Henson	0.0	0.2	0.3	0.5	0	1	2	3	596
Munsey/Erickson	27.6	0.0	68.4	96.0	970	0	2,401	3,371	3,512
Horse Ranch Park	3.2	0.0	73.0	76.1	123	0	2,834	2,957	3,884
Willow Creek	3.8	2.0	46.3	52.1	11	6	136	153	294
Mineral Mountain	1.8	0.3	38.7	40.8	43	6	912	962	2,355
Crystal Creek	2.6	49.2	13.2	65.1	14	262	70	346	532
Cottonwoods	29.1	0.1	51.0	80.2	3,259	12	5,725	8,996	11,219
Dominguez	95.6	0.0	4.0	99.6	11,965	0	494	12,459	12,513
Long Canyon	76.6	0.0	22.9	99.5	13,121	0	3,926	17,048	17,132
Schofield Pass	1.2	0.0	36.6	37.8	10	0	317	327	866
Beckwiths	16.9	0.1	43.8	60.7	3,119	10	8,058	11,187	18,417
Huntsman Ridge	19.5	0.4	68.0	88.0	2,063	46	7,191	9,301	10,574
Flattops/Elk Park	4.6	1.1	30.3	36.0	3,444	866	22,950	27,260	75,684
Flat Irons	47.6	0.3	51.9	99.8	5,468	32	5,965	11,465	11,494
Cochetopa Hills	7.1	41.9	22.4	71.4	3,428	20,320	10,861	34,609	48,464
Electric Mountain	14.2	0.1	62.2	76.5	1,384	9	6,050	7,443	9,732
Castle	5.1	0.1	39.2	44.5	483	6	3,684	4,172	9,386
Sunset	25.8	0.0	66.2	92.0	1,494	0	3,828	5,323	5,785
American Flag Mountain	0.0	22.6	3.6	26.2	3	2,665	419	3,086	11,788
Sawtooth	7.3	5.8	41.1	54.3	1,669	1,336	9,399	12,404	22,841
Poverty Gulch	2.2	1.1	16.1	19.3	117	59	866	1,042	5,391

Beaver	18.0	2.3	59.8	80.1	661	85	2,198	2,945	3,676
Soap Creek	44.4	0.0	40.4	84.8	3,581	1	3,254	6,837	8,062
Kannah Creek	60.1	0.0	26.2	86.4	20,727	12	9,040	29,780	34,484
Clear Fork	13.4	0.5	61.2	75.1	3,265	119	14,901	18,285	24,333
Whetstone	1.3	0.5	24.4	26.2	204	72	3,768	4,045	15,428
Mount Lamborn	39.7	0.1	37.1	76.8	8,926	12	8,338	17,276	22,500
Turner Creek	3.7	0.3	56.4	60.3	469	33	7,235	7,737	12,838
Unaweep	68.7	0.0	28.1	96.8	8,338	0	3,413	11,750	12,135
Flattop Mountain	41.1	0.0	35.4	76.5	2,227	2	1,914	4,143	5,413
McClure Pass	38.7	0.0	41.2	79.9	132	0	140	272	340
Tomahawk	31.9	0.1	60.8	92.8	4,092	17	7,803	11,911	12,839
Sanford Basin	0.5	15.4	4.3	20.2	62	1,988	550	2,600	12,871

Table 1, Tab 2: GMUG National Forests, underrepresented Ecological Systems ("Ecosystems")

Colorado Roadless Unit	Federal Representation % Coverage				Federal Representation Acreage				
	< 5%	5 - 9.9%	10 - 19.9%	< 20%	< 5% (Acres)	5 - 9.9% (Acres)	10 - 19.9% (Acres)	< 20% (Acres)	Total Roadless Acreage
Agate Creek	0.1	1.1	38.7	39.9	10	135	4,575	4,721	11,832
Calamity Basin	87.2	11.3	1.1	99.5	10,858	1,404	132	12,394	12,451
Cannibal Plateau	0.2	12.5	3.9	16.6	32	1,809	567	2,408	14,497
Canyon Ck/Antero	0.0	0.1	10.7	10.8	0	1	171	172	1,595
Canyon Creek	0.4	1.1	29.0	30.5	43	119	3,136	3,298	10,797
Carson	0.0	6.5	2.8	9.2	0	386	165	551	5,966
Cataract	0.1	0.1	1.2	1.4	13	7	124	144	10,018
Cimarron Ridge	0.3	25.4	4.8	30.5	40	3,200	601	3,840	12,605
Cochetopa	0.8	43.9	11.5	56.2	54	2,905	760	3,719	6,622
Crystal Peak	0.0	18.3	3.3	21.7	4	2,112	381	2,497	11,513
Curecanti	14.7	32.3	15.5	62.6	1,823	4,001	1,922	7,746	12,378
Currant Creek	37.4	57.0	1.0	95.4	4,016	6,125	108	10,249	10,747
Deer Creek	2.6	47.6	22.1	72.3	245	4,495	2,082	6,822	9,437
Double Top	0.6	20.1	13.3	34.0	149	4,764	3,150	8,063	23,731
East Elk	8.0	24.0	29.7	61.7	481	1,441	1,784	3,706	6,010
Failes Creek/Soldier Creek	0.5	14.8	8.5	23.7	42	1,322	757	2,121	8,950
Gothic	0.2	12.8	20.3	33.3	12	738	1,172	1,922	5,772
Granite Basin	3.2	12.7	30.1	46.0	805	3,241	7,682	11,727	25,520
Hope Lake	0.7	1.7	2.9	5.3	59	135	234	427	8,127
Italian Mountain	0.1	2.1	9.6	11.7	6	183	855	1,045	8,914
Johnson Basin	60.8	31.8	7.0	99.6	7,242	3,786	834	11,862	11,911
Last Dollar/Sheep Creek	0.4	27.2	11.0	38.6	28	1,709	689	2,425	6,281
Little Cimarron	0.2	11.4	7.1	18.8	10	481	300	792	4,221
Matterhorn	0.0	7.3	6.3	13.6	0	257	222	479	3,533
Mendicant	8.3	38.7	9.9	56.9	1,579	7,385	1,898	10,862	19,102
Mirror Lake	0.4	0.5	4.5	5.5	26	29	273	328	6,004
Naturita Canyon	50.2	42.1	7.7	100.0	2,307	1,935	352	4,595	4,595
Pilot Knob	28.1	67.2	3.4	98.6	4,830	11,576	577	16,984	17,218
Salt Creek	2.5	59.1	5.5	67.1	225	5,313	497	6,035	8,993
Steuben	15.0	41.6	30.8	87.4	518	1,430	1,059	3,007	3,440

Sunnyside	84.1	0.5	15.4	100.0	8,955	55	1,637	10,648	10,648
Texas Creek	0.0	0.8	64.7	65.5	0	21	1,705	1,726	2,634
Battlements	26.0	42.9	11.7	80.6	6,348	10,474	2,856	19,679	24,421
Hightower	28.6	69.8	0.8	99.2	1,023	2,497	30	3,549	3,579
Kelso Mesa	72.3	23.5	4.1	99.9	25,648	8,317	1,468	35,433	35,458
Turret Ridge	0.2	11.6	3.2	15.0	10	636	173	819	5,460
Union	0.1	0.3	35.2	35.6	1	5	548	555	1,560
Whitehouse Mountain	0.3	5.2	4.7	10.2	49	734	661	1,444	14,164
Horsefly Canyon	71.8	12.9	15.3	100.0	4,469	802	953	6,224	6,224
Baldy	25.9	48.5	5.5	79.8	558	1,047	118	1,723	2,159
Wilson	0.2	29.9	0.7	30.7	4	785	17	807	2,627
Windy Point	70.6	26.1	3.3	99.9	8,982	3,318	419	12,719	12,727
Matchless Mountain	4.1	10.0	45.7	59.8	1,112	2,692	12,344	16,148	27,000
North Henson	0.0	0.5	0.0	0.5	0	3	0	3	596
Munsey/Erickson	25.7	52.0	19.4	97.1	902	1,827	683	3,412	3,512
Horse Ranch Park	2.3	73.0	5.5	80.7	89	2,835	213	3,136	3,884
Willow Creek	0.0	49.7	3.3	53.0	0	146	10	156	294
Mineral Mountain	0.0	31.9	7.2	39.1	0	751	169	920	2,355
Crystal Creek	0.0	2.6	64.1	66.7	0	14	341	355	532
Cottonwoods	21.6	53.1	5.7	80.4	2,427	5,961	636	9,024	11,219
Dominguez	93.2	4.9	1.9	100.0	11,660	616	238	12,513	12,513
Long Canyon	63.8	27.5	8.2	99.5	10,938	4,713	1,396	17,048	17,132
Schofield Pass	1.1	24.0	35.1	60.2	10	208	304	522	866
Beckwiths	14.9	35.9	15.2	66.0	2,748	6,610	2,794	12,153	18,417
Huntsman Ridge	18.9	61.9	11.9	92.8	2,002	6,547	1,262	9,810	10,574
Flattops/Elk Park	2.8	25.3	11.5	39.7	2,136	19,175	8,723	30,035	75,684
Flat Irons	44.0	28.5	27.3	99.8	5,053	3,280	3,138	11,471	11,494
Cochetopa Hills	3.3	9.4	59.2	71.8	1,581	4,544	28,681	34,806	48,464
Electric Mountain	5.1	67.4	4.7	77.2	498	6,557	455	7,510	9,732
Castle	0.5	37.3	8.4	46.1	44	3,501	784	4,328	9,386
Sunset	16.0	74.3	2.0	92.3	924	4,298	116	5,338	5,785
American Flag Mountain	0.1	0.9	26.1	27.1	17	101	3,073	3,190	11,788
Sawtooth	3.1	41.8	11.7	56.7	705	9,553	2,682	12,940	22,841
Poverty Gulch	2.2	9.3	20.4	31.8	118	499	1,100	1,717	5,391

Beaver	15.4	27.4	38.3	81.1	565	1,007	1,409	2,981	3,676
Soap Creek	41.5	25.7	21.6	88.8	3,346	2,076	1,740	7,162	8,062
Kannah Creek	58.6	23.5	10.1	92.1	20,200	8,091	3,482	31,773	34,484
Clear Fork	12.6	58.1	6.5	77.2	3,077	14,128	1,574	18,779	24,333
Whetstone	1.0	19.9	14.6	35.5	153	3,073	2,255	5,482	15,428
Mount Lamborn	37.9	33.2	12.3	83.3	8,522	7,470	2,757	18,749	22,500
Turner Creek	2.2	51.6	10.7	64.5	288	6,621	1,372	8,282	12,838
Unaweep	56.5	20.5	20.8	97.8	6,852	2,491	2,527	11,869	12,135
Flattop Mountain	29.2	42.1	9.3	80.6	1,581	2,279	504	4,364	5,413
McClure Pass	0.0	79.2	0.7	79.9	0	270	2	272	340
Tomahawk	27.1	61.0	4.8	92.9	3,481	7,828	615	11,923	12,839
Sanford Basin	0.5	2.3	18.1	20.9	67	296	2,326	2,689	12,871

Table 2: Ecosystem Composition of Colorado Roadless Areas

Values are the estimated acres of each ecosystem occuring within each Wilderness Inventory Unit	Colorado Roadless Areas								
Ecosystem	Agate Creek	Calamity Basin	Cannibal Plateau	Canyon Ck/Antero	Canyon Creek	Carson	Cataract	Cimarron Ridge	Cochetopa
Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland	23	151	18	0	1	43	0	417	27
Rocky Mountain Aspen Forest and Woodland	70	784	1,401	1	52	334	3	2,639	1,760
Rocky Mountain Lodgepole Pine Forest	4,060	0	0	2	2,600	0	0	12	101
Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	3,416	6	4,040	263	2,671	1,492	429	4,504	1,679
Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland	2,749	51	2,848	17	2,052	2,180	774	4,061	622
Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland	6	0	0	0	74	0	0	0	254
Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland	115	33	0	0	12	0	0	89	84
Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland	38	82	0	0	0	0	0	92	80
Southern Rocky Mountain Ponderosa Pine Woodland	22	469	2	0	11	0	0	0	94
Colorado Plateau Pinyon-Juniper Woodland	0	4,447	0	0	0	0	0	0	0
Southern Rocky Mountain Pinyon-Juniper Woodland	0	0	0	0	0	0	0	0	0
Rocky Mountain Lower Montane Riparian Woodland and Shrubland	0	0	0	0	0	0	0	0	0
Rocky Mountain Subalpine-Montane Riparian Woodland	4	0	0	0	0	0	0	0	0
Southern Rocky Mountain Montane-Subalpine Grassland	19	0	380	0	44	7	0	94	1,024
Rocky Mountain Gambel Oak-Mixed Montane Shrubland	4	5,258	0	0	0	0	0	13	0
Rocky Mountain Lower Montane-Foothill Shrubland	0	194	0	0	0	0	0	0	0
Rocky Mountain Subalpine-Montane Mesic Meadow	344	17	179	159	314	0	8	172	301
Rocky Mountain Alpine-Montane Wet Meadow	4	0	26	3	2	19	103	77	47
Rocky Mountain Subalpine-Montane Riparian Shrubland	333	0	2,140	123	695	516	1,772	56	348
North American Arid West Emergent Marsh	0	2	0	0	0	0	0	0	0
Inter-Mountain Basins Mat Saltbush Shrubland	0	0	0	0	0	0	0	0	0
Inter-Mountain Basins Mixed Salt Desert Scrub	0	0	0	0	0	0	0	0	0
Inter-Mountain Basins Big Sagebrush Shrubland	0	58	0	0	0	0	0	0	0
Inter-Mountain Basins Montane Sagebrush Steppe	4	719	28	0	40	0	0	19	53
Wyoming Basins Dwarf Sagebrush Shrubland and Steppe	0	0	0	0	0	0	0	0	0
Inter-Mountain Basins Semi-Desert Grassland	0	0	0	0	0	0	0	0	0
Inter-Mountain Basins Semi-Desert Shrub Steppe	0	0	0	0	0	0	0	0	0
Rocky Mountain Alpine Fell-Field	205	0	415	94	202	367	809	28	0
Rocky Mountain Alpine Turf	180	0	1,874	168	848	211	4,121	0	0
Rocky Mountain Cliff, Canyon and Massive Bedrock	10	0	362	7	208	146	14	159	148
Colorado Plateau Mixed Bedrock Canyon and Tableland	0	0	0	0	0	0	0	0	0
Inter-Mountain Basins Active and Stabilized Dune	0	0	0	0	0	0	0	0	0
Inter-Mountain Basins Shale Badland	0	0	0	0	0	0	0	0	0
Rocky Mountain Alpine Bedrock and Scree	221	0	773	759	957	650	1,968	116	0
Cultivated Cropland	0	171	0	0	0	0	0	0	0
Introduced Upland Vegetation - Perennial Grassland and Forbland	0	8	0	0	0	0	0	0	0
Recently Logged Areas	1	0	8	0	11	2	4	49	0
Recently Burned	0	0	0	0	0	0	0	0	0
Disturbed/Successional - Recently Chained Pinyon-Juniper	0	0	0	0	0	0	0	0	0
Open Water (Fresh)	0	0	3	0	0	0	13	8	1
Quarries, Mines, Gravel Pits and Oil Wells	2	0	0	0	2	0	0	0	0
Developed, Low Intensity	0	0	0	0	0	0	0	0	0
Developed, High Intensity	0	0	0	0	0	0	0	0	0

Crystal Peak	Curecanti	Currant Creek	Deer Creek	Double Top	East Elk	Failes Creek/Soldier Creek	Gothic	Granite Basin	Hope Lake	Italian Mountain	Johnson Basin	Last Dollar/Sheep Creek	Little Cimarron	Matterhorn
3	131	11	21	68	46	75	1	27	0	0	323	98	19	0
1,992	3,301	6,093	2,796	3,755	1,148	1,017	578	2,350	96	82	2,555	1,204	445	235
0	13	0	42	34	27	24	0	4,333	0	539	0	4	45	0
2,550	1,885	449	1,448	6,379	1,302	3,181	929	5,802	931	1,894	3	1,815	1,770	325
2,082	2,616	12	723	4,785	972	3,431	1,222	6,237	1,457	1,919	47	606	1,346	274
0	0	0	0	0	0	0	0	93	0	0	0	0	0	0
12	869	5	14	26	965	83	0	901	0	0	248	7	59	0
3	525	0	5	9	454	95	0	413	0	0	514	1	1	0
0	61	0	0	0	107	3	0	130	0	0	907	1	0	0
0	4	0	0	0	21	0	0	3	0	0	1,269	0	0	0
0	0	0	0	0	0	0	0	5	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	3	0	0	0
0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
110	492	21	1,647	772	132	218	123	636	1	82	0	380	16	13
0	398	3,902	0	0	3	3	0	4	0	0	5,611	2	0	0
0	0	1	0	0	0	0	0	0	0	0	112	0	0	0
48	126	68	1,604	1,732	84	221	401	1,256	33	231	70	153	14	31
93	49	32	376	1,210	24	266	514	504	35	49	0	60	14	118
626	131	37	286	2,193	30	175	739	725	702	1,278	0	141	50	180
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
0	1,416	111	241	149	453	28	11	789	0	0	140	16	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	6	0	0	0	0	0	0	0	0
143	0	0	2	120	1	6	63	64	345	150	0	38	40	46
2,510	0	0	111	1,525	0	25	155	362	622	1,275	0	250	64	1,404
226	339	3	42	139	230	68	258	273	165	36	1	464	167	72
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1,106	0	0	44	665	0	12	742	510	3,643	1,354	0	1,005	159	825
0	0	1	1	0	0	0	0	0	0	0	107	3	0	0
0	0	0	1	0	0	5	0	0	0	0	0	0	0	0
7	15	0	30	169	9	10	36	91	38	19	0	26	1	9
0	0	0	0	0	0	0	0	7	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	2	0	2	0	2	0	2	4	59	0	0	6	10	0
0	0	0	0	0	0	0	0	0	0	6	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	4	0	0	0	2	0	0	0	0	0	0	1	0	0

Mendicant	Mirror Lake	Naturita Canyon	Pilot Knob	Salt Creek	Steuben	Sunnyside	Texas Creek	Battlements	Hightower	Kelso Mesa	Turret Ridge	Union	Whitehouse Mountain	Horsefly Canyon	Baldy	Wilson
684	0	0	207	283	38	2	0	140	31	462	271	0	119	3	38	322
6,179	22	6	11,353	4,891	1,251	37	18	8,983	2,440	5,682	237	3	485	130	756	458
2	124	0	0	0	28	0	1,700	0	0	0	0	476	2	0	0	0
3,732	1,289	0	15	1,871	250	0	702	3,028	8	1	2,465	166	2,717	0	170	503
3,596	1,138	0	68	928	174	0	174	1,258	18	24	1,920	808	4,387	0	264	773
0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
104	0	157	145	20	594	85	0	38	0	242	19	1	98	250	12	0
140	0	196	399	23	389	88	0	8	0	1,212	18	1	200	703	7	0
4	0	1,930	10	0	90	8	0	2	0	1,846	0	0	26	669	27	0
4	0	1,792	36	0	14	6,236	0	8	0	7,343	0	0	0	1,315	77	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	3	8	0	0	0	0	0	0	25	0	0	0	91	0	0
0	0	0	11	0	0	3	0	0	0	0	0	0	0	0	0	0
477	3	0	6	138	40	8	3	1,291	26	34	30	2	63	0	225	4
731	0	367	2,769	213	24	672	0	4,747	381	14,342	0	0	15	2,721	423	0
0	0	0	1	0	0	25	0	12	0	1,400	0	0	0	18	0	0
473	129	0	4	356	20	3	4	1,816	28	14	29	44	48	0	80	4
561	1	0	2	98	18	1	0	475	2	0	0	5	95	0	2	8
628	777	0	151	158	10	0	32	231	4	0	26	16	160	0	2	33
0	0	0	0	0	0	2	0	0	0	3	0	0	0	0	0	0
0	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	566	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	2	66	0	0	0	66	0	0	0	0	0	0
776	0	30	1,998	12	477	186	0	1,547	641	2,152	0	0	3	7	41	0
0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0
0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	340	0	0	0	0	0	0	226	0	0	2	0	142	0	0	6
10	1,442	0	0	0	0	0	0	0	0	0	3	12	628	0	0	14
618	19	0	17	0	9	1,458	0	519	0	0	107	21	218	0	17	4
0	0	0	0	0	0	671	0	0	0	1	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	220	0	0	0	0	0	0	0	0	0	0
244	681	0	0	0	0	0	0	0	0	0	224	2	4,685	0	0	491
11	0	115	16	0	0	48	0	28	1	252	0	0	0	251	18	4
0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
40	4	0	0	1	10	0	0	58	0	0	98	0	40	0	0	2
0	0	0	0	0	0	1	0	0	0	292	0	0	0	0	0	0
0	0	0	0	0	0	209	0	0	0	62	0	0	0	67	0	0
49	26	0	3	0	0	0	0	2	0	0	10	1	28	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	37	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	3	0	0	0	0	3	0	0	0

Windy Point	Matchless Mountain	North Henson	Munsey/Erickson	Horse Ranch Park	Willow Creek	Mineral Mountain	Crystal Creek	Cottonwoods	Dominguez	Long Canyon	Schofield Pass	Beckwiths	Huntsman
28	52	0	62	34	11	43	0	832	0	170	1	367	61
1,990	1,266	2	1,756	2,795	135	628	0	5,067	291	2,529	169	6,162	6,327
0	9,826	0	0	0	6	1	262	0	0	0	0	3	0
1	4,198	29	67	475	138	405	48	846	0	22	106	1,660	614
6	3,966	554	33	119	0	884	128	1,211	0	63	6	2,891	89
0	137	0	0	0	0	70	0	0	0	0	0	0	0
73	1,012	0	383	12	1	31	31	59	45	424	0	767	35
67	256	0	258	7	0	83	39	149	139	956	0	747	26
1,285	869	0	6	0	0	0	14	3	305	2,013	0	40	0
2,346	0	0	45	0	0	0	0	18	5,206	2,882	0	73	0
0	20	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	10	0	0	0	0	0	5	16	0	0	0
0	14	0	0	0	0	0	0	12	0	0	0	0	4
14	341	0	4	5	0	75	0	60	20	1	38	35	117
6,389	30	0	755	70	0	0	0	2,193	4,547	6,685	0	1,875	1,862
82	0	0	0	0	0	0	0	0	65	223	0	0	0
280	907	0	1	16	0	26	0	388	0	16	110	321	686
0	160	0	16	60	3	16	0	18	0	0	191	115	498
0	988	1	1	110	0	65	1	138	0	0	158	446	60
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	25	0	0	0	0	0	54	4	0	0	0
85	1,052	0	66	18	0	0	0	210	1,704	955	10	762	126
0	0	0	0	0	0	0	0	0	2	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	1	0	5	0	0	0	0	0	0	8	26	0
0	854	0	0	1	0	2	0	0	0	0	4	5	0
0	169	0	24	119	0	13	9	10	54	0	3	843	12
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	709	8	0	38	0	10	0	0	0	0	63	1,236	0
74	7	0	2	1	0	0	0	3	34	172	0	2	14
0	1	0	0	0	0	0	0	0	0	0	0	0	0
0	164	1	0	0	0	5	0	0	0	0	0	7	41
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	42	1	0	0	0
0	0	0	0	0	0	0	0	2	0	0	0	28	0
0	3	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	9	0

Flattops/Elk Park	Flat Irons	Cochetopa Hills	Electric Mountain	Castle	Sunset	American Flag Mountain	Sawtooth	Poverty Gulch	Beaver	Soap Creek	Kannah Creek	Clear Fork	Whetstone	Mount Lamborn
1,354	193	618	886	445	570	0	498	0	53	97	542	189	68	435
15,949	2,865	1,801	5,651	2,866	3,728	36	7,604	379	888	1,650	6,634	13,455	2,620	6,666
0	0	20,253	9	6	0	2,637	1,165	3	85	1	4	0	47	3
32,726	8	6,042	813	2,919	264	3,615	4,581	186	273	302	2,059	3,110	3,717	1,159
10,902	14	6,567	1,345	1,901	165	3,496	4,333	959	409	510	538	1,404	3,825	2,056
0	0	307	0	0	0	3	57	0	0	0	0	0	0	0
57	890	3,711	137	78	65	0	397	15	618	992	315	116	112	536
18	2,209	4,074	209	14	33	0	258	6	659	401	79	171	85	524
1	222	1,237	0	0	0	0	466	0	43	144	10	0	0	81
2	55	0	0	0	0	0	0	0	4	145	10,364	6	0	1,155
0	0	94	0	0	0	0	0	0	0	2	0	0	0	0
0	3	1	0	0	0	0	0	0	0	14	51	2	0	0
0	32	55	0	0	0	1	1	2	0	0	2	0	0	2
1,005	0	876	20	190	0	38	815	67	23	185	899	365	361	281
1,331	4,651	64	409	7	846	0	0	5	4	527	6,691	2,636	3	4,639
2	1	0	0	0	0	0	0	0	0	11	13	0	0	129
5,874	0	86	32	530	2	331	268	399	10	22	1,090	793	574	251
2,254	0	262	57	135	0	72	528	529	6	13	83	415	180	259
1,403	0	319	63	236	18	818	701	1,278	13	88	114	991	273	400
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	33	0	0	0
0	0	0	0	0	0	0	0	0	0	0	127	0	0	51
0	0	0	0	0	0	0	0	0	1	38	21	0	0	50
653	341	1,389	60	28	75	3	689	112	556	2,591	2,739	420	134	2,151
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
613	0	0	0	0	0	11	113	103	0	0	0	7	74	11
0	0	155	0	2	0	325	59	137	0	0	0	10	271	1
520	6	242	10	20	15	32	64	146	30	311	1,910	79	1,257	1,182
0	0	0	0	0	0	0	0	0	0	0	107	0	0	24
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	268	0	0	0	330	58	1,012	0	0	0	32	1,786	124
88	2	26	30	3	3	0	15	0	0	13	9	14	0	112
4	0	0	0	0	0	0	0	0	0	0	0	0	0	29
866	0	12	0	0	0	26	169	54	0	0	7	119	25	8
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	1	0	0	65
48	0	7	0	6	0	10	0	0	0	4	24	0	16	79
0	0	0	0	0	0	4	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	20	0	0	0
0	0	0	0	0	0	0	0	0	0	1	0	0	0	32

Turner Creek	Unaweep	Flattop Mountain	McClure Pass	Tomahawk	Sanford Basin
181	954	625	132	619	0
6,121	1,001	1,631	138	7,198	271
0	0	0	0	16	1,988
2,792	21	642	12	519	3,597
1,662	244	408	56	346	2,350
0	0	0	0	0	15
37	320	1	2	373	0
15	1,290	3	0	208	0
0	532	21	0	8	0
0	626	0	0	17	0
0	0	0	0	0	0
0	35	0	0	0	0
0	0	0	0	1	0
286	4	0	0	2	25
121	5,170	10	0	2,689	0
0	329	0	0	1	0
776	799	280	0	5	234
219	0	0	0	0	17
100	0	0	0	50	1,220
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	48	0	0	0	0
165	628	1,566	0	741	62
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	699
0	0	0	0	0	1,195
326	119	220	0	12	87
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
2	0	0	0	0	1,104
2	15	4	0	17	0
1	0	1	0	0	0
33	0	2	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	16	5
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0

Table 3, Tab 1: GMUG National Forest Ecosystem Representation

Ecological Group ("Ecosystem")	GMUG Wilderness (Acres)	GMUG Non-Wilderness (Acres)	All GMUG (Acres)	% GMUG Wilderness	% Federal Wilderness
Inter-Mountain Basins Active and Stabilized Dune	12	1	13	91.2	2.3
Rocky Mountain Alpine Bedrock and Scree	71,844	46,653	118,496	60.6	54.2
Rocky Mountain Alpine Fell-Field	12,331	8,699	21,030	58.6	61.8
Rocky Mountain Alpine Turf	45,780	34,085	79,865	57.3	58.5
Rocky Mountain Cliff, Canyon and Massive Bedrock	19,710	23,199	42,909	45.9	19.5
Rocky Mountain Alpine-Montane Wet Meadow	17,010	22,803	39,814	42.7	19.8
Developed, High Intensity	58	105	162	35.5	0.1
Rocky Mountain Subalpine-Montane Riparian Shrubland	31,494	57,398	88,892	35.4	32.4
Quarries, Mines, Gravel Pits and Oil Wells	23	50	73	31.2	0.5
Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland	98,213	228,148	326,361	30.1	31.3
Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	117,838	353,529	471,367	25.0	32.4
Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland	977	4,920	5,897	16.6	29.4
Southern Rocky Mountain Montane-Subalpine Grassland	8,560	49,212	57,772	14.8	7.8
Open Water (Fresh)	1,069	6,235	7,303	14.6	4.1
Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland	7,018	47,288	54,306	12.9	11.7
Rocky Mountain Aspen Forest and Woodland	67,689	456,591	524,280	12.9	9.5
Rocky Mountain Subalpine-Montane Mesic Meadow	10,210	70,785	80,995	12.6	18.1
Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland	6,188	44,906	51,094	12.1	11.5
Rocky Mountain Lodgepole Pine Forest	12,747	162,104	174,850	7.3	12.5
Recently Logged Areas	945	15,661	16,605	5.7	6.6
Rocky Mountain Subalpine-Montane Riparian Woodland	31	588	619	5.0	14.9
Inter-Mountain Basins Montane Sagebrush Steppe	8,053	162,660	170,712	4.7	4.9
Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland	3,831	88,186	92,017	4.2	6.1
Rocky Mountain Gambel Oak-Mixed Montane Shrubland	10,433	269,075	279,508	3.7	2.2
Rocky Mountain Lower Montane Riparian Woodland and Shrubland	32	1,055	1,088	2.9	2.4
Inter-Mountain Basins Big Sagebrush Shrubland	101	6,397	6,499	1.6	2.1
Introduced Upland Vegetation - Perennial Grassland and Forbland	4	267	270	1.4	0.7
Southern Rocky Mountain Ponderosa Pine Woodland	831	97,097	97,928	0.8	8.3
Colorado Plateau Pinyon-Juniper Woodland	743	103,591	104,334	0.7	3.3

Cultivated Cropland	98	18,805	18,903	0.5	0.0
Rocky Mountain Lower Montane-Foothill Shrubland	7	5,865	5,872	0.1	0.9
Colorado Plateau Pinyon-Juniper Shrubland	0	111	111	0.0	1.6
Southern Rocky Mountain Pinyon-Juniper Woodland	0	435	435	0.0	4.0
North American Arid West Emergent Marsh	0	24	24	0.0	2.8
Inter-Mountain Basins Greasewood Flat	0	7	7	0.0	2.0
Inter-Mountain Basins Mat Saltbush Shrubland	0	50	50	0.0	0.0
Inter-Mountain Basins Mixed Salt Desert Scrub	0	1,153	1,153	0.0	1.4
Wyoming Basins Dwarf Sagebrush Shrubland and Steppe	0	22	22	0.0	0.2
Inter-Mountain Basins Semi-Desert Grassland	0	16	16	0.0	4.4
Inter-Mountain Basins Semi-Desert Shrub Steppe	0	7	7	0.0	2.0
Colorado Plateau Mixed Bedrock Canyon and Tableland	0	955	955	0.0	4.5
Inter-Mountain Basins Shale Badland	0	226	226	0.0	4.0
Undifferentiated Barren Land	0	8	8	0.0	1.9
Introduced Upland Vegetation - Annual Grassland	0	123	123	0.0	0.7
Recently Burned	0	1,988	1,988	0.0	8.0
Disturbed/Successional - Recently Chained Pinyon-Juniper	0	7,295	7,295	0.0	0.6
Developed, Low Intensity	0	124	124	0.0	0.1
Total	**553,877**	**2,385,960**	**2,939,836**	**18.8**	**7.6**

Table 3, Tab 2: GMUG National Forest Ecosystem Representation at the Forest Scale

Ecological Group ("Ecosystem")	GMUG Wilderness (Acres)	GMUG Non-Wilderness (Acres)	All GMUG (Acres)	% GMUG Wilderness	% Coverage, GMUG Forest Area
Representation @ < 20%					
Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland	977	4,920	5,897	16.6	0.2
Southern Rocky Mountain Montane-Subalpine Grassland	8,560	49,212	57,772	14.8	2.0
Open Water (Fresh)	1,069	6,235	7,303	14.6	0.2
Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland	7,018	47,288	54,306	12.9	1.8
Rocky Mountain Aspen Forest and Woodland	67,689	456,591	524,280	12.9	17.8
Rocky Mountain Subalpine-Montane Mesic Meadow	10,210	70,785	80,995	12.6	2.7
Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland	6,188	44,906	51,094	12.1	1.7
Rocky Mountain Lodgepole Pine Forest	12,747	162,104	174,850	7.3	5.9
Rocky Mountain Subalpine-Montane Riparian Woodland	31	588	619	5.0	0.0
Inter-Mountain Basins Montane Sagebrush Steppe	8,053	162,660	170,712	4.7	5.8
Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland	3,831	88,186	92,017	4.2	3.1
Rocky Mountain Gambel Oak-Mixed Montane Shrubland	10,433	269,075	279,508	3.7	9.5
Rocky Mountain Lower Montane Riparian Woodland and Shrubland	32	1,055	1,088	2.9	0.0
Inter-Mountain Basins Big Sagebrush Shrubland	101	6,397	6,499	1.6	0.2
Introduced Upland Vegetation - Perennial Grassland and Forbland	4	267	270	1.4	0.0
Southern Rocky Mountain Ponderosa Pine Woodland	831	97,097	97,928	0.8	3.3
Colorado Plateau Pinyon-Juniper Woodland	743	103,591	104,334	0.7	3.5
Rocky Mountain Lower Montane-Foothill Shrubland	7	5,865	5,872	0.1	0.2
Colorado Plateau Pinyon-Juniper Shrubland	0	111	111	0.0	0.0
Southern Rocky Mountain Pinyon-Juniper Woodland	0	435	435	0.0	0.0
North American Arid West Emergent Marsh	0	24	24	0.0	0.0
Inter-Mountain Basins Greasewood Flat	0	7	7	0.0	0.0
Inter-Mountain Basins Mat Saltbush Shrubland	0	50	50	0.0	0.0
Inter-Mountain Basins Mixed Salt Desert Scrub	0	1,153	1,153	0.0	0.0
Wyoming Basins Dwarf Sagebrush Shrubland and Steppe	0	22	22	0.0	0.0
Inter-Mountain Basins Semi-Desert Grassland	0	16	16	0.0	0.0
Inter-Mountain Basins Semi-Desert Shrub Steppe	0	7	7	0.0	0.0
Colorado Plateau Mixed Bedrock Canyon and Tableland	0	955	955	0.0	0.0

Inter-Mountain Basins Shale Badland	0	226	226	0.0	0.0
Introduced Upland Vegetation - Annual Grassland	0	123	123	0.0	0.0
Total	**138,523**	**1,579,951**	**1,718,474**	**8.1**	**58.2**
Representation @ < 10%					
Rocky Mountain Lodgepole Pine Forest	12,747	162,104	174,850	7.3	5.9
Rocky Mountain Subalpine-Montane Riparian Woodland	31	588	619	5.0	0.0
Inter-Mountain Basins Montane Sagebrush Steppe	8,053	162,660	170,712	4.7	5.8
Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland	3,831	88,186	92,017	4.2	3.1
Rocky Mountain Gambel Oak-Mixed Montane Shrubland	10,433	269,075	279,508	3.7	9.5
Rocky Mountain Lower Montane Riparian Woodland and Shrubland	32	1,055	1,088	2.9	0.0
Inter-Mountain Basins Big Sagebrush Shrubland	101	6,397	6,499	1.6	0.2
Introduced Upland Vegetation - Perennial Grassland and Forbland	4	267	270	1.4	0.0
Southern Rocky Mountain Ponderosa Pine Woodland	831	97,097	97,928	0.8	3.3
Colorado Plateau Pinyon-Juniper Woodland	743	103,591	104,334	0.7	3.5
Rocky Mountain Lower Montane-Foothill Shrubland	7	5,865	5,872	0.1	0.2
Colorado Plateau Pinyon-Juniper Shrubland	0	111	111	0.0	0.0
Southern Rocky Mountain Pinyon-Juniper Woodland	0	435	435	0.0	0.0
North American Arid West Emergent Marsh	0	24	24	0.0	0.0
Inter-Mountain Basins Greasewood Flat	0	7	7	0.0	0.0
Inter-Mountain Basins Mat Saltbush Shrubland	0	50	50	0.0	0.0
Inter-Mountain Basins Mixed Salt Desert Scrub	0	1,153	1,153	0.0	0.0
Wyoming Basins Dwarf Sagebrush Shrubland and Steppe	0	22	22	0.0	0.0
Inter-Mountain Basins Semi-Desert Grassland	0	16	16	0.0	0.0
Inter-Mountain Basins Semi-Desert Shrub Steppe	0	7	7	0.0	0.0
Colorado Plateau Mixed Bedrock Canyon and Tableland	0	955	955	0.0	0.0
Inter-Mountain Basins Shale Badland	0	226	226	0.0	0.0
Introduced Upland Vegetation - Annual Grassland	0	123	123	0.0	0.0
Total	**36,811**	**900,015**	**936,826**	**3.9**	**31.7**
Representation @ < 5%					
Inter-Mountain Basins Montane Sagebrush Steppe	8,053	162,660	170,712	4.7	5.8
Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland	3,831	88,186	92,017	4.2	3.1
Rocky Mountain Gambel Oak-Mixed Montane Shrubland	10,433	269,075	279,508	3.7	9.5

Rocky Mountain Lower Montane Riparian Woodland and Shrubland	32	1,055	1,088	2.9	0.0
Inter-Mountain Basins Big Sagebrush Shrubland	101	6,397	6,499	1.6	0.2
Introduced Upland Vegetation - Perennial Grassland and Forbland	4	267	270	1.4	0.0
Southern Rocky Mountain Ponderosa Pine Woodland	831	97,097	97,928	0.8	3.3
Colorado Plateau Pinyon-Juniper Woodland	743	103,591	104,334	0.7	3.5
Rocky Mountain Lower Montane-Foothill Shrubland	7	5,865	5,872	0.1	0.2
Colorado Plateau Pinyon-Juniper Shrubland	0	111	111	0.0	0.0
Southern Rocky Mountain Pinyon-Juniper Woodland	0	435	435	0.0	0.0
North American Arid West Emergent Marsh	0	24	24	0.0	0.0
Inter-Mountain Basins Greasewood Flat	0	7	7	0.0	0.0
Inter-Mountain Basins Mat Saltbush Shrubland	0	50	50	0.0	0.0
Inter-Mountain Basins Mixed Salt Desert Scrub	0	1,153	1,153	0.0	0.0
Wyoming Basins Dwarf Sagebrush Shrubland and Steppe	0	22	22	0.0	0.0
Inter-Mountain Basins Semi-Desert Grassland	0	16	16	0.0	0.0
Inter-Mountain Basins Semi-Desert Shrub Steppe	0	7	7	0.0	0.0
Colorado Plateau Mixed Bedrock Canyon and Tableland	0	955	955	0.0	0.0
Inter-Mountain Basins Shale Badland	0	226	226	0.0	0.0
Introduced Upland Vegetation - Annual Grassland	0	123	123	0.0	0.0
Total	**24,034**	**737,323**	**761,357**	**3.2**	**25.8**

Table 3, Tab 3: GMUG National Forest Ecosystem Representation at the Federal Scale

Ecological Group ("Ecosystem")	Rio Grande NF Wilderness (Acres)	Rio Grande NF Non-Wilderness (Acres)	All Rio Grande NF (Acres)	% Federal Wilderness	% Coverage, Rio Grande Forest Area
Representation @ < 20%					
Rocky Mountain Subalpine-Montane Riparian Woodland	2	516	518	17.9	0.0
Rocky Mountain Lodgepole Pine Forest	1,801	43,089	44,890	13.4	2.5
Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland	2,069	56,698	58,767	13.4	3.3
Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland	3,615	63,607	67,222	12.8	3.7
Southern Rocky Mountain Montane-Subalpine Grassland	6,478	184,796	191,274	12.2	10.6
Rocky Mountain Aspen Forest and Woodland	28,744	180,349	209,094	12.1	11.6
Southern Rocky Mountain Ponderosa Pine Woodland	634	63,099	63,733	9.2	3.5
Recently Logged Areas	2,809	21,751	24,560	6.8	1.4
Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland	3,459	13,758	17,217	6.6	1.0
Inter-Mountain Basins Montane Sagebrush Steppe	39	3,590	3,629	6.5	0.2
Inter-Mountain Basins Semi-Desert Grassland	0	1,265	1,265	6.3	0.1
Open Water (Fresh)	670	2,557	3,227	5.2	0.2
Southern Rocky Mountain Pinyon-Juniper Woodland	244	46,843	47,087	5.0	2.6
Rocky Mountain Lower Montane Riparian Woodland and Shrubland	0	412	412	4.4	0.0
Colorado Plateau Pinyon-Juniper Woodland	0	180	180	4.0	0.0
Rocky Mountain Gambel Oak-Mixed Montane Shrubland	22	1,812	1,833	3.7	0.1
Inter-Mountain Basins Active and Stabilized Dune	0	1	1	2.8	0.0
Inter-Mountain Basins Big Sagebrush Shrubland	28	107	135	2.6	0.0
Inter-Mountain Basins Semi-Desert Shrub Steppe	0	6,470	6,470	2.4	0.4
Rocky Mountain Lower Montane-Foothill Shrubland	3	567	571	1.4	0.0
Introduced Upland Vegetation - Perennial Grassland and Forbland	2	126	128	0.8	0.0
Total	**50,619**	**691,594**	**742,213**	**6.0**	**41.1**
Representation @ < 10%					
Southern Rocky Mountain Ponderosa Pine Woodland	634	63,099	63,733	9.2	3.5
Recently Logged Areas	2,809	21,751	24,560	6.8	1.4
Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland	3,459	13,758	17,217	6.6	1.0
Inter-Mountain Basins Montane Sagebrush Steppe	39	3,590	3,629	6.5	0.2

Inter-Mountain Basins Semi-Desert Grassland	0	1,265	1,265	6.3	0.1
Open Water (Fresh)	670	2,557	3,227	5.2	0.2
Southern Rocky Mountain Pinyon-Juniper Woodland	244	46,843	47,087	5.0	2.6
Rocky Mountain Lower Montane Riparian Woodland and Shrubland	0	412	412	4.4	0.0
Colorado Plateau Pinyon-Juniper Woodland	0	180	180	4.0	0.0
Rocky Mountain Gambel Oak-Mixed Montane Shrubland	22	1,812	1,833	3.7	0.1
Inter-Mountain Basins Active and Stabilized Dune	0	1	1	2.8	0.0
Inter-Mountain Basins Big Sagebrush Shrubland	28	107	135	2.6	0.0
Inter-Mountain Basins Semi-Desert Shrub Steppe	0	6,470	6,470	2.4	0.4
Rocky Mountain Lower Montane-Foothill Shrubland	3	567	571	1.4	0.0
Introduced Upland Vegetation - Perennial Grassland and Forbland	2	126	128	0.8	0.0
Total	**7,910**	**162,538**	**170,448**	**4.5**	**9.4**
Representation @ < 5%					
Rocky Mountain Lower Montane Riparian Woodland and Shrubland	0	412	412	4.4	0.0
Colorado Plateau Pinyon-Juniper Woodland	0	180	180	4.0	0.0
Rocky Mountain Gambel Oak-Mixed Montane Shrubland	22	1,812	1,833	3.7	0.1
Inter-Mountain Basins Active and Stabilized Dune	0	1	1	2.8	0.0
Inter-Mountain Basins Big Sagebrush Shrubland	28	107	135	2.6	0.0
Inter-Mountain Basins Semi-Desert Shrub Steppe	0	6,470	6,470	2.4	0.4
Rocky Mountain Lower Montane-Foothill Shrubland	3	567	571	1.4	0.0
Introduced Upland Vegetation - Perennial Grassland and Forbland	2	126	128	0.8	0.0
Total	**55**	**9,675**	**9,730**	**3.0**	**0.5**

Table 4: Colorado Roadless Area Analysis of Ecosystem Composition

Values are the estimated acres of each ecosystem occuring within each Wilderness Inventory Unit. Orange cells represent a combination of units whose protection would achieve adequate representation on the forest level.

				Colorado Roadless Areas						
Ecosystem	Forest Ecosystem Representation	Acres needed for adequate protection in wilderness (>20%)	Number of Roadless Areas to Reach Adequate Protection	Deer Creek	Battlements	Cochetopa	Flattops/Elk Park	Kannah Creek	Cochetopa Hills	Sawtooth
Colorado Plateau Mixed Bedrock Canyon and Tableland	< 5	191	1	0	0	0	0	107	0	0
Colorado Plateau Pinyon-Juniper Woodland	< 5	20,867	3	0	8	0	2	10,364	0	0
Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland	< 5	18,403	NA	21	140	27	1,354	542	618	498
Inter-Mountain Basins Big Sagebrush Shrubland	< 5	1,300	NA	0	0	0	0	21	0	0
Inter-Mountain Basins Mat Saltbush Shrubland	< 5	10	1	0	0	0	0	33	0	0
Inter-Mountain Basins Mixed Salt Desert Scrub	< 5	231	1	0	0	0	0	127	0	0
Inter-Mountain Basins Montane Sagebrush Steppe	< 5	34,142	NA	241	1,547	53	653	2,739	1,389	689
Inter-Mountain Basins Semi-Desert Grassland	< 5	3	1	0	0	0	0	0	0	0
Inter-Mountain Basins Semi-Desert Shrub Steppe	< 5	1	1	0	0	0	0	0	0	0
Inter-Mountain Basins Shale Badland	< 5	45	1	0	0	0	0	0	0	0
Introduced Upland Vegetation - Perennial Grassland and Forbland	< 5	54	NA	1	1	0	4	0	0	0
North American Arid West Emergent Marsh	< 5	5	2	0	0	0	0	0	0	0
Rocky Mountain Gambel Oak-Mixed Montane Shrubland	< 5	55,902	9	0	4,747	0	1,331	6,691	64	0
Rocky Mountain Lower Montane Riparian Woodland and Shrubland	< 5	218	5	0	0	0	0	51	1	0
Rocky Mountain Lower Montane-Foothill Shrubland	< 5	1,174	1	0	12	0	2	13	0	0
Southern Rocky Mountain Pinyon-Juniper Woodland	< 5	87	1	0	0	0	0	0	94	0
Southern Rocky Mountain Ponderosa Pine Woodland	< 5	19,586	NA	0	2	94	1	10	1,237	466
Wyoming Basins Dwarf Sagebrush Shrubland and Steppe	< 5	4	2	0	0	0	0	0	0	0
Recently Logged Areas	5 - 10	3,321	NA	30	58	0	866	7	12	169
Rocky Mountain Lodgepole Pine Forest	5 - 10	34,970	4	42	0	101	0	4	20,253	1,165
Rocky Mountain Subalpine-Montane Riparian Woodland	5 - 10	124	5	0	0	0	0	2	55	1
Open Water (Fresh)	11 - 20	1,461	NA	2	2	1	48	24	7	0
Rocky Mountain Aspen Forest and Woodland	11 - 20	104,856	13	2,796	8,983	1,760	15,949	6,634	1,801	7,604
Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland	11 - 20	1,179	NA	0	0	254	0	0	307	57
Rocky Mountain Subalpine-Montane Mesic Meadow	11 - 20	16,199	10	1,604	1,816	301	5,874	1,090	86	268
Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland	11 - 20	10,861	10	14	38	84	57	315	3,711	397
Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland	11 - 20	10,219	6	5	8	80	18	79	4,074	258
Southern Rocky Mountain Montane-Subalpine Grassland	11 - 20	11,554	16	1,647	1,291	1,024	1,005	899	876	815
Inter-Mountain Basins Active and Stabilized Dune	> 20	NA	NA	0	0	0	0	0	0	0
Quarries, Mines, Gravel Pits and Oil Wells	> 20	NA	NA	0	0	0	0	0	0	0
Rocky Mountain Alpine Bedrock and Scree	> 20	NA	NA	44	0	0	5	0	268	58
Rocky Mountain Alpine Fell-Field	> 20	NA	NA	2	226	0	613	0	0	113
Rocky Mountain Alpine Turf	> 20	NA	NA	111	0	0	0	0	155	59
Rocky Mountain Alpine-Montane Wet Meadow	> 20	NA	NA	376	475	47	2,254	83	262	528
Rocky Mountain Cliff, Canyon and Massive Bedrock	> 20	NA	NA	42	519	148	520	1,910	242	64
Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	> 20	NA	NA	1,448	3,028	1,679	32,726	2,059	6,042	4,581
Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland	> 20	NA	NA	723	1,258	622	10,902	538	6,567	4,333
Rocky Mountain Subalpine-Montane Riparian Shrubland	> 20	NA	NA	286	231	348	1,403	114	319	701

Double Top	Granite Basin	Curecanti	Mendicant	Last Dollar/Sheep Creek	Cannibal Plateau	Clear Fork	Whetstone	Matchless Mountain	Turner Creek	Mount Lamborr	Baldy	Failes Creek/Sold	Castle	Soap Creek
0	0	0	0	0	0	0	0	0	0	24	0	0	0	0
0	3	4	4	0	0	6	0	0	0	1,155	77	0	0	145
68	27	131	684	98	18	189	68	52	181	435	38	75	445	97
0	0	0	0	0	0	0	0	0	0	50	0	0	0	38
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	51	0	0	0	0
149	789	1,416	776	16	28	420	134	1,052	165	2,151	41	28	28	2,591
0	0	0	0	0	0	0	0	0	0	5	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	6	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	1	1	29	0	5	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	4	398	731	2	0	2,636	3	30	121	4,639	423	3	7	527
0	0	0	0	0	0	2	0	0	0	0	0	0	0	14
0	0	0	0	0	0	0	0	0	0	129	0	0	0	11
0	5	0	0	0	0	0	0	20	0	0	0	0	0	2
0	130	61	4	1	2	0	0	869	0	81	27	3	0	144
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
169	91	15	40	26	8	119	25	164	33	8	0	10	0	0
34	4,333	13	2	4	0	0	47	9,826	0	3	0	24	6	1
0	2	0	0	0	0	0	0	14	0	2	0	0	0	0
0	4	2	49	6	3	0	16	0	0	79	0	0	6	4
3,755	2,350	3,301	6,179	1,204	1,401	13,455	2,620	1,266	6,121	6,666	756	1,017	2,866	1,650
0	93	0	0	0	0	0	0	137	0	0	0	0	0	0
1,732	1,256	126	473	153	179	793	574	907	776	251	80	221	530	22
26	901	869	104	7	0	116	112	1,012	37	536	12	83	78	992
9	413	525	140	1	0	171	85	256	15	524	7	95	14	401
772	636	492	477	380	380	365	361	341	286	281	225	218	190	185
0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
0	0	0	2	0	0	0	0	3	0	0	0	0	0	0
665	510	0	244	1,005	773	32	1,786	709	2	124	0	12	0	0
120	64	0	29	38	415	7	74	0	0	11	0	6	0	0
1,525	362	0	10	250	1,874	10	271	854	0	1	0	25	2	0
1,210	504	49	561	60	26	415	180	160	219	259	2	266	135	13
139	273	339	618	464	362	79	1,257	169	326	1,182	17	68	20	311
6,379	5,802	1,885	3,732	1,815	4,040	3,110	3,717	4,198	2,792	1,159	170	3,181	2,919	302
4,785	6,237	2,616	3,596	606	2,848	1,404	3,825	3,966	1,662	2,056	264	3,431	1,901	510
2,193	725	131	628	141	2,140	991	273	988	100	400	2	175	236	88

Salt Creek	East Elk	Gothic	Huntsman Ri	Crystal Pea	Cimarron R	Italian Mountair	Mineral Mount	Poverty Gulch	Whitehouse M	Cottonwoods	Canyon Cr	Steuben	American Flag Mo	Schofield F	Beckwiths	Kelso Mesa
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
0	21	0	0	0	0	0	0	0	0	18	0	14	0	0	73	7,343
283	46	1	61	3	417	0	43	0	119	832	1	38	0	1	367	462
0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	66
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	453	11	126	0	19	0	0	112	3	210	40	477	3	10	762	2,152
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
213	3	0	1,862	0	13	0	0	5	15	2,193	0	24	0	0	1,875	14,342
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,400
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	107	0	0	0	0	0	0	0	26	3	11	90	0	0	40	1,846
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
1	9	36	41	7	49	19	5	54	40	0	11	10	26	0	7	0
0	27	0	0	0	12	539	1	3	2	0	2,600	28	2,637	0	3	0
0	0	0	4	0	0	0	0	2	0	12	0	0	1	0	0	0
0	2	2	0	4	8	0	0	0	28	2	0	0	10	0	28	0
4,891	1,148	578	6,327	1,992	2,639	82	628	379	485	5,067	52	1,251	36	169	6,162	5,682
0	0	0	0	0	0	0	70	0	0	0	74	0	3	0	0	0
356	84	401	686	48	172	231	26	399	48	388	314	20	331	110	321	14
20	965	0	35	12	89	0	31	15	98	59	12	594	0	0	767	242
23	454	0	26	3	92	0	83	6	200	149	0	389	0	0	747	1,212
138	132	123	117	110	94	82	75	67	63	60	44	40	38	38	35	34
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	6	0	0	0	0	2	0	4	0	0	0
0	0	742	0	1,106	116	1,354	10	1,012	4,685	0	957	0	330	63	1,236	0
0	1	63	0	143	28	150	0	103	142	0	202	0	11	8	26	0
0	0	155	0	2,510	0	1,275	2	137	628	0	848	0	325	4	5	0
98	24	514	498	93	77	49	16	529	95	18	2	18	72	191	115	0
0	230	258	12	226	159	36	13	146	218	10	208	9	32	3	843	0
1,871	1,302	929	614	2,550	4,504	1,894	405	186	2,717	846	2,671	250	3,615	106	1,660	1
928	972	1,222	89	2,082	4,061	1,919	884	959	4,387	1,211	2,052	174	3,496	6	2,891	24
158	30	739	60	626	56	1,278	65	1,278	160	138	695	10	818	158	446	0

Turret Ridge	Hightower	Sanford Basin	Beaver	Currant Creek	Electric Mountain	Dominguez	Agate Creek	Little Cimarro	Windy Point	Matterhorn	Sunnyside	Carson	Pilot Knob	Horse Ran
0	0	0	0	0	0	0	0	0	0	0	671	0	0	0
0	0	0	4	0	0	5,206	0	0	2,346	0	6,236	0	36	0
271	31	0	53	11	886	0	23	19	28	0	2	43	207	34
0	0	0	1	0	0	54	0	0	4	0	66	0	0	0
0	0	0	0	0	0	0	0	0	0	0	15	0	0	0
0	0	0	0	0	0	0	0	0	0	0	566	0	0	0
0	641	62	556	111	60	1,704	4	0	85	0	186	0	1,998	18
0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	220	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
0	381	0	4	3,902	409	4,547	4	0	6,389	0	672	0	2,769	70
0	0	0	0	0	0	5	0	0	0	0	0	0	8	0
0	0	0	0	1	0	65	0	0	82	0	25	0	1	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	43	0	0	305	22	0	1,285	0	8	0	10	0
0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
98	0	0	0	0	0	0	1	1	0	9	0	2	0	0
0	0	1,988	85	0	9	0	4,060	45	0	0	0	0	0	0
0	0	0	0	0	0	0	4	0	0	0	3	0	11	0
10	0	5	0	0	0	0	0	10	0	0	0	0	3	0
237	2,440	271	888	6,093	5,651	291	70	445	1,990	235	37	334	11,353	2,795
0	0	15	0	0	0	0	6	0	0	0	0	0	0	0
29	28	234	10	68	32	0	344	14	280	31	3	0	4	16
19	0	0	618	5	137	45	115	59	73	0	85	0	145	12
18	0	0	659	0	209	139	38	1	67	0	88	0	399	7
30	26	25	23	21	20	20	19	16	14	13	8	7	6	5
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
224	0	1,104	0	0	0	0	221	159	0	825	0	650	0	38
2	0	699	0	0	0	0	205	40	0	46	0	367	0	5
3	0	1,195	0	0	0	0	180	64	0	1,404	0	211	0	1
0	2	17	6	32	57	0	4	14	0	118	1	19	2	60
107	0	87	30	3	10	54	10	167	0	72	1,458	146	17	119
2,465	8	3,597	273	449	813	0	3,416	1,770	1	325	0	1,492	15	475
1,920	18	2,350	409	12	1,345	0	2,749	1,346	6	274	0	2,180	68	119
26	4	1,220	13	37	63	0	333	50	0	180	0	516	151	110

Wilson	Unaweep	Munsey/E	Texas Cree	Mirror Lake	Tomahawk	Union	Hope Lake	Long Canyon	Johnson Basin	Willow Creek	Flat Irons	Horsefly Canyon	Naturita Canyon	Calamity Bas	Crystal Creek
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	626	45	0	0	17	0	0	2,882	1,269	0	55	1,315	1,792	4,447	0
322	954	62	0	0	619	0	0	170	323	11	193	3	0	151	0
0	48	25	0	0	0	0	0	4	2	0	0	0	0	58	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	628	66	0	0	741	0	0	955	140	0	341	7	30	719	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
0	5,170	755	0	0	2,689	0	0	6,685	5,611	0	4,651	2,721	367	5,258	0
0	35	10	0	0	0	0	0	16	3	0	3	91	3	0	0
0	329	0	0	0	1	0	0	223	112	0	1	18	0	194	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	532	6	0	0	8	0	0	2,013	907	0	222	669	1,930	469	14
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	4	0	0	38	0	0	0	0	0	0	0	0
0	0	0	1,700	124	16	476	0	0	0	6	0	0	0	0	262
0	0	0	0	0	1	0	0	0	0	0	32	0	0	0	0
0	0	0	0	26	16	1	59	0	0	0	0	0	0	0	0
458	1,001	1,756	18	22	7,198	3	96	2,529	2,555	135	2,865	130	6	784	0
0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0
4	799	1	4	129	5	44	33	16	70	0	0	0	0	17	0
0	320	383	0	0	373	1	0	424	248	1	890	250	157	33	31
0	1,290	258	0	0	208	1	0	956	514	0	2,209	703	196	82	39
4	4	4	3	3	2	2	1	1	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
491	0	0	0	681	0	2	3,643	0	0	0	0	0	0	0	0
6	0	0	0	340	0	0	345	0	0	0	0	0	0	0	0
14	0	0	0	1,442	0	12	622	0	0	0	0	0	0	0	0
8	0	16	0	1	0	5	35	0	0	3	0	0	0	0	0
4	119	24	0	19	12	21	165	0	1	0	6	0	0	0	9
503	21	67	702	1,289	519	166	931	22	3	138	8	0	0	6	48
773	244	33	174	1,138	346	808	1,457	63	47	0	14	0	0	51	128
33	0	1	32	777	50	16	702	0	0	0	0	0	0	0	1

Sunset	Flattop Moun	McClure Pass	Canyon Ck	Cataract	North Hen
0	0	0	0	0	0
0	0	0	0	0	0
570	625	132	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
75	1,566	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	1	0	0	0	0
0	0	0	0	0	0
846	10	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	21	0	0	0	0
0	0	0	0	0	0
0	2	0	0	4	1
0	0	0	2	0	0
0	0	0	0	0	0
0	0	0	0	13	0
3,728	1,631	138	1	3	2
0	0	0	0	0	0
2	280	0	159	8	0
65	1	2	0	0	0
33	3	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	759	1,968	8
0	0	0	94	809	1
0	0	0	168	4,121	0
0	0	0	3	103	0
15	220	0	7	14	0
264	642	12	263	429	29
165	408	56	17	774	554
18	0	0	123	1,772	1

Example of Region 5's Incorporation of Ecosystem Representation Analysis into Chapter 70 Inventory

Inyo NF Wilderness Inventory Areas
Summary of The Wilderness Society's data on
Under-represented Ecosystems in the National Wilderness Preservation System

Background

The Wilderness Society comments indicated the Wilderness Evaluation process should consider the suitability of Wilderness Inventory Areas with under-represented and rare ecosystems. The Wilderness Society utilized several sets of available information at the national scale to identify under-represented ecosystems in the National Wilderness Preservation System (NWPS).

The National Vegetation Classification System Group 6[1] data was used to identify the set of thirty-six ecological groups within the Inyo NF. For each ecological group on the forest, they provided two calculations: the percentage of an ecological group's total area that is within the NWPS; the percentage of an ecological group's area within the Inyo NF that is within designated wilderness. The ecological groups were divided into four classes of representation, which are termed categories A through D below.

Category A is ecological groups on the Inyo NF that have less than five percent of their area protected within the NWPS:

1. *Great Basin Xeric Mixed Sagebrush Shrubland- 3% protected in NWPS*
2. *Inter-Mountain Basins Big Sagebrush Shrubland-3% protected in NWPS*
3. *Inter-Mountain Basins Semi-Desert Shrub Steppe-2% protected in NWPS*
4. *Inter-Mountain Basins Mixed Salt Desert Scrub – 2% protected in NWPS*

Category B is ecological groups on the Inyo NF that have between five and ten percent of their area protected within the NWPS:

1. *Great Basin Foothill & Lower Montane Riparian Woodland and Shrubland- 9% protected in NWPS*
2. *Inter-Mountain Basins Montane Sagebrush Steppe – 7% protected in NWPS.*

Category C is ecological groups on the Inyo NF that have between ten and twenty percent of their area protected within the NWPS. The Wilderness Society indicated it considers ecosystems with less than twenty percent of its total area in the NWPS as inadequately represented[2].

1. *Great Basin Pinyon-Juniper Woodlands – 14% of ecosystem protected in NWPS*
2. *Rocky Mountain Aspen Forest and Woodland – 12% of ecosystem protected in NWPS.*

Category D is ecological groups on the Inyo NF that have more than twenty percent of their area protected within the NWPS, and are not discussed further.

Data Management and processing

1. Eight of thirty-six ecological types were not considered in this summary because their label indicated they are developed land.
2. Area size information was converted from hectares to acres.
3. Ecosystems in each category were ranked by size, largest to smallest.

---

[1] The National Vegetation Classification System website indicates the ecological context for Group 6 data: regional mesoclimate, geology, substrates, hydrology and disturbance regimes.

[2] The twenty percent representation threshold is based on Society for Conservation Biology and Convention on Biological Diversity targets (personal communication with Matt Dietz).

4. Ecosystems in each category with less than 1,000 total acres on all Inyo NF non-wilderness lands were not included in this summary.
5. For each category, the acres for the ecological groups in that category were summed for each wilderness inventory unit.
6. The percentage of each wilderness inventory unit's total area comprised of "under-represented" ecological groups was calculated for each of the Categories A-C.

The table below summarizes the Wilderness Society representation data for each wilderness inventory area listed in the polygon column:

General location: 1988 Forest Plan management area labels describe the general location of the inventory unit, and whether the unit is adjacent to designated wilderness.

Size: The area in acres indicated is the "parent polygon".

Category A: The summary first displays the percentage of the wilderness inventory unit comprised of Category A ecological groups, and the types of type of ecological groups in Category A within the inventory unit. Any ecological groups with more than 1,000 acres in an inventory unit is highlighted in bold font.

Category B: The summary first displays the percentage of the wilderness inventory unit comprised of Category B ecological groups, and the types of type of ecological groups in Category B within the inventory unit. Any ecological groups with more than 1,000 acres in an inventory unit is highlighted in bold font.

Category C: Next, the summary displays the percentage of the wilderness inventory unit comprised of Category C ecological groups, and the types of ecological groups in Category C within the inventory unit. Any ecological groups with more than 1,000 acres in an inventory unit is highlighted in bold font. The difference between Category B and Category C for most inventory units is largely attributed to the addition of *Great Basin Pinyon-Juniper Woodland* in Category C acreage.

Note: The percent of the wilderness inventory unit comprised of Category B ecological groups includes the area of Category A ecological groups (the names of the Category A ecosystems, however, are not listed again under Category B). The percent of the wilderness inventory unit comprised of Category C ecological groups includes the area of both Category A and B ecological groups

Inyo NF Representation: The percentage of a unit's area comprised of ecological groups with less than twenty percent total acreage for the ecological group on the Inyo NF in designated wilderness. The twenty percent representation is the only category displayed for Inyo NF because only six of fifty-five wilderness inventory units have more than 1,000 acres of ecological groups with less than twenty percent of their total acreage on the forest in designated wilderness. The ecological groups in this category include:

- *Inter-Mountain Basins Mixed Salt Desert Scrub*
- *Great Basin Xeric Mixed Sagebrush Shrubland*
- *Inter-Mountain Basins Semi-Desert Shrub Steppe*

Wilderness Inventory Units	National Vegetation Classification System summary
944	**General location:** Benton-Casa Diablo Management Area **Size:** 7,629 acres **Category A:** 40% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS: • *Great Basin Xeric Mixed Sagebrush Shrubland* • ***Inter-Mountain Basins Big Sagebrush Shrubland*** • *Inter-Mountain Basins Semi-Desert Shrub Steppe* • *Inter-Mountain Basins Mixed Salt Desert Scrub* **Category B:** 61% of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological groups in category B include: • ***Inter-Mountain Basins Montane Sagebrush Steppe*** **Category C:** 100% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • ***Great Basin Pinyon-Juniper Woodlands*** **Inyo NF representation:** This inventory unit does not contain any ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
995	**General location:** Benton-Casa Diablo Management Area **Size:** 5,806 acres **Category A:** 2% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Shrubland* • *Great Basin Xeric Mixed Sagebrush Shrubland* **Category B:** 35% of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological groups in category B include: • ***Inter-Mountain Basins Montane Sagebrush Steppe***

	• *Great Basin Foothill & Lower Montane Riparian Woodland and Shrubland* **Category C:** 98% percent of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • ***Great Basin Pinyon-Juniper Woodlands*** **Inyo NF representation:** This inventory unit does not contain any ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1012	**General location:** Glass Mountain and Benton-Casa Diablo Management Areas **Size:** 40,368 acres **Category A:** 10% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS: • ***Inter-Mountain Basins Big Sagebrush Shrubland*** • *Inter-Mountain Basins Mixed Salt Desert Scrub* • *Great Basin Xeric Mixed Sagebrush Shrubland* • *Inter-Mountain Basins Semi-Desert Shrub Steppe* **Category B:** 32% of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological groups in category B include: • ***Inter-Mountain Basins Montane Sagebrush Steppe*** • *Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland* **Category C:** 75% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • ***Great Basin Pinyon-Juniper Woodland*** • *Rocky Mountain Aspen Forest and Woodland* **Inyo NF representation:** Less than one percent of the area of this inventory unit contains ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1039	**General location:** Glass Mountain Management Area **Size:** 11,026 acres **Category A:** 3% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Shrubland* • *Great Basin Xeric Mixed Sagebrush Shrubland*

	Category B: 20% of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological groups in category B include: • ***Inter-Mountain Basins Montane Sagebrush Steppe*** • *Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland* **Category C:** 97% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • ***Great Basin Pinyon-Juniper Woodland*** **Inyo NF representation:** This inventory unit does not contain any ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1068	**General location:** Glass Mountain Management Area **Size:** 12,311 acres **Category A:** 20% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS: • ***Inter-Mountain Basins Big Sagebrush Shrubland*** • *Inter-Mountain Basins Mixed Salt Desert Scrub* • *Great Basin Xeric Mixed Sagebrush Shrubland* • *Inter-Mountain Basins Semi-Desert Shrub Steppe* **Category B:** 63% of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological groups in category B include: • ***Inter-Mountain Basins Montane Sagebrush Steppe*** • *Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland* **Category C:** 93% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • ***Great Basin Pinyon-Juniper Woodland*** • *Rocky Mountain Aspen Forest and Woodland* **Inyo NF representation:** Less than one percent of the area of this inventory unit contains ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1072	**General location:** Mono Basin and Glass Mountain Management Areas **Size:** 7,574 acres

	Category A: 57% percent of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS: • ***Inter-Mountain Basins Big Sagebrush Shrubland*** **Category B:** 57% of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological groups in category B include: • *Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland* **Category C:** 69% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • *Great Basin Pinyon-Juniper Woodland* • *Rocky Mountain Aspen Forest and Woodland* **Inyo NF representation:** This inventory unit does not contain any ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1080	**General location:** South Sierra Management Area **Size:** 1,137 acres adjacent to South Sierra Wilderness **Category A:** 39% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Shrubland* **Category B: none** **Category C:** 52% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • *Great Basin Pinyon-Juniper Woodland* • *Rocky Mountain Aspen Forest and Woodland* **Inyo NF representation:** This inventory unit does not contain any ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1081	**General location:** South Sierra Management Area **Size:** 5,413 acres adjacent to Golden Trout Wilderness **Category A:** 8% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Shrubland*

	Category B: none **Category C:** 27% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • *Great Basin Pinyon-Juniper Woodland* • *Rocky Mountain Aspen Forest and Woodland* **Inyo NF representation:** This inventory unit does not contain any ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1092	**General location:** Golden Trout Management Area **Size:** 4,552 acres adjacent to Golden Trout Wilderness **Category A:** 1% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Shrubland* **Category B:** 1% of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological groups in category B include: • *Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland* **Category C:** 23% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • *Great Basin Pinyon-Juniper Woodland* • *Rocky Mountain Aspen Forest and Woodland* **Inyo NF representation:** This inventory unit does not contain any ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1098	**General location:** Owens Valley Escarpment Management Area **Size:** 1,476 acres adjacent to John Muir Wilderness **Category A:** None **Category B:** Less than one percent of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological groups in category B include: • *Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland* **Category C:** 5% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological

	groups in Category C include: • *Great Basin Pinyon-Juniper Woodland* • *Rocky Mountain Aspen Forest and Woodland* **Inyo NF representation:** This inventory unit does not contain any ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1099	**General location:** Owens Valley Escarpment Management Area **Size:** 1,092 acres adjacent to John Muir Wilderness **Category A:** None **Category B:** Less than one percent of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological groups in category B include: • *Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland* **Category C:** 13% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • *Great Basin Pinyon-Juniper Woodland* • *Rocky Mountain Aspen Forest and Woodland* **Inyo NF representation:** This inventory unit does not contain any ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1106	**General location:** Owens Valley Escarpment Management Area **Size:** 1,408 acres adjacent to John Muir Wilderness **Category A:** 2% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Shrubland* **Category B:** 4% of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological groups in category B include: • *Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland* **Category C:** 17% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • *Great Basin Pinyon-Juniper Woodland* • *Rocky Mountain Aspen Forest and Woodland*

	Inyo NF representation: This inventory unit does not contain any ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1108	**General location:** Owens Valley Escarpment Management Area **Size:** 2,100 acres adjacent to John Muir Wilderness **Category A:** Less than one percent of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Shrubland* **Category B:** Less than one percent of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological groups in category B include: • *Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland* **Category C:** 5% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • *Great Basin Pinyon-Juniper Woodland* • *Rocky Mountain Aspen Forest and Woodland* **Inyo NF representation:** This inventory unit does not contain any ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1109	**General location:** Owens Valley Escarpment Management Area **Size:** 1,319 acres adjacent to John Muir Wilderness **Category A:** 5% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Shrubland* **Category B:** 5% of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological groups in category B include: • *Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland* **Category C:** Ten percent of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • *Great Basin Pinyon-Juniper Woodland* • *Rocky Mountain Aspen Forest and Woodland*

	Inyo NF representation: This inventory unit does not contain any ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1110	**General location:** Owens Valley Escarpment Management Area **Size:** 1,650 acres adjacent to John Muir Wilderness **Category A:** 2% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Shrubland* • *Great Basin Xeric Mixed Sagebrush Shrubland* **Category B:** 2% of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological groups in category B include: • *Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland* **Category C:** 6% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • *Great Basin Pinyon-Juniper Woodland* • *Rocky Mountain Aspen Forest and Woodland* **Inyo NF representation:** 7% of this inventory unit contains ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1112	**General location:** Owens Valley Escarpment Management Area **Size:** 4,949 acres adjacent to John Muir Wilderness **Category A:** 33% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS: • *Great Basin Xeric Mixed Sagebrush Shrubland* • ***Inter-Mountain Basins Big Sagebrush Shrubland*** • *Inter-Mountain Basins Semi-Desert Shrub Steppe* • *Inter-Mountain Basins Mixed Salt Desert Scrub* **Category B:** 35% of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological groups in category B include: • *Inter-Mountain Basins Montane Sagebrush Steppe* • *Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland* **Category C:** 46% of the inventory unit is comprised of ecological groups which

	have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • *Great Basin Pinyon-Juniper Woodland* • *Rocky Mountain Aspen Forest and Woodland* **Inyo NF representation:** 23% of the area of this inventory unit contains ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1115	**General location:** Owens Valley Escarpment Management Area **Size:** 3,485 acres adjacent to John Muir Wilderness **Category A:** 82% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS: • *Great Basin Xeric Mixed Sagebrush Shrubland* • ***Inter-Mountain Basins Big Sagebrush Shrubland*** • *Inter-Mountain Basins Semi-Desert Shrub Steppe* • *Inter-Mountain Basins Mixed Salt Desert Scrub* **Category B:** 84% of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological groups in category B include: • *Inter-Mountain Basins Montane Sagebrush Steppe* • *Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland* **Category C:** 100% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • *Great Basin Pinyon-Juniper Woodland* **Inyo NF representation:** 5% of the area of this inventory unit contains ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1116	**General location:** Owens Valley Escarpment Management Area **Size:** 2,437 acres adjacent to John Muir Wilderness **Category A:** 55% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS: • *Great Basin Xeric Mixed Sagebrush Shrubland* • ***Inter-Mountain Basins Big Sagebrush Shrubland*** • *Inter-Mountain Basins Semi-Desert Shrub Steppe* • *Inter-Mountain Basins Mixed Salt Desert Scrub* **Category B:** 61% of this inventory unit is comprised of ecological groups which

	have less than ten percent of their total area protected in the NWPS. Ecological groups in category B include: • *Inter-Mountain Basins Montane Sagebrush Steppe* • *Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland* **Category C:** 98% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • *Great Basin Pinyon-Juniper Woodland* **Inyo NF representation:** 2% of the area of this inventory unit contains ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1140	**General location:** Coyote Management Area **Size:** 75,299 acres adjacent to the John Muir Wilderness **Category A:** 13% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS: • ***Great Basin Xeric Mixed Sagebrush Shrubland*** • ***Inter-Mountain Basins Big Sagebrush Shrubland*** • *Inter-Mountain Basins Semi-Desert Shrub Steppe* • ***Inter-Mountain Basins Mixed Salt Desert Scrub*** **Category B:** 29% of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological groups in category B include: • ***Inter-Mountain Basins Montane Sagebrush Steppe*** • *Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland* **Category C:** 65% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • ***Great Basin Pinyon-Juniper Woodland*** • *Rocky Mountain Aspen Forest and Woodland* **Inyo NF representation:** 2% of the area of this inventory unit contains ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1147	**General location:** Rock Creek-Pine Creek Management Area **Size:** 1,351 acres adjacent to John Muir Wilderness **Category A:** 22% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the

	NWPS: • *Inter-Mountain Basins Big Sagebrush Shrubland* **Category B:** None **Category C:** 37% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • *Great Basin Pinyon-Juniper Woodland* • *Rocky Mountain Aspen Forest and Woodland* **Inyo NF representation:** This inventory unit does not contain any ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1148	**General location:** Rock Creek-Pine Creek Management Area **Size:** 1,756 acres adjacent to John Muir Wilderness **Category A:** 7% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Shrubland* **Category B:** 8% of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological groups in category B include: • *Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland* **Category C:** 19% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • *Great Basin Pinyon-Juniper Woodland* • *Rocky Mountain Aspen Forest and Woodland* **Inyo NF representation:** This inventory unit does not contain any ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1154	**General location:** Rock Creek-Pine Creek Management Area **Size:** 5,243 acres adjacent to John Muir Wilderness **Category A:** 8% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Shrubland* • *Inter-Mountain Basins Mixed Salt Desert Scrub* **Category B:** 10% of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological

	groups in category B include: • *Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland* **Category C:** 54% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • ***Great Basin Pinyon-Juniper Woodland*** • *Rocky Mountain Aspen Forest and Woodland* **Inyo NF representation:** This inventory unit does not contain any ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1155	**General location:** Rock Creek-Pine Creek Management Area **Size:** 3,498 acres adjacent to John Muir Wilderness **Category A:** 1% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Shrubland* **Category B:** 3% of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological groups in category B include: • *Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland* **Category C:** 35% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • *Great Basin Pinyon-Juniper Woodland* • *Rocky Mountain Aspen Forest and Woodland* **Inyo NF representation:** This inventory unit does not contain any ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1156	**General location:** Convict-McGee Management Area **Size:** 5,129 acres adjacent to John Muir Wilderness **Category A:** 22% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Shrubland* **Category B:** 24% percent of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological groups in category B include:

	• *Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland* **Category C:** 57% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • *Great Basin Pinyon-Juniper Woodland* • *Rocky Mountain Aspen Forest and Woodland* **Inyo NF representation:** This inventory unit does not contain any ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1159	**General location:** Mammoth Escarpment Management Area **Size:** 14,833 acres adjacent to John Muir Wilderness **Category A:** 11% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS: • ***Inter-Mountain Basins Big Sagebrush Shrubland*** **Category B:** 11% of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological groups in category B include: • *Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland* **Category C:** 27% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • ***Great Basin Pinyon-Juniper Woodland*** • *Rocky Mountain Aspen Forest and Woodland* **Inyo NF representation:** This inventory unit does not contain any ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1161	**General location:** Reds Meadow-Fish Creek Management Area **Size:** 1,656 acres adjacent to Ansel Adams Wilderness **Category A and B:** Almost none of this area is comprised of ecosystems which have less than ten percent of their total area protected in the National Wilderness Preservation System: **Category C:** 2% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • *Great Basin Pinyon-Juniper Woodland* • *Rocky Mountain Aspen Forest and Woodland*

	Inyo NF representation: This inventory unit does not contain any ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1164	**General location:** Reds Meadow-Fish Creek Management Area **Size:** 1,017 acres adjacent to Ansel Adams Wilderness **Categories A, B and C:** Almost none of this area is comprised of ecosystems which have less than ten percent of their total area protected in the National Wilderness Preservation System: **Inyo NF representation:** This inventory unit does not contain any ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1179	**General location:** Walker-Parker Management Area **Size:** 7,212 acres adjacent to Ansel Adams Wilderness **Category A:** 10% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Shrubland* **Category B:** 10% of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological groups in category B include: • *Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland* **Category C:** 51% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • ***Great Basin Pinyon-Juniper Woodland*** • *Rocky Mountain Aspen Forest and Woodland* **Inyo NF representation:** This inventory unit does not contain any ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1195	**General location:** Mono Basin Management Area **Size:** 2,008 acres adjacent to Ansel Adams Wilderness **Category A:** 21% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Shrubland* **Category B: none** **Category C:** 68% of the inventory unit is comprised of ecological groups which

	have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • *Great Basin Pinyon-Juniper Woodland* • *Rocky Mountain Aspen Forest and Woodland* **Inyo NF representation:** This inventory unit does not contain any ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1208	**General location:** Lee Vining Management Area **Size:** 2,516 acres adjacent to Ansel Adams Wilderness **Category A:** 1% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Shrubland* **Category B: none** **Category C:** 2% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • *Great Basin Pinyon-Juniper Woodland* • *Rocky Mountain Aspen Forest and Woodland* **Inyo NF representation:** This inventory unit does not contain any ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1211	**General location:** Lee Vining Management Area **Size:** 1,949 acres adjacent to Ansel Adams Wilderness **Category A:** 4% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Shrubland* **Category B:** 4% of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological groups in category B include: • *Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland* **Category C:** 34% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • *Great Basin Pinyon-Juniper Woodland* • *Rocky Mountain Aspen Forest and Woodland* **Inyo NF representation:** This inventory unit does not contain any ecological

	groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1232	**General location:** Inyo Mountains Management Area **Size:** 3,205 acres adjacent to South Sierra Wilderness **Categories A and B**: Almost none of this area is comprised of ecosystems which have less than ten percent of their total area protected in the National Wilderness Preservation System. **Category C:** 9% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • *Great Basin Pinyon-Juniper Woodland* **Inyo NF representation:** This inventory unit does not contain any ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1236	**General location:** Inyo Mountains Management Area **Size:** 73,178 acres; a portion is adjacent to the Inyo Mountains Wilderness **Category A:** 32% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS: • ***Great Basin Xeric Mixed Sagebrush Shrubland*** • ***Inter-Mountain Basins Big Sagebrush Shrubland*** • ***Inter-Mountain Basins Semi-Desert Shrub Steppe*** • *Inter-Mountain Basins Mixed Salt Desert Scrub* **Category B:** 44% of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological groups in category B include: • ***Inter-Mountain Basins Montane Sagebrush Steppe*** • *Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland* **Category C:** 80% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • ***Great Basin Pinyon-Juniper Woodland*** **Inyo NF representation:** 7% of the area of this inventory unit contains ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1242	**General location:** White Mountains Management Area **Size:** 10,084 acres

	Category A: 8% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Shrubland* • *Inter-Mountain Basins Montane Sagebrush Steppe* **Category B:** 14% of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological groups in category B include: • *Inter-Mountain Basins Montane Sagebrush Steppe* **Category C:** 25% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • ***Great Basin Pinyon-Juniper Woodland*** **Inyo NF representation:** Less than one percent of the area of this inventory unit contains ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1246	**General location:** White Mountains Management Area **Size:** 43,230 acres **Category A:** 43% percent of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS: • ***Great Basin Xeric Mixed Sagebrush Shrubland*** • ***Inter-Mountain Basins Big Sagebrush Shrubland*** • *Inter-Mountain Basins Semi-Desert Shrub Steppe* • ***Inter-Mountain Basins Mixed Salt Desert Scrub*** **Category B:** 48% of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological groups in category B include: • ***Inter-Mountain Basins Montane Sagebrush Steppe*** • *Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland* **Category C:** 96% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • ***Great Basin Pinyon-Juniper Woodland*** **Inyo NF representation:** 8% of the area of this inventory unit contains ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.

1248	**General location:** White Mountains Management Area **Size:** 38,756 acres **Category A:** 31% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS: • ***Great Basin Xeric Mixed Sagebrush Shrub****land* • ***Inter-Mountain Basins Big Sagebrush Shrubland*** • *Inter-Mountain Basins Semi-Desert Shrub Steppe* • ***Inter-Mountain Basins Mixed Salt Desert Scrub*** **Category B:** 41% of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological groups in category B include: • ***Inter-Mountain Basins Montane Sagebrush Steppe*** • *Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland* **Category C:** 93% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • ***Great Basin Pinyon-Juniper Woodland*** **Inyo NF representation:** 6% of the area of this inventory unit contains ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1258	**General location:** White Mountains Management Area **Size:** 35,248 acres **Category A:** 18% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS: • ***Great Basin Xeric Mixed Sagebrush Shrubland*** • ***Inter-Mountain Basins Big Sagebrush Shrubland*** • *Inter-Mountain Basins Semi-Desert Shrub Steppe* • *Inter-Mountain Basins Mixed Salt Desert Scrub* **Category B:** 35% of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological groups in category B include: • ***Inter-Mountain Basins Montane Sagebrush Steppe*** • *Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland* **Category C:** 84% of the inventory unit is comprised of ecological groups which

	have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • ***Great Basin Pinyon-Juniper Woodland*** **Inyo NF representation:** 3% of the area of this inventory unit contains ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1275	**General location:** White Mountains Management Area **Size:** 10,435 acres adjacent to White Mountains Wilderness **Category A:** 33% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS: • *Great Basin Xeric Mixed Sagebrush Shrubland* • ***Inter-Mountain Basins Big Sagebrush Shrubland*** • *Inter-Mountain Basins Semi-Desert Shrub Steppe* • ***Inter-Mountain Basins Mixed Salt Desert Scrub*** **Category B:** 59% of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological groups in category B include: • ***Inter-Mountain Basins Montane Sagebrush Steppe*** • *Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland* **Category C:** 90% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • ***Great Basin Pinyon-Juniper Woodland*** **Inyo NF representation:** 7% of the area of this inventory unit contains ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1276	**General location:** White Mountains Management Area **Size:** 1,048 acres adjacent to White Mountains Wilderness **Category A:** 67% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS: • *Great Basin Xeric Mixed Sagebrush Shrubland* • *Inter-Mountain Basins Big Sagebrush Shrubland* • *Inter-Mountain Basins Semi-Desert Shrub Steppe* • *Inter-Mountain Basins Mixed Salt Desert Scrub* **Category B:** 73% of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological

	groups in category B include: • *Inter-Mountain Basins Montane Sagebrush Steppe* • *Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland* **Category C:** 92% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • *Great Basin Pinyon-Juniper Woodland* **Inyo NF representation:** 21% of the area of this inventory unit contains ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1281	**General location:** White Mountains Management Area **Size:** 11,210 acres adjacent to White Mountains Wilderness **Category A:** 5% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Shrubland* • *Inter-Mountain Basins Mixed Salt Desert Scrub* • *Great Basin Xeric Mixed Sagebrush Shrubland* **Category B:** 31% of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological groups in category B include: • ***Inter-Mountain Basins Montane Sagebrush Steppe*** • *Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland* **Category C:** 87% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • ***Great Basin Pinyon-Juniper Woodland*** **Inyo NF representation:** Less than one percent of the area of this inventory unit contains ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1295	**General location:** White Mountains Management Area **Size:** 2,065 acres adjacent to White Mountains Wilderness **Category A:** 14% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Shrubland* • *Great Basin Xeric Mixed Sagebrush Shrubland*

	Category B: 16% of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological groups in category B include: • *Inter-Mountain Basins Montane Sagebrush Steppe* **Category C:** 20% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • *Great Basin Pinyon-Juniper Woodland* **Inyo NF representation:** 5% of the area of this inventory unit contains ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1297	**General location:** White Mountains Management Area **Size:** 1,092 acres adjacent to White Mountains Wilderness **Category A:** 81% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS: • *Great Basin Xeric Mixed Sagebrush Shrubland* • *Inter-Mountain Basins Big Sagebrush Shrubland* • *Inter-Mountain Basins Semi-Desert Shrub Steppe* • *Inter-Mountain Basins Mixed Salt Desert Scrub* **Category B:** 83% of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological groups in category B include: • *Inter-Mountain Basins Montane Sagebrush Steppe* • *Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland* **Category C:** 92% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • *Great Basin Pinyon-Juniper Woodland* **Inyo NF representation:** 26% of the area of this inventory unit contains ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1301	**General location:** White Mountains Management Area **Size:** 3,010 acres adjacent to White Mountains Wilderness **Category A:** 71% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS:

	• *Great Basin Xeric Mixed Sagebrush Shrubland* • *Inter-Mountain Basins Big Sagebrush Shrubland* • *Inter-Mountain Basins Semi-Desert Shrub Steppe* • *Inter-Mountain Basins Mixed Salt Desert Scrub* **Category B:** 74% of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological groups in category B include: • *Inter-Mountain Basins Montane Sagebrush Steppe* **Category C:** 96% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • *Great Basin Pinyon-Juniper Woodland* **Inyo NF representation:** 17% of the area of this inventory unit contains ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1308	**General location:** White Mountains Management Area **Size:** 13,886 acres adjacent to White Mountains Wilderness **Category A:** 70% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS: • *Great Basin Xeric Mixed Sagebrush Shrubland* • ***Inter-Mountain Basins Big Sagebrush Shrubland*** • *Inter-Mountain Basins Semi-Desert Shrub Steppe* • ***Inter-Mountain Basins Mixed Salt Desert Scrub*** **Category B:** 76% of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological groups in category B include: • *Inter-Mountain Basins Montane Sagebrush Steppe* • *Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland* **Category C:** 98% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • ***Great Basin Pinyon-Juniper Woodland*** **Inyo NF representation:** 23% of the area of this inventory unit contains ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.

1311	**General location:** White Mountains Management Area **Size:** 11,214 acres adjacent to Boundary Peak and White Mountains Wilderness **Category A:** 17% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS: • *Great Basin Xeric Mixed Sagebrush Shrubland* • *Inter-Mountain Basins Big Sagebrush Shrubland* • *Inter-Mountain Basins Semi-Desert Shrub Steppe* • *Inter-Mountain Basins Mixed Salt Desert Scrub* **Category B:** 37% of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological groups in category B include: • ***Inter-Mountain Basins Montane Sagebrush Steppe*** • *Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland* **Category C:** 75% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • ***Great Basin Pinyon-Juniper Woodland*** **Inyo NF representation:** 4% of the area of this inventory unit contains ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1312	**General location:** White Mountains Management Area **Size:** 8,133 acres adjacent to Boundary Peak Wilderness(comprised of three sub-areas) **Category A:** 5% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Shrubland* • *Great Basin Xeric Mixed Sagebrush Shrubland* **Category B:** 29% of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological groups in category B include: • ***Inter-Mountain Basins Montane Sagebrush Steppe*** **Category C:** 72% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • ***Great Basin Pinyon-Juniper Woodland***

<table>
<tr><td></td><td>Inyo NF representation: Less than one percent of the area of this inventory unit contains ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.</td></tr>
<tr><td>1326</td><td>General location: White Mountains Management Area
Size: 5,464 acres

Category A: 25% percent of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS:
• Great Basin Xeric Mixed Sagebrush Shrubland
• Inter-Mountain Basins Big Sagebrush Shrubland
• Inter-Mountain Basins Semi-Desert Shrub Steppe
• Inter-Mountain Basins Mixed Salt Desert Scrub

Category B: 37%of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological groups in category B include:
• Inter-Mountain Basins Montane Sagebrush Steppe

Category C: 92% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include:
• Great Basin Pinyon-Juniper Woodland

Inyo NF representation: 4% of the area of this inventory unit contains ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.</td></tr>
<tr><td>1332</td><td>General location: Pizona Management Area
Size: 5,254 acres

Category A: 41% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS:
• Great Basin Xeric Mixed Sagebrush Shrubland
• Inter-Mountain Basins Big Sagebrush Shrubland
• Inter-Mountain Basins Semi-Desert Shrub Steppe
• Inter-Mountain Basins Mixed Salt Desert Scrub

Category B: 44% of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological groups in category B include:
• Inter-Mountain Basins Montane Sagebrush Steppe
• Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland</td></tr>
</table>

	Category C: 98% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • ***Great Basin Pinyon-Juniper Woodland*** **Inyo NF representation:** 4% of the area of this inventory unit contains ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1339	**General location:** Pizona Management Area **Size:** 19,826 acres **Category A:** 28% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS: • *Great Basin Xeric Mixed Sagebrush Shrubland* • ***Inter-Mountain Basins Big Sagebrush Shrubland*** • *Inter-Mountain Basins Semi-Desert Shrub Steppe* • *Inter-Mountain Basins Mixed Salt Desert Scrub* **Category B:** 35% of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological groups in category B include: • ***Inter-Mountain Basins Montane Sagebrush Steppe*** **Category C:** 99% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • ***Great Basin Pinyon-Juniper Woodland*** **Inyo NF representation:** 1% of the area of this inventory unit contains ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1342	**General location:** White Mountains Management Area **Size:** 6,144 acres **Category A:** 31% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS: • *Great Basin Xeric Mixed Sagebrush Shrubland* • ***Inter-Mountain Basins Big Sagebrush Shrubland*** • *Inter-Mountain Basins Semi-Desert Shrub Steppe* • *Inter-Mountain Basins Mixed Salt Desert Scrub* **Category B:** 35% of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological

<table>
<tr><td></td><td>groups in category B include:
Inter-Mountain Basins Montane Sagebrush Steppe
Category C: 90% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include:
Great Basin Pinyon-Juniper Woodland
Inyo NF representation: 2% of the area of this inventory unit contains ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.</td></tr>
<tr><td>1355</td><td>General location: Pizona Management Area
Size: 10,297 acres

Category A: 30% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS:
Great Basin Xeric Mixed Sagebrush Shrubland
Inter-Mountain Basins Big Sagebrush Shrubland
Inter-Mountain Basins Semi-Desert Shrub Steppe
Inter-Mountain Basins Mixed Salt Desert Scrub
Category B: 31% of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological groups in category B include:
Inter-Mountain Basins Montane Sagebrush Steppe
Category C: 100% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include:
Great Basin Pinyon-Juniper Woodland
Inyo NF representation: Less than one percent of the area of this inventory unit contains ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.</td></tr>
<tr><td>1357</td><td>General location: Pizona Management Area
Size: 5,805 acres

Category A: 52% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS:
Great Basin Xeric Mixed Sagebrush Shrubland
Inter-Mountain Basins Big Sagebrush Shrubland
Inter-Mountain Basins Semi-Desert Shrub Steppe
Inter-Mountain Basins Mixed Salt Desert Scrub</td></tr>
</table>

	Category B: 52% of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological groups in category B include: • *Inter-Mountain Basins Montane Sagebrush Steppe* **Category C:** 100% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • ***Great Basin Pinyon-Juniper Woodland*** **Inyo NF representation:** Less than one percent of the area of this inventory unit contains ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1361	**General location:** Pizona Management Area **Size:** 8,855 acres **Category A:** 34% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS: • *Great Basin Xeric Mixed Sagebrush Shrubland* • ***Inter-Mountain Basins Big Sagebrush Shrubland*** • *Inter-Mountain Basins Semi-Desert Shrub Steppe* • *Inter-Mountain Basins Mixed Salt Desert Scrub* **Category B:** 35% of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological groups in category B include: • *Inter-Mountain Basins Montane Sagebrush Steppe* **Category C:** 99% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • ***Great Basin Pinyon-Juniper Woodland*** **Inyo NF representation:** Less than one percent of the area of this inventory unit contains ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1376	**General location:** Benton-Casa Diablo Management Area **Size:** 9,922 acres **Category A:** 9% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS: • *Great Basin Xeric Mixed Sagebrush Shrubland* • *Inter-Mountain Basins Big Sagebrush Shrubland*

	• *Inter-Mountain Basins Semi-Desert Shrub Steppe* • *Inter-Mountain Basins Mixed Salt Desert Scrub* **Category B:** 15% of this inventory unit is comprised of ecological groups which have less than ten percent of their total area protected in the NWPS. Ecological groups in category B include: • *Inter-Mountain Basins Montane Sagebrush Steppe* • *Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland* **Category C:** 100% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • ***Great Basin Pinyon-Juniper Woodland*** **Inyo NF representation:** Less than one percent of the area of this inventory unit contains ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.
1432	This area is on the Sequoia NF
1391	**General location:** South Sierra Management Area **Size:** 33,248 acres adjacent to South Sierra Wilderness **Category A:** 11% of the inventory unit is comprised of the following ecological groups, which have less than five percent of their total area protected in the NWPS: • ***Inter-Mountain Basins Big Sagebrush Shrubland*** **Category B: none** **Category C:** 53% of the inventory unit is comprised of ecological groups which have less than twenty percent of their total area protected in the NWPS. Ecological groups in Category C include: • ***Great Basin Pinyon-Juniper Woodland*** • *Rocky Mountain Aspen Forest and Woodland* **Inyo NF representation:** This inventory unit does not contain any ecological groups with less than twenty percent of their area on the Inyo NF in designated wilderness.

Sierra NF Wilderness Inventory Areas
Summary of The Wilderness Society's data on
Under-represented Ecosystems in the National Wilderness Preservation System

Background
The Wilderness Society (TWS) comments indicated the Wilderness Evaluation process should consider the suitability of Wilderness Inventory Areas with under-represented and rare ecosystems. The Wilderness Society utilized several sets of available information at the national scale to identify under-represented ecosystems in the National Wilderness Preservation System (NWPS).

The National Vegetation Classification System Group 6[1] data was used to identify the set of forty-two ecological group within the Sierra NF. For each ecological group on the forest, the Wilderness Society provided two calculations: the percentage of an ecological group's total area (nation-wide) that is within the NWPS; the percentage of an ecological group's area within the Sierra NF that is within designated wilderness. The ecological groups were divided into four classes of representation, which are termed categories A through D below.

Category A is ecological groups on the Sierra NF that have less than five percent of their area protected within the NWPS:
Inter-Mountain Basins Big Sagebrush Shrubland-3% protected in NWPS
Inter-Mountain Basins Big Sagebrush Steppe-2% protected in NWPS
Temperate Pacific Freshwater Mudflat- 5% protected in NWPS

Category B is ecological groups on the Sierra NF that have between five and ten percent of their area protected within the NWPS:
1. *Open Water – fresh – 6% protected in NWPS*

Category C is ecological groups on the Sierra NF that have between ten and twenty percent of their area protected within the NWPS. The Wilderness Society indicated it considers ecological groups with less than twenty percent of its total area in the NWPS as inadequately represented[2].
1. *California Central Valley and Southern Coastal Grassland-12% protected in NWPS*
2. *California Central Valley Mixed Oak Savanna-14% protected in NWPS*
3. *California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna-11% protected in NWPS*
4. *Great Basin Pinyon-Juniper Woodlands – 14% of ecosystem protected in NWPS*
5. *Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland and Shrubland-19% protected in NWPS*
6. *Mediterranean California Mesic Mixed Conifer Forest and Woodland-12% protected in NWPS*
7. *Mediterranean California Mixed Oak Woodland-10% protected in NWPS*
8. *Northern and Central California Dry-Mesic Chaparral-11% protected in NWPS*
9. *Rocky Mountain Aspen Forest and Woodland – 12% of ecosystem protected in NWPS.*

---

[1] The National Vegetation Classification System website indicates the ecological context for Group 6 data: regional mesoclimate, geology, substrates, hydrology and disturbance regimes.
[2] The twenty percent representation threshold is based on Society for Conservation Biology and Convention on Biological Diversity targets (personal communication with Matt Dietz).

Category D is ecological groups on the Sierra NF that have more than twenty percent of their area protected within the NWPS, and are not discussed further.

Data Management and processing

1. Six of the forty-two ecological groups were not considered in this summary because their label indicated they are developed land.
2. No Category B data on the *open water (fresh)* ecosystem will be summarized because the TWS data did not include the acreage for this ecosystem on individual wilderness inventory units.
3. Area size information was converted from hectares to acres.
4. Ecological group in each category were ranked by size, largest to smallest.
5. Ecological group in each category with less than 1,000 total acres on all Sierra NF non-wilderness lands were not included in this summary.
6. For each category, the acres for the ecological groups in that category were summed for each wilderness inventory unit.
7. The percentage of each wilderness inventory unit's total area comprised of "under-represented" ecological groups was calculated.

The table below summarizes TWS "representation" data for each wilderness inventory area listed in the polygon column:

General location: Indicates whether the unit is adjacent to designated wilderness.

Size: The area in acres indicated is the "parent polygon".

Category A: The summary first displays the percentage of the wilderness inventory unit comprised of Category A ecological groups, and the types of type of ecological groups in Category A within the inventory unit. Any ecological groups with more than 1,000 acres in an inventory unit is highlighted in bold font.

Category C: Next, the summary displays the percentage of the wilderness inventory unit comprised of Category C ecological groups and the types of ecological groups within the inventory unit. Any ecological groups with more than 1,000 acres in an inventory unit is highlighted in bold font.**Note:** The percent of the wilderness inventory unit comprised of Category C ecosystems includes the area of Category A ecosystems (the names of the Category A ecosystems, however, are not listed again under Category C).

Sierra NF representation: The forest representation section displays two percentages. The first is the percentage of the area of a wilderness inventory unit that is comprised of ecological groups that have **less than five percent** of their total area on the forest in designated wilderness. The ecological groups with less than five percent of their total acreage on the forest in designated wilderness include:

- *California Central Valley Mixed Oak Savanna*
- *California Central Valley and Southern Coastal Grassland*
- *California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna*

- *Northern and Central California Dry-Mesic Chaparral*
- *Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland*
- *Recently burned forest acres*
- *Temperate Pacific Freshwater Mudflat*

- The second percentage is the percentage of the area of a wilderness inventory unit that is comprised of ecological groups that have **less than twenty percent** of their total acreage on the forest in designated wilderness. The ecological groups with less than twenty percent of their total acreage on the forest in designated wilderness include the same ecological groups as above, with the addition of:
- *Mediterranean California Mixed Oak Woodland*
- *Mojave Mid-elevation Mixed Desert Scrub*

Wilderness Inventory Unit	Summary
227	**General location:** Not adjacent to designated wilderness **Size:** 15,358 acres **Category A:** Less than 1% of this inventory unit is comprised of the following Category A ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Steppe* **Category C:** 78% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • ***California Central Valley Mixed Oak Savanna*** • ***California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna*** • ***Mediterranean California Mixed Oak Woodland*** • *Rocky Mountain Aspen Forest and Woodland* • ***Mediterranean California Mesic Mixed Conifer Forest and Woodland*** • *Great Basin Pinyon-Juniper Woodland* • *Northern and Central California Dry-Mesic Chaparral* • *California Central Valley and Southern Coastal Grassland* **Sierra NF Representation**: 65% percent of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 95% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
304	**General location:** Not adjacent to designated wilderness **Size:** 5,916 acres **Category A:** There are no Category A ecological groups, which have less than five percent of their total area protected in the NWPS, in this wilderness inventory unit.

	Category C: 88% of this Inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • ***California Central Valley Mixed Oak Savanna*** • ***California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna*** • *Mediterranean California Mixed Oak Woodland* • *Mediterranean California Mesic Mixed Conifer Forest and Woodland* • *Northern and Central California Dry-Mesic Chaparral* **Sierra NF Representation**: 87% of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 95% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
315	**General location:** Not adjacent to designated wilderness **Size:** 17,908 acres **Category A:** 2% of this Inventory unit is comprised of the following Category A ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Steppe* • *Inter-Mountain basins Big Sagebrush Shrubland* **Category C:** 62% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • ***California Central Valley Mixed Oak Savanna*** • ***California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna*** • ***Mediterranean California Mixed Oak Woodland*** • *Rocky Mountain Aspen Forest and Woodland* • ***Mediterranean California Mesic Mixed Conifer Forest and Woodland*** • *Great Basin Pinyon-Juniper Woodland* • *Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland and Shrubland* • *Northern and Central California Dry-Mesic Chaparral* **Sierra NF Representation**: 35% of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 73% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
330	**General location:** Not adjacent to designated wilderness **Size:** 7,804 acres **Category A:** 9% of this inventory unit is comprised of the following Category A ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Steppe*

	• *Inter-Mountain basins Big Sagebrush Shrubland* **Category C:** 85% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *California Central Valley Mixed Oak Savanna* • *California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna* • *Mediterranean California Mixed Oak Woodland* • *Rocky Mountain Aspen Forest and Woodland* • ***Mediterranean California Mesic Mixed Conifer Forest and Woodland*** • *Great Basin Pinyon-Juniper Woodland* • *Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland and Shrubland* • *Northern and Central California Dry-Mesic Chaparral* **Sierra NF Representation**: 2% of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 68% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
357	**General location:** Not adjacent to designated wilderness **Size:** 5,374 acres **Category A:** Less than one percent of this Inventory unit is comprised of the following Category A ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Steppe* • *Inter-Mountain basins Big Sagebrush Shrubland* **Category C:** 45% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *California Central Valley Mixed Oak Savanna* • ***California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna*** • *Mediterranean California Mixed Oak Woodland* • *Mediterranean California Mesic Mixed Conifer Forest and Woodland* • *Northern and Central California Dry-Mesic Chaparral* **Sierra NF Representation**: 72% of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 93% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
441	**General location:** Not adjacent to designated wilderness **Size:** 6,892 acres **Category A:** 10% of this Inventory unit is comprised of the following Category A ecological groups, which has less than five percent of their total area protected in the

	NWPS: • *Inter-Mountain basins Big Sagebrush Shrubland* **Category C:** 28% percent of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *Mediterranean California Mixed Oak Woodland* • ***Mediterranean California Mesic Mixed Conifer Forest and Woodland*** • *Rocky Mountain Aspen Forest and Woodland* • *Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland and Shrubland* **Sierra NF Representation**: None of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 16% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
539	**General location:** Adjacent to Dinkey Lakes Wilderness **Size:** 48,312 acres **Category A:** 3% of this Inventory unit is comprised of the following Category A ecological groups, which has less than five percent of their total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Shrubland* • *Inter-Mountain Basins Big Sagebrush Steppe* • *Temperate Pacific Freshwater Mudflat* **Category C:** 6% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *Mediterranean California Mixed Oak Woodland* • ***Mediterranean California Mesic Mixed Conifer Forest and Woodland*** • *Rocky Mountain Aspen Forest and Woodland* • *Great Basin Pinyon-Juniper Woodland* • *Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland and Shrubland* **Sierra NF Representation**: 1% of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 3% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
557	**General location:** Not adjacent to designated wilderness **Size:** 5,072 acres **Category A:** 1% of this Inventory unit is comprised of the following Category A ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Steppe* • *Inter-Mountain basins Big Sagebrush Shrubland*

	Category C: 34% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna* • *Mediterranean California Mixed Oak Woodland* • ***Mediterranean California Mesic Mixed Conifer Forest and Woodland*** • *Rocky Mountain Aspen Forest and Woodland* • *Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland and Shrubland* • *Northern and Central California Dry-Mesic Chaparral* **Sierra NF Representation**: 58% of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. Most of the ecological group acreage in this unit is "recently burned forest acres". 90% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
577	**General location:** Adjacent to Kaiser Wilderness **Size:** 7,127 acres **Category A:** 1% of this Inventory unit is comprised of the following Category A ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Steppe* • *Inter-Mountain basins Big Sagebrush Shrubland* **Category C:** 25% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *Mediterranean California Mixed Oak Woodland* • ***Mediterranean California Mesic Mixed Conifer Forest and Woodland*** • *Rocky Mountain Aspen Forest and Woodland* • *Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland and Shrubland* • *Great Basin Pinyon-Juniper Woodland* **Sierra NF Representation**: None of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 22% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
586	**General location:** Not adjacent to designated wilderness **Size:** 5,412 acres **Category A:** 1% of this Inventory unit is comprised of the following Category A ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Steppe* • *Inter-Mountain basins Big Sagebrush Shrubland*

	Category C: 63% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna* • *Mediterranean California Mixed Oak Woodland* • ***Mediterranean California Mesic Mixed Conifer Forest and Woodland*** • *Rocky Mountain Aspen Forest and Woodland* • *Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland and Shrubland* • *Northern and Central California Dry-Mesic Chaparral* **Sierra NF Representation**: 25% of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 85% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
646	**General location:** Not adjacent to designated wilderness **Size:** 18,013 acres **Category A:** 4% of this inventory unit is comprised of the following Category A ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Steppe* • *Inter-Mountain basins Big Sagebrush Shrubland* **Category C:** 47%of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *Mediterranean California Mixed Oak Woodland* • ***Mediterranean California Mesic Mixed Conifer Forest and Woodland*** • *Rocky Mountain Aspen Forest and Woodland* • *Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland and Shrubland* • *Great Basin Pinyon-Juniper Woodland* **Sierra NF Representation**: None of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 41% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
688	**General location:** Not adjacent to designated wilderness **Size:** 6,515 acres **Category A:** 8% of this inventory unit is comprised of the following Category A ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Steppe* • *Inter-Mountain basins Big Sagebrush Shrubland*

	Category C: 71% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *Mediterranean California Mixed Oak Woodland* • ***Mediterranean California Mesic Mixed Conifer Forest and Woodland*** • *Rocky Mountain Aspen Forest and Woodland* • *Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland and Shrubland* • *Great Basin Pinyon-Juniper Woodland* **Sierra NF Representation**: None of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 56% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
772	**General location:** Not adjacent to designated wilderness **Size:** 47,747 acres **Category A:** 1% of this inventory unit is comprised of the following Category A ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Steppe* • *Inter-Mountain basins Big Sagebrush Shrubland* **Category C:** 70% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *California Central Valley Mixed Oak Savanna* • ***California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna*** • ***Mediterranean California Mixed Oak Woodland*** • *Rocky Mountain Aspen Forest and Woodland* • ***Mediterranean California Mesic Mixed Conifer Forest and Woodland*** • *Great Basin Pinyon-Juniper Woodland* • *Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland and Shrubland* • ***Northern and Central California Dry-Mesic Chaparral*** **Sierra NF Representation**: 34%` of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 91% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
781	**General location:** Adjacent to John Muir Wilderness **Size:** 2,477 acres **Category A:** 21% percent of this inventory unit is comprised of the following Category A ecological groups, which has less than five percent of their total area protected in the

	NWPS: • *Inter-Mountain basins Big Sagebrush Shrubland* **Category C:** 32% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *Mediterranean California Mixed Oak Woodland* • *Rocky Mountain Aspen Forest and Woodland* • *Mediterranean California Mesic Mixed Conifer Forest and Woodland* • *Great Basin Pinyon-Juniper Woodland* • *Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland and Shrubland* **Sierra NF Representation**: None of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 9% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
785	**General location:** Adjacent to John Muir Wilderness **Size:** 1,254 acres **Category A:** 46% of this inventory unit is comprised of the following Category A ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Shrubland* • *Temperate Pacific Freshwater Mudflat* **Category C:** 50% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *Rocky Mountain Aspen Forest and Woodland* • *Mediterranean California Mesic Mixed Conifer Forest and Woodland* • *Great Basin Pinyon-Juniper Woodland* **Sierra NF Representation**: 27% of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 27% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
795	**General location:** Adjacent to John Muir Wilderness **Size:** 1,206 acres **Category A:** 9% of this inventory unit is comprised of the following Category A ecological groups, which has less than five percent of their total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Shrubland* **Category C:** 17% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *Rocky Mountain Aspen Forest and Woodland*

	• *Mediterranean California Mesic Mixed Conifer Forest and Woodland* • *Great Basin Pinyon-Juniper Woodland* • *Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland and Shrubland* **Sierra NF Representation**: None of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 1% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
797	**General location:** Adjacent to John Muir Wilderness **Size:** 1,299 acres **Category A:** None of this inventory unit is comprised of the following Category A ecological groups, which has less than five percent of their total area protected in the NWPS. **Category C:** 2% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *Rocky Mountain Aspen Forest and Woodland* • *Mediterranean California Mesic Mixed Conifer Forest and Woodland* • *Great Basin Pinyon-Juniper Woodland* **Sierra NF Representation**: None of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 1% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
815	**General location:** Adjacent to John Muir Wilderness **Size:** 3,888 acres **Category A:** 12% of this inventory unit is comprised of the following Category A ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Shrubland* • *Temperate Pacific Freshwater Mudflat* **Category C:** 14% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *Rocky Mountain Aspen Forest and Woodland* • *Mediterranean California Mesic Mixed Conifer Forest and Woodland* • *Great Basin Pinyon-Juniper Woodland* • *Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland and Shrubland* **Sierra NF Representation**:

	9% of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 9% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
819	**General location:** Adjacent to John Muir Wilderness **Size:** 37,528 acres **Category A:** 6% of this inventory unit is comprised of the following Category A ecological groups, which have less than five percent of their total area protected in the NWPS: • ***Inter-Mountain Basins Big Sagebrush Shrubland*** • *Inter-Mountain Basins Big Sagebrush Steppe* **Category C:** 60% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *California Central Valley Mixed Oak Savanna* • ***California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna*** • ***Mediterranean California Mixed Oak Woodland*** • *Rocky Mountain Aspen Forest and Woodland* • ***Mediterranean California Mesic Mixed Conifer Forest and Woodland*** • ***Great Basin Pinyon-Juniper Woodland*** • *Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland and Shrubland* • ***Northern and Central California Dry-Mesic Chaparral*** **Sierra NF Representation**: 23% of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 63% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
820	**General location:** Adjacent to John Muir Wilderness **Size:** 1,741 acres **Category A:** 15% of this inventory unit is comprised of the following Category A ecological groups , which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Shrubland* • *Inter-Mountain Basins Big Sagebrush Steppe* **Category C:** 56% of this inventory unit is comprised of the following ecological groups , which have less than twenty percent of their total area protected in the NWPS: • *Mediterranean California Mixed Oak Woodland* • *Rocky Mountain Aspen Forest and Woodland* • *Mediterranean California Mesic Mixed Conifer Forest and Woodland* • *Great Basin Pinyon-Juniper Woodland*

	• *Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland and Shrubland* **Sierra NF Representation**: 23% of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 33% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
821	**General location:** Adjacent to Yosemite National Park Wilderness **Size:** 13,370 acres **Category A:** Less than 1% of this inventory unit is comprised of the following Category A ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Shrubland* **Category C:** 16% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *Mediterranean California Mixed Oak Woodland* • *Rocky Mountain Aspen Forest and Woodland* • ***Mediterranean California Mesic Mixed Conifer Forest and Woodland*** • *Great Basin Pinyon-Juniper Woodland* • *Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland and Shrubland* **Sierra NF Representation**: Less than one percent of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 14% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
822	**General location:** Adjacent to Ansel Adams Wilderness **Size:** 10,581 acres **Category A:** 3% of this inventory unit is comprised of the following Category A ecological groups, which has less than five percent of its total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Shrubland* **Category C:** 16% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *Mediterranean California Mixed Oak Woodland* • *Rocky Mountain Aspen Forest and Woodland* • ***Mediterranean California Mesic Mixed Conifer Forest and Woodland*** • *Great Basin Pinyon-Juniper Woodland* • *Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland and Shrubland* **Sierra NF Representation**:

	None of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 11% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
1378	**General location:** Adjacent to John Muir Wilderness Note – This WIA may be located on both Sierra and Sequoia NF[UFS1] **Size:** 71,974 acres **Category A:** 1% of this inventory unit is comprised of the following Category A ecological groups, which has less than five percent of its total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Shrubland* • *Inter-Mountain Basins Big Sagebrush Steppe* **Category C:** 31% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • ***California Central Valley Mixed Oak Savanna*** • ***California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna*** • ***Mediterranean California Mixed Oak Woodland*** • *Rocky Mountain Aspen Forest and Woodland* • ***Mediterranean California Mesic Mixed Conifer Forest and Woodland*** • *Great Basin Pinyon-Juniper Woodland* • *Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland and Shrubland* • ***Northern and Central California Dry-Mesic Chaparral*** **Sierra NF Representation**: 16% of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 33% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.

Sequoia NF Wilderness Inventory Areas
Summary of The Wilderness Society's data on
Under-represented Ecosystems in the National Wilderness Preservation System

Background

The Wilderness Society (TWS) comments indicated the Wilderness Evaluation process should consider the suitability of Wilderness Inventory Areas with under-represented and rare ecosystems. The Wilderness Society utilized several sets of available information at the national scale to identify under-represented ecosystems in the National Wilderness Preservation System (NWPS).

The National Vegetation Classification System Group 6[1] (ecological group) data was used to identify a set of forty-four "ecosystems" that are within the Sequoia NF boundary. For each ecological group on the forest, the Wilderness Society provided two calculations: the percentage of an ecological group's total area (nation-wide) that is within the NWPS; the percentage of an ecological group's area within the Sequoia NF that is within designated wilderness. The ecological groups were divided into four classes of representation, which are termed categories A through D below.

Category A is ecological groups on the Sequoia NF that have less than five percent of their area protected within the NWPS:

1. *Inter-Mountain Basins Big Sagebrush Shrubland-three percent protected in NWPS*
2. *Inter-Mountain Basins Big Sagebrush Steppe-two percent protected in NWPS*

Category B is ecological groups on the Sequoia NF that have between five and ten percent of their area protected within the NWPS:

- *There are no ecological groups on the Sequoia NF in this category of representation.*

Category C is ecological groups on the Sequoia NF that have between ten and twenty percent of their area protected within the NWPS. The Wilderness Society indicated it considers ecological groups with less than twenty percent of its total area in the NWPS as inadequately represented[2] in the NWPS.

1. *California Central Valley and Southern Coastal Grassland-12% protected in NWPS*
2. *California Central Valley Mixed Oak Savanna-14% percent protected in NWPS*
3. *California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna-11% protected in NWPS*
4. *Great Basin Pinyon-Juniper Woodlands – 14% protected in NWPS*
5. *Mediterranean California Mesic Mixed Conifer Forest and Woodland-12% protect in NWPS*
6. *Mediterranean California Mixed Oak Woodland-10% protected in NWPS*
7. *Northern and Central California Dry-Mesic Chaparral-11% protected in NWPS*
8. *Rocky Mountain Aspen Forest and Woodland – 12% of ecosystem protected in NWPS.*

Category D is ecological groups on the Sequoia NF that have more than twenty percent of their area protected within the NWPS, and are not discussed further.

---

[1] The National Vegetation Classification System website indicates the ecological context for Group 6 data: regional mesoclimate, geology, substrates, hydrology and disturbance regimes.

[2] The twenty percent representation threshold is based on Society for Conservation Biology and Convention on Biological Diversity targets (personal communication with Matt Dietz).

Sequoia NF Wilderness Inventory Areas
Summary of The Wilderness Society's data on
Under-represented Ecosystems in the National Wilderness Preservation System

Data Management and processing

1. Eight of the forty-four ecological groups were not considered in this summary because their label indicated they are developed land.
2. Area size information was converted from hectares to acres.
3. Ecological groups in each category were ranked by size, largest to smallest.
4. Ecological groups in each category with less than 1,000 total acres on all Sequoia NF non-wilderness lands were not included in this summary.
5. For each category, the acres for the ecological groups in that category were summed for each wilderness inventory unit.
6. The percentage of each wilderness inventory unit's total area comprised of "under-represented" ecological groups was calculated.

The table below summarizes TWS "representation" data for each wilderness inventory area listed in the polygon column:

General location: Indicates whether the unit is adjacent to designated wilderness.

Size: The area in acres indicated is the "parent polygon".

Category A: The summary first displays the percentage of the wilderness inventory unit comprised of Category A ecological groups, and the types of type of ecological groups in Category A within the inventory unit. Any ecological groups with more than 1,000 acres in an inventory unit is highlighted in bold font. **Category C:** Next, the summary displays the percentage of the wilderness inventory unit comprised of Category C ecological groups, and the types of ecological groups in Category C within the inventory unit. Any ecological groups with more than 1,000 acres in an inventory unit is highlighted in bold font. **Note:** The percent of the wilderness inventory unit comprised of Category C ecological groups includes the area of Category A ecological groups (the names of the Category A ecosystems, however, are not listed again under Category C).

Sequoia NF representation: The forest representation section displays two percentages. The first is the percentage of the area of a wilderness inventory unit that is comprised of ecological groups that have less than five percent of their total area on the forest in designated wilderness. The ecological groups with less than five percent of their total acreage on the forest in designated wilderness include:

- *California Central Valley Mixed Oak Savanna*
- *California Central Valley and Southern Coastal Grassland*

The second percentage is the percentage of the area of a wilderness inventory unit that is comprised of ecological groups that have less than twenty percent of their total acreage on the forest in designated wilderness. The ecological groups with less than twenty percent of their total acreage on the forest in designated wilderness include the same ecological groups as above, with the addition of:

- *California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna*
- *Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland*

- *Mediterranean California Mesic Mixed Conifer Forest and Woodland*
- *Mediterranean California Mixed Oak Woodland*
- *Northern and Central California Dry-Mesic Chaparral*

Wilderness Inventory Unit	Summary
18	**General location:** Not adjacent to designated wilderness **Size:** 6,337 acres **Category A:** 2% of this inventory unit is comprised of the following Category A ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Steppe* • *Inter-Mountain Basins Big Sagebrush Steppe* **Category C:** 38% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna* • *Mediterranean California Mixed Oak Woodland* • ***Mediterranean California Mesic Mixed Conifer Forest and Woodland*** • *Great Basin Pinyon-Juniper Woodland* • *Rocky Mountain Aspen Forest and Woodland* **Sequoia NF Representation**: None of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 29% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
36	**General location:** Not adjacent to wilderness **Size:** 2,089 acres **Category A:** 1% of this inventory unit is comprised of the following Category A ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Steppe* • *Inter-Mountain Basins Big Sagebrush Steppe* **Category C:** 34% of this Inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *California Central Valley Mixed Oak Savanna* • *California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna* • *Great Basin Pinyon-Juniper Woodland*

	• *Mediterranean California Mesic Mixed Conifer Forest and Woodland* • *Mediterranean California Mixed Oak Woodland* • *Northern and Central California Dry-Mesic Chaparral* **Sequoia NF Representation**: None of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 36% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
63	**General location:** Not adjacent to designated wilderness **Size:** 5,223 acres **Category A:** 1% of this Inventory unit is comprised of the following Category A ecological group, which has less than five percent of its total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Steppe* **Category C:** 30% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *California Central Valley Mixed Oak Savanna* • *California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna* • *Great Basin Pinyon-Juniper Woodland* • *Mediterranean California Mesic Mixed Conifer Forest and Woodland* • *Mediterranean California Mixed Oak Woodland* • *Northern and Central California Dry-Mesic Chaparral* • *Rocky Mountain Aspen Forest and Woodland* **Sequoia NF Representation**: 6% of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 32% percent of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
66	**General location:** Not adjacent to designated wilderness **Size:** 8,289 acres **Category A:** Less than one percent of this inventory unit is comprised of the following Category A ecological group, which has less than five percent of its total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Steppe* **Category C:** 88% percent of this inventory unit is comprised of the following ecosystems, which have less than twenty percent of their total area protected in the NWPS: • ***California Central Valley and Southern Coastal Grassland*** • ***California Central Valley Mixed Oak Savanna***

	• *California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna* • *Mediterranean California Mesic Mixed Conifer Forest and Woodland* • *Mediterranean California Mixed Oak Woodland* • *Northern and Central California Dry-Mesic Chaparral* **Sequoia NF Representation**: 28% of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 37% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
73	**General location:** Not adjacent to designated wilderness **Size:** 15,128 acres **Category A:** 1% of this Inventory unit is comprised of the following Category A ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Steppe* • *Inter-Mountain basins Big Sagebrush Shrubland* **Category C:** 31% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *California Central Valley and Southern Coastal Grassland* • *California Central Valley Mixed Oak Savanna* • ***California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna*** • *Great Basin Pinyon-Juniper Woodland* • *Mediterranean California Mesic Mixed Conifer Forest and Woodland* • ***Mediterranean California Mixed Oak Woodland*** • *Northern and Central California Dry-Mesic Chaparral* • *Rocky Mountain Aspen Forest and Woodland* **Sequoia NF Representation**: None of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 32% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
99	**General location:** Not adjacent to designated wilderness **Size:** 9,386 acres **Category A:** Less than one percent of this inventory unit is comprised of Category A ecological groups. which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Shrubland*

<table>
<tr><td></td><td>
Inter-Mountain Basins Big Sagebrush Steppe
Category C: 34% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS:

Great Basin Pinyon-Juniper Woodland
Mediterranean California Mesic Mixed Conifer Forest and Woodland
Mediterranean California Mixed Oak Woodland
Rocky Mountain Aspen Forest and Woodland

Sequoia NF Representation:
None of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness.
34% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
</td></tr>
<tr><td>120</td><td>
General location: Not adjacent to designated wilderness
Size: 6,855 acres
Category A: None of this Inventory unit is comprised of Category A ecological groups.
Category C: 38% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS:

California Central Valley and Southern Coastal Grassland
California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna
Mediterranean California Mesic Mixed Conifer Forest and Woodland
Mediterranean California Mixed Oak Woodland

Sequoia NF Representation:
None of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness.
38% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
</td></tr>
<tr><td>160</td><td>
General location: Not adjacent to designated wilderness
Size: 16,126 acres
Category A: Less than one percent of this Inventory unit is comprised of the following Category A ecological group, which has less than five percent of its total area protected in the NWPS:
Inter-Mountain basins Big Sagebrush Shrubland
Category C: 17% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS:

Great Basin Pinyon-Juniper Woodland
Mediterranean California Mesic Mixed Conifer Forest and Woodland
Mediterranean California Mixed Oak Woodland

</td></tr>
</table>

	• *Rocky Mountain Aspen Forest and Woodland* **Sequoia NF Representation**: None of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 16% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
162	**General location:** Not adjacent to designated wilderness **Size:** 15,806 acres **Category A:** None of this Inventory unit is comprised of a Category A ecological group. **Category C:** 38% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *California Central Valley and Southern Coastal Grassland* • *California Central Valley Mixed Oak Savanna* • *California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna* • *Great Basin Pinyon-Juniper Woodland* • ***Mediterranean California Mesic Mixed Conifer Forest and Woodland*** • ***Mediterranean California Mixed Oak Woodland*** • *Northern and Central California Dry-Mesic Chaparral* **Sequoia NF Representation**: 3% of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 38% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
173	**General location:** Not adjacent to designated wilderness **Size:** 5,307 acres **Category A:** None of this Inventory unit is comprised of a Category A ecological group. **Category C:** 39% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *California Central Valley and Southern Coastal Grassland* • *California Central Valley Mixed Oak Savanna* • *California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna* • *Mediterranean California Mesic Mixed Conifer Forest and Woodland* • ***Mediterranean California Mixed Oak Woodland*** • *Northern and Central California Dry-Mesic Chaparral*

	Sequoia NF Representation: None of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 39% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
190	**General location:** Not adjacent to designated wilderness **Size:** 7,100 acres **Category A:** Less than one percent of this Inventory unit is comprised of the following Category A ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain basins Big Sagebrush Shrubland* • *Inter-Mountain Basins Big Sagebrush Steppe* **Category C:** 36% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *California Central Valley and Southern Coastal Grassland* • *California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna* • *Great Basin Pinyon-Juniper Woodland* • ***Mediterranean California Mesic Mixed Conifer Forest and Woodland*** • ***Mediterranean California Mixed Oak Woodland*** • *Northern and Central California Dry-Mesic Chaparral* • *Rocky Mountain Aspen Forest and Woodland* **Sequoia NF Representation**: None of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 36% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
1364	**General location:** Not adjacent to designated wilderness **Size:** 9,203 acres **Category A:** Less than one percent of this Inventory unit is comprised of the following Category A ecological group, which has less than five percent of its total area protected in the NWPS: • *Inter-Mountain basins Big Sagebrush Steppe* **Category C:** 39% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *California Central Valley and Southern Coastal Grassland* • *California Central Valley Mixed Oak Savanna* • *California Lower Montane Blue Oak-Foothill Pine Woodland and*

	Savanna • *Great Basin Pinyon-Juniper Woodland* • *Mediterranean California Mesic Mixed Conifer Forest and Woodland* • ***Mediterranean California Mixed Oak Woodland*** • *Northern and Central California Dry-Mesic Chaparral* • *Rocky Mountain Aspen Forest and Woodland* **Sequoia NF Representation**: 7% of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 38% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
1377	**General location:** Adjacent to Monarch Wilderness **Size:** 11,559 acres **Category A:** 1% of this Inventory unit is comprised of the following Category A ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain basins Big Sagebrush Steppe* • *Inter-Mountain Basins Big Sagebrush Shrubland* **Category C:** 24% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *Great Basin Pinyon-Juniper Woodland* • ***Mediterranean California Mesic Mixed Conifer Forest and Woodland*** • *Mediterranean California Mixed Oak Woodland* • *Rocky Mountain Aspen Forest and Woodland* **Sequoia NF Representation**: None of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 23%of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
1380	**General location:** Adjacent to Jennie Lakes Wilderness **Size:** 1,316 acres **Category A:** 3% of this Inventory unit is comprised of the following Category A ecological group, which has less than five percent of its total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Shrubland* **Category C:** 21% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *Great Basin Pinyon-Juniper Woodland* • *Mediterranean California Mesic Mixed Conifer Forest and Woodland* • *Rocky Mountain Aspen Forest and Woodland*

	Sequoia NF Representation: None of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 17% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
1381	**General location:** Not adjacent to designated wilderness **Size:** 1,317 acres **Category A:** 1% of this Inventory unit is comprised of the following Category A ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain basins Big Sagebrush Steppe* • *Inter-Mountain Basins Big Sagebrush Shrubland* **Category C:** 19% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *Great Basin Pinyon-Juniper Woodland* • *Mediterranean California Mesic Mixed Conifer Forest and Woodland* • *Mediterranean California Mixed Oak Woodland* • *Rocky Mountain Aspen Forest and Woodland* **Sequoia NF Representation**: None of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 17% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
1384	**General location:** Not adjacent to designated wilderness **Size:** 39,629 acres **Category A:** 7% of this Inventory unit is comprised of the following Category A ecological groups, which have less than five percent of their total area protected in the NWPS: • ***Inter-Mountain basins Big Sagebrush Steppe*** • ***Inter-Mountain Basins Big Sagebrush Shrubland*** **Category C:** 27% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *California Central Valley Mixed Oak Savanna* • ***California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna*** • ***Great Basin Pinyon-Juniper Woodland*** • ***Mediterranean California Mesic Mixed Conifer Forest and Woodland*** • *Mediterranean California Mixed Oak Woodland* • *Northern and Central California Dry-Mesic Chaparral* • *Rocky Mountain Aspen Forest and Woodland*

	Sequoia NF Representation: None of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 12% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
1385	**General location:** Adjacent to Jennie Lakes Wilderness and Sequoia and Kings Canyon NP **Size:** 8,216 acres **Category A:** 1% of this Inventory unit is comprised of the following Category A ecological group, which has less than five percent of its total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Shrubland* **Category C:** 1% inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *Great Basin Pinyon-Juniper Woodland* • *Mediterranean California Mesic Mixed Conifer Forest and Woodland* • *Rocky Mountain Aspen Forest and Woodland* **Sequoia NF Representation**: None of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. None of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
1387	**General location:** Adjacent to Golden Trout Wilderness **Size:** 89,629 acres **Category A:** 2% of this Inventory unit is comprised of the following Category A ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain basins Big Sagebrush Steppe* • ***Inter-Mountain Basins Big Sagebrush Shrubland*** **Category C:** 26% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • ***California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna*** • ***Great Basin Pinyon-Juniper Woodland*** • ***Mediterranean California Mesic Mixed Conifer Forest and Woodland*** • ***Mediterranean California Mixed Oak Woodland*** • *Northern and Central California Dry-Mesic Chaparral* • ***Rocky Mountain Aspen Forest and Woodland*** **Sequoia NF Representation**: None of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness.

	21% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
1390	**General location:** Adjacent to Golden Trout Wilderness **Size:** 1,100 acres **Category A:** 4% of this Inventory unit is comprised of the following Category A ecological group, which has less than five percent of its total area protected in the NWPS: • *Inter-Mountain basins Big Sagebrush Steppe* • *Inter-Mountain Basins Big Sagebrush Shrubland* **Category C:** 13% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna* • *Great Basin Pinyon-Juniper Woodland* • *Mediterranean California Mesic Mixed Conifer Forest and Woodland* • *Mediterranean California Mixed Oak Woodland* • *Rocky Mountain Aspen Forest and Woodland* **Sequoia NF Representation**: None of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. One percent of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
1394	**General location:** Adjacent to Domeland Wilderness **Size:** 51,801 acres **Category A:** 12% of this Inventory unit is comprised of the following Category A ecological groups, which have less than five percent of their total area protected in the NWPS: • ***Inter-Mountain basins Big Sagebrush Steppe*** • ***Inter-Mountain Basins Big Sagebrush Shrubland*** **Category C:** 21% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *California Central Valley Mixed Oak Savanna* • *California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna* • ***Great Basin Pinyon-Juniper Woodland*** • *Mediterranean California Mesic Mixed Conifer Forest and Woodland* • *Mediterranean California Mixed Oak Woodland* • *Northern and Central California Dry-Mesic Chaparral* • *Rocky Mountain Aspen Forest and Woodland*

	Sequoia NF Representation: None of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 3% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
1395	**General location:** Adjacent to Golden Trout Wilderness **Size:** 2,285 acres **Category A:** Less than one percent of this Inventory unit is comprised of the following Category A ecological group, which has less than five percent of its total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Shrubland* **Category C:** 4% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *Great Basin Pinyon-Juniper Woodland* • ***Mediterranean California Mesic Mixed Conifer Forest and Woodland*** • *Rocky Mountain Aspen Forest and Woodland* **Sequoia NF Representation**: 2% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness. None of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness.
1397	**General location:** Not adjacent to designated wilderness **Size:** 3,104 acres **Category A:** Less than one percent of this Inventory unit is comprised of the following Category A ecological group, which has less than five percent of its total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Shrubland* **Category C:** 14% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *Great Basin Pinyon-Juniper Woodland* • *Mediterranean California Mesic Mixed Conifer Forest and Woodland* • *Mediterranean California Mixed Oak Woodland* • *Rocky Mountain Aspen Forest and Woodland* **Sequoia NF Representation**: None of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 14% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.

1404	**General location:** Not adjacent to designated wilderness **Size:** 6,068 acres **Category A:** None of this Inventory unit is comprised of a Category A ecological group. **Category C:** 38% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *California Central Valley and Southern Coastal Grassland* • *California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna* • *Great Basin Pinyon-Juniper Woodland* • *Mediterranean California Mesic Mixed Conifer Forest and Woodland* • ***Mediterranean California Mixed Oak Woodland*** • *Northern and Central California Dry-Mesic Chaparral* **Sequoia NF Representation**: None of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 38% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
1408	**General location:** Not adjacent to designated wilderness **Size:** 48,730 acres **Category A:** 3% of this Inventory unit is comprised of the following Category A ecological groups, which have less than five percent of their total area protected in the NWPS: • ***Inter-Mountain basins Big Sagebrush Steppe*** • *Inter-Mountain Basins Big Sagebrush Shrubland* **Category C:** 35% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *California Central Valley Mixed Oak Savanna* • ***California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna*** • ***Great Basin Pinyon-Juniper Woodland*** • ***Mediterranean California Mesic Mixed Conifer Forest and Woodland*** • ***Mediterranean California Mixed Oak Woodland*** • *Northern and Central California Dry-Mesic Chaparral* • *Rocky Mountain Aspen Forest and Woodland* **Sequoia NF Representation**: Less than one percent of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 29% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.

1410	**General location:** Not adjacent to designated wilderness **Size:** 8,494 acres **Category A:** 2% of this Inventory unit is comprised of the following Category A ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain basins Big Sagebrush Steppe* • *Inter-Mountain Basins Big Sagebrush Shrubland* **Category C:** 15% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna* • *Great Basin Pinyon-Juniper Woodland* • *Mediterranean California Mesic Mixed Conifer Forest and Woodland* • *Mediterranean California Mixed Oak Woodland* • *Rocky Mountain Aspen Forest and Woodland* **Sequoia NF Representation**: None of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 7% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
1420	**General location:** Not adjacent to designated wilderness **Size:** 6,398 acres **Category A:** Less than one percent of this Inventory unit is comprised of the following Category A ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain basins Big Sagebrush Steppe* • *Inter-Mountain Basins Big Sagebrush Shrubland* **Category C:** 37% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *California Central Valley and Southern Coastal Grassland* • *California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna* • *Great Basin Pinyon-Juniper Woodland* • ***Mediterranean California Mesic Mixed Conifer Forest and Woodland*** • ***Mediterranean California Mixed Oak Woodland*** • *Northern and Central California Dry-Mesic Chaparral* • *Rocky Mountain Aspen Forest and Woodland* **Sequoia NF Representation**: None of this inventory unit is comprised of ecological groups that have less than five

	percent of their area on the Forest protected in designated wilderness. 37% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
1422	**General location:** Not adjacent to designated wilderness **Size:** 8,008 acres **Category A:** 5% of this Inventory unit is comprised of the following Category A ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain basins Big Sagebrush Steppe* • *Inter-Mountain Basins Big Sagebrush Shrubland* **Category C:** 37% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *California Central Valley Mixed Oak Savanna* • *California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna* • *Great Basin Pinyon-Juniper Woodland* • *Mediterranean California Mesic Mixed Conifer Forest and Woodland* • *Mediterranean California Mixed Oak Woodland* • *Northern and Central California Dry-Mesic Chaparral* • *Rocky Mountain Aspen Forest and Woodland* **Sequoia NF Representation**: Less than one percent of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 25% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
1425	**General location:** Not adjacent to designated wilderness **Size:** 14,675 acres **Category A:** 1% of this Inventory unit is comprised of the following Category A ecological group, which has less than five percent of its total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Steppe* **Category C:** 32% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *California Central Valley and Southern Coastal Grassland* • *California Central Valley Mixed Oak Savanna* • ***California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna*** • *Great Basin Pinyon-Juniper Woodland* • *Mediterranean California Mesic Mixed Conifer Forest and Woodland* • ***Mediterranean California Mixed Oak Woodland***

	• *Northern and Central California Dry-Mesic Chaparral* • *Rocky Mountain Aspen Forest and Woodland* **Sequoia NF Representation**: 6% of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 30% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
1426	**General location:** Adjacent to Bright Star (BLM) Wilderness **Size:** 49,918 acres **Category A:** 7% of this Inventory unit is comprised of the following Category A ecological groups, which have less than five percent of their total area protected in the NWPS: • ***Inter-Mountain basins Big Sagebrush Steppe*** • ***Inter-Mountain Basins Big Sagebrush Shrubland*** **Category C:** 33% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *California Central Valley Mixed Oak Savanna* • ***California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna*** • ***Great Basin Pinyon-Juniper Woodland*** • ***Mediterranean California Mesic Mixed Conifer Forest and Woodland*** • *Mediterranean California Mixed Oak Woodland* • *Northern and Central California Dry-Mesic Chaparral* • *Rocky Mountain Aspen Forest and Woodland* **Sequoia NF Representation**: None of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 17% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
1427	**General location:** Not adjacent to designated wilderness **Size:** 6,747 acres **Category A:** 5% of this Inventory unit is comprised of the following Category A ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain basins Big Sagebrush Steppe* • *Inter-Mountain Basins Big Sagebrush Shrubland* **Category C:** 25% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna*

	• *Great Basin Pinyon-Juniper Woodland* • *Mediterranean California Mesic Mixed Conifer Forest and Woodland* • *Mediterranean California Mixed Oak Woodland* • *Northern and Central California Dry-Mesic Chaparral* • *Rocky Mountain Aspen Forest and Woodland* **Sequoia NF Representation**: None of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 17% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
1429	**General location:** Not adjacent to designated wilderness **Size:** 2,729 acres **Category A:** Less than one percent of this Inventory unit is comprised of the following Category A ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain basins Big Sagebrush Steppe* • *Inter-Mountain Basins Big Sagebrush Shrubland* **Category C:** 34% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *Great Basin Pinyon-Juniper Woodland* • *Mediterranean California Mesic Mixed Conifer Forest and Woodland* • *Mediterranean California Mixed Oak Woodland* • *Rocky Mountain Aspen Forest and Woodland* **Sequoia NF Representation**: None of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. 35% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
1431	**General location:** Adjacent to Domeland Wilderness **Size:** 7,234 acres **Category A:** 7% of this Inventory unit is comprised of the following Category A ecological group, which has less than five percent of its total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Shrubland* **Category C:** 14% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *Great Basin Pinyon-Juniper Woodland* • *Mediterranean California Mesic Mixed Conifer Forest and Woodland* • *Mediterranean California Mixed Oak Woodland*

	• *Rocky Mountain Aspen Forest and Woodland* **Sequoia NF Representation**: None of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. None of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
1432	**General location:** Adjacent to Golden Trout Wilderness **Size:** 1,133 acres **Category A:** Less than one percent of this Inventory unit is comprised of the following Category A ecological group, which has less than five percent of its total area protected in the NWPS: • *Inter-Mountain Basins Big Sagebrush Shrubland* **Category C:** 3% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *Great Basin Pinyon-Juniper Woodland* • *Mediterranean California Mesic Mixed Conifer Forest and Woodland* **Sequoia NF Representation**: None of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. None of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
1434	**General location:** Adjacent to Monarch Wilderness **Size:** 3,726 acres **Category A:** 1% of this Inventory unit is comprised of the following Category A ecological groups, which have less than five percent of their total area protected in the NWPS: • *Inter-Mountain basins Big Sagebrush Steppe* • *Inter-Mountain Basins Big Sagebrush Shrubland* **Category C:** 30% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna* • *Great Basin Pinyon-Juniper Woodland* • *Mediterranean California Mesic Mixed Conifer Forest and Woodland* • *Mediterranean California Mixed Oak Woodland* • *Northern and Central California Dry-Mesic Chaparral* • *Rocky Mountain Aspen Forest and Woodland* **Sequoia NF Representation**: None of this inventory unit is comprised of ecological groups that have less than five

	percent of their area on the Forest protected in designated wilderness. 33% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.
1391	**General location:** Adjacent to South Sierra Wilderness. Note – Portions of 1391 are located on both the Inyo and Sequoia NF – TWS data indicated this unit as #1458 **Size:** 17,253 acres **Category A:** 7% of this inventory unit is comprised of the following Category A ecological groups, which has less than five percent of its total area protected in the NWPS: • ***Inter-Mountain Basins Big Sagebrush Shrubland*** • *Inter-Mountain Basins Big Sagebrush Steppe* **Category C:** 14% of this inventory unit is comprised of the following ecological groups, which have less than twenty percent of their total area protected in the NWPS: • *Great Basin Pinyon-Juniper Woodland* • *Mediterranean California Mesic Mixed Conifer Forest Mediterranean California Mixed Oak Woodland* • *Northern and Central California Dry-Mesic Chaparral* • *Rocky Mountain Aspen Forest and Woodland* **Sequoia NF Representation**: None of this inventory unit is comprised of ecological groups that have less than five percent of their area on the Forest protected in designated wilderness. Less than 1% of this inventory unit is comprised of ecological groups that have less than twenty percent of their area on the Forest protected in designated wilderness.

Appendix 2: Annotated Bibliography on Economic Benefits of Protected Public Lands

Several studies discuss the forces behind the changing economy of much of rural America. Many of these studies attribute strong economic and population growth to "lifestyle migrants." These are residents who either rely on investment or retirement income or who have businesses or employment which is not tied to a particular location. These migrants seek locations with high levels of amenities, including those that are associated with an abundance of protected public lands such as wilderness and national monuments.

Berrens, R., J. Talberth, J. Thacher, M. Hand. 2006. *Economic and Community Benefits of Protecting New Mexico's Inventoried Roadless Areas*. Sante Fe, NM: Center for Sustainable Economy. 69 pp. Available online at http://www.sustainable-economy.org/main/send_client_files?f=Final%2520Report.pdf.

Berrens et al. (2006) examine several categories of non-market economic values associated with the 1.6 million acres of inventoried roadless areas on National Forests in New Mexico. These authors use specific data on roadless area size and characteristics, data on the economic values of recreation in New Mexico, the economic value of clean water and other non-market values to estimate the total annual value of retaining the wilderness character associated with inventoried roadless areas: "Annual economic benefits range up to $42 million for maintenance of water quality, $24 million for carbon sequestration, $26 million for outdoor recreation, $14 million for passive uses, and $1.4 million in enhanced property values. Annual community effects range up to 938 jobs and $23 million in personal income." (p. 3)

Duffy-Deno, K.T. 1998. The effect of federal wilderness on county growth in the intermountain western United States. *Journal of Regional Science*. 38(1):109-136.

Duffy-Deno (1998) examines 250 non-urban counties in the eight intermountain west states. He finds that there is no evidence that the existence of federal wilderness is directly or indirectly associated with population or employment changes in these counties. The study also finds that there is no evidence that wilderness has any affect on resource extraction employment in these western counties.

Holmes, F. P. and W.E. Hecox. 2004. Does wilderness impoverish rural regions? *International Journal of Wilderness*. 10(3): 34-39. Available online at http://www.wilderness.net/library/documents/IJWDec04_Holmes.pdf.

In a study of 113 rural Western Counties, Holmes and Hecox (2004) find a positive correlation between the percent of land in designated wilderness and population, income and employment growth. They also find that wilderness is correlated with higher growth in investment income and entrepreneurial activity.

Loomis, J.B. and R. Richardson. 2000. Economic Values of Protecting Roadless Areas in the United States. Prepared for The Wilderness Society and Heritage Forests Campaign. 44pp. Available online at http://www.sierraforestlegacy.org/Resources/Conservation/FireForestEcology/ForestEconomics/Economics-Loomis00.pdf.

According to research by Loomis and Richardson (2000), the 42 million acres of roadless lands "…can be expected to provide almost $600 million in recreation benefits each year, more than $280 million in passive use values, and nearly 24,000 jobs. (p. iii)" In additions, these research find that roadless areas also produce between $490 million and $1 billion in carbon sequestration services and $490 million in waste treatment services.

Loomis, J.B. 2000. Economic values of wilderness recreation and passive use: What we think we know at the beginning of the 21st century. In: McCool, Stephen F.; Cole, David N.; Borrie, William T.; O'Loughlin, Jennifer, comps. 2000. Wilderness science in a time of change conference—Volume 2: Wilderness within the context of larger systems; 1999 May 23–27;Missoula, MT. Proceedings RMRS-P-15-VOL-2. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 5-13. Available online at http://www.fs.fed.us/rm/pubs/rmrs_p015_2/rmrs_p015_2_005_013.pdf.

Loomis (2000) estimates that the value of recreation on all U.S. wilderness lands is $574 million per year. The economic value of Western wilderness (not including Alaska) is estimated to be $168/acre or $7 billion per year. The economic value of Eastern wilderness is $468 million annually.

Lorah, P.A. 2000. Population growth, economic security, and cultural change in wilderness counties. In: McCool, Stephen F.; Cole, David N.; Borrie, William T.; O'Loughlin, Jennifer, comps. 2000. Wilderness science in a time of change conference—Volume 2: Wilderness within the context of larger systems; 1999 May 23–27;Missoula, MT. Proceedings RMRS-P-15-VOL-2. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 230-237. Available online at http://www.fs.fed.us/rm/pubs/rmrs_p015_2/rmrs_p015_2_230_237.pdf.

Counter to many people's beliefs, Lorah (2000) finds that counties with wilderness showed growth in income, population and employment. He also finds that the presence of wilderness in these counties has also helped them to diversify economies that had been stagnant due to over-reliance on declining resource extraction industries.

Phillips, S. 2000. Windfalls for wilderness: Land protection and land value in the Green Mountains. In: McCool, Stephen F.; Cole, David N.; Borrie, William T.; O'Loughlin, Jennifer, comps. 2000. Wilderness science in a time of change conference—Volume 2: Wilderness within the context of larger systems; 1999 May 23–27;Missoula, MT. Proceedings RMRS-P-15-VOL-2. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 258-267. Available online at http://www.wilderness.net/library/documents/Phillips_2-33.pdf.

Final results described in Phillips, S. 2004.Windfalls for Wilderness: Land Protection and Land Value in the Green Mountains. Ph.D. Dissertation. Virginia Polytechnic Institute and State University, Blacksburg, VA. (A summary of the doctoral thesis is provided in The Economic Benefits of Wilderness: Focus on Property Value Enhancement, Wilderness Society Science and Policy Brief, no. 2, March 2004. 8 pages.)

Data on land sales near Green Mountain National Forest wilderness areas show that the presence of wilderness areas, proximity to these wilderness areas and the extent of the wilderness areas each is associated with higher residential property values.

Rosenberger, R.S. and D.B.K. English 2005. Impacts of Wilderness on Local Economic Development. In: Cordell, H.K., J.C. Bergstrom and J.M. Bowker (eds). The Multiple Values of Wilderness. Venture Publishing: State College, PA.

While wilderness recreation generates some economic activity for local communities, the more important impact lies in what Rosenberger and English (2005) call a "wilderness-related advantage." They cite several research studies which together indicate that rural counties with wilderness or other protected federal lands experience greater population and economic growth than those without wilderness.

Rudzitis, G. and R. Johnson. 2000. The impact of wilderness and other wildlands on local economies and regional development trends. In: McCool, Stephen F.; Cole, David N.; Borrie, William T.; O'Loughlin, Jennifer, comps. 2000. Wilderness science in a time of change conference—Volume 2: Wilderness within the context of larger systems; 1999 May 23–27;Missoula, MT. Proceedings RMRS-P-15-VOL-2. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 14-26. Available online at http://www.wilderness.net/library/documents/science1999/Volume2/Rudzitis_2-4.pdf.

This study (Rudzitis and Johnson 2000) also finds that while wilderness recreation benefits to local communities are modest, the presence of wilderness appears to draw residents and new economic activity that does have a substantial positive impact on local economies.

A Summary Profile

County Region

Selected Geographies:

Montrose County, CO; Mesa County, CO; San Miguel County, CO; San Juan County, CO; Ouray County, CO; Gunnison County, CO; Delta County, CO; Hinsdale County, CO; Saguache County, CO; Garfield County, CO

Benchmark Geographies:

U.S.

Produced by
Economic Profile System
EPS
November 28, 2016

About the Economic Profile System (EPS)

EPS is a free, easy-to-use software application that produces detailed socioeconomic reports of counties, states, and regions, including custom aggregations.

EPS uses published statistics from federal data sources, including Bureau of Economic Analysis and Bureau of the Census, U.S. Department of Commerce; and Bureau of Labor Statistics, U.S. Department of Labor.

The Bureau of Land Management and Forest Service have made significant financial and intellectual contributions to the operation and content of EPS.

See headwaterseconomics.org/EPS for more information about the other tools and capabilities of EPS.

For technical questions, contact Patty Gude at eps@headwaterseconomics.org, or 406-599-7425.

headwaterseconomics.org

Headwaters Economics is an independent, nonprofit research group. Our mission is to improve community development and land management decisions in the West.

www.blm.gov

The Bureau of Land Management, an agency within the U.S. Department of the Interior, administers 249.8 million acres of America's public lands, located primarily in 12 Western States. It is the mission of the Bureau of Land Management to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations.

www.fs.fed.us

The Forest Service, an agency of the U.S. Department of Agriculture, administers national forests and grasslands encompassing 193 million acres. The Forest Service's mission is to achieve quality land management under the "sustainable multiple-use management concept" to meet the diverse needs of people while protecting the resource. Significant intellectual, conceptual, and content contributions were provided by the following individuals: Dr. Pat Reed, Dr. Jessica Montag, Doug Smith, M.S., Fred Clark, M.S., Dr. Susan A. Winter, and Dr. Ashley Goldhor-Wilcock.

Table of Contents

Note to Users:

This is one of fourteen reports that can be created and downloaded from EPS Web. You may want to run another EPS report for either a different geography or topic. Topics include land use, demographics, specific industry sectors, the role of non-labor income, the wildland-urban interface, the role of amenities in economic development, and payments to county governments from federal lands. Throughout the reports, references to online resources are indicated in parentheses. These resources are provided as hyperlinks on each report's final page. The EPS reports are downloadable as Excel, PDF, and Word documents. For further information and to download reports, go to:

headwaterseconomics.org/eps

How are geographies similar or different?

This page describes similarities and differences in key summary statistics from other EPS-HDT reports.

Summary

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Population, 2014	40,873	148,255	7,840	720	4,629	15,725	29,870	786	6,196	57,461	312,355	318,857,056
Trends												
Population % change, 1970-2014	122.6%	172.1%	300.0%	-12.7%	201.2%	104.1%	95.3%	289.1%	61.2%	284.0%	162.1%	56.5%
Employment % change, 1970-2014	202.8%	272.6%	959.3%	104.6%	250.7%	357.6%	155.5%	773.5%	148.2%	537.8%	293.2%	103.6%
Personal Income % change, 1970-2014	303.0%	384.0%	1309.7%	65.6%	511.4%	428.2%	244.8%	577.5%	239.1%	675.4%	410.1%	181.7%
Prosperity												
Unemployment rate, 2015	5.1%	5.5%	3.7%	4.1%	4.3%	2.9%	5.7%	3.0%	6.1%	4.1%	5.0%	5.3%
Average earnings per job, 2014 (2015 $s)	$37,238	$43,028	$35,745	$15,856	$28,011	$32,184	$36,943	$14,263	$29,857	$45,026	$40,551	$57,022
Per capita income, 2014 (2015 $s)	$33,818	$38,112	$60,486	$31,932	$46,154	$38,657	$33,971	$40,814	$29,775	$47,476	$39,412	$46,095
Economy												
Non-Labor % of total personal income, 2014	44.8%	38.4%	52.0%	49.8%	54.0%	45.9%	46.7%	66.1%	44.4%	46.0%	42.8%	35.8%
Services % of total employment, 2014	62.1%	69.2%	75.6%	35.2%	~58.4%	65.7%	56.0%	34.3%	~42.9%	62.8%	~65.2%	72.1%
Government % of total employment, 2014	13.9%	11.8%	9.5%	10.5%	11.7%	16.5%	16.1%	10.6%	18.5%	14.1%	13.1%	12.9%
Use Sectors^												
Timber % of total private employment, 2014	~1.7%	~0.1%	~0.0%	0.0%	0.0%	~0.1%	~0.8%	0.0%	0.0%	~0.1%	~0.3%	0.7%
Mining % of total private employment, 2014	1.3%	5.5%	~0.0%	0.0%	~0.2%	~9.0%	~8.2%	~5.8%	~0.3%	4.7%	~4.9%	0.6%
Fossil fuels (oil, gas, & coal), 2014	~1.0%	~5.5%	~0.0%	0.0%	0.0%	~8.4%	~7.5%	0.0%	0.0%	4.5%	~4.8%	0.5%
Other mining, 2014	~0.5%	~0.3%	0.0%	0.0%	~0.2%	~0.6%	~0.2%	~5.8%	~0.3%	~3.3%	~0.9%	~0.3%
Agriculture % of total employment, 2014	5.8%	2.9%	1.7%	0.0%	4.1%	2.3%	9.3%	3.4%	14.7%	1.9%	3.6%	1.4%
Travel & Tourism % of total private employmen	~13.1%	~18.3%	~54.1%	~70.1%	~42.2%	~36.3%	~11.9%	~47.5%	~9.5%	~20.6%	~20.8%	15.5%
Federal Land*												
Federal Land % total land ownership	68.3%	72.9%	59.6%	88.7%	46.4%	79.2%	55.8%	95.3%	72.6%	62.2%	70.7%	28.2%
Forest Service %	22.9%	25.8%	21.0%	71.0%	38.1%	60.8%	25.7%	77.8%	46.2%	27.3%	38.8%	8.4%
BLM %	43.3%	45.9%	38.6%	17.7%	7.4%	18.2%	29.9%	17.5%	16.6%	34.9%	29.8%	10.6%
Park Service %	2.0%	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	8.3%	0.0%	1.7%	3.4%
Military %	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.0%
Other %	0.2%	0.3%	0.0%	0.0%	0.9%	0.2%	0.1%	0.0%	1.5%	0.0%	0.4%	4.9%
Federal land % Type A**	11.3%	18.7%	10.2%	30.3%	24.8%	27.6%	23.9%	49.1%	25.1%	15.8%	22.8%	41.8%
Federal payments % of gov. revenue, FY2012	2.5%	3.0%	6.1%	12.2%	6.0%	3.6%	2.5%	20.8%	68.8%	1.1%	3.6%	
Development												
Residential land area % change, 2000-2010	42.1%	33.9%	7.2%	23.6%	26.8%	63.1%	36.8%	61.9%	78.3%	38.3%	39.0%	12.3%
Wildland-Urban Interface % developed, 2010	1.5%	2.3%	16.8%	10.8%	6.1%	7.6%	12.5%	17.5%	10.8%	8.1%	8.3%	16.3%

^Data for timber, mining, and travel and tourism-related are from County Business Patterns which excludes proprietors, and data for agriculture are from Bureau of Economic Analysis which includes proprietors.

* The land ownership data source and year vary depending on the selected geography. See following pages for specifics.

** Federal public lands that are managed primarily for natural, cultural, and recreational features. These lands include National Parks and Preserves (NPS), Wilderness (NPS, FWS, FS, BLM), National Conservation Areas (BLM), National Monuments (NPS, FS, BLM), National Recreation Areas (NPS, FS, BLM), National Wild and Scenic Rivers (NPS), Waterfowl Production Areas (FWS), Wildlife Management Areas (FWS), Research Natural Areas (FS, BLM), Areas of Critical Environmental Concern (BLM), and National Wildlife Refuges (FWS).

~ Some data are withheld by the federal government to avoid the disclosure of potentially confidential information. Headwaters Economics uses data from the U.S. Department of Commerce to estimate these data gaps. These values are shown in gray & preceded with tildes (~).

Data Sources: Various; see following pages for specifics.

How are geographies similar or different?

What do we measure on this page?

This page describes similarities and differences in key summary statistics from other EPS reports.

Trends: Refers to general indicators of economic well-being (population, employment, and real personal income) measured over time.

Prosperity: Refers to common indicators of individual well-being or hardship (unemployment, average earnings per job, and per capita income).

Economy: Refers to three significant areas of the economy: non-labor income (e.g., government transfer payments, and investment and retirement income), and services and government employment.

Use Sectors: Refers to components of the economy (commodity sectors including timber, mining and agriculture, and industries that include travel and tourism) that have the potential for being associated with the use of public lands.

Federal Land: Refers to the amount and type of federal land ownership, and the dependence of county governments on payments related to federal lands. NPS = National Park Service; FS = Forest Service; BLM = Bureau of Land Management; FWS = Fish and Wildlife Service.

Development: Refers to the residential development of private lands, including the wildland-urban interface. The wildland-urban interface data are available and reported only for the 11 western public lands states (not including Alaska and Hawaii).

Why is it important?

Not all counties, regions, or states are the same. It is important to understand the differences and similarities between geographies because land management actions may affect areas differently, depending on demographics, the makeup of the economy, and land use characteristics.

This report allows the user to see a broad range of measures, compared across geographies, at a glance. Based on this reading, the user can refer to other EPS topic-specific reports for more details. For example, if a county shows unusually high unemployment rates, you may want to run a county-specific report (EPS Socioeconomic Measures) for that county. If another county shows a relatively high number of people employed in the timber industry, you may want to run the EPS Timber report for that county.

Another use of this report is to see whether the analysis area, if it consists of a group of counties, can be analyzed according to similarities. For example, the user may want to group together counties with a high proportion of government employment, and group other counties that have a significant amount of employment in mining.

Methods

Data sources used in this report are described in subsequent pages. We report the most recent published data by source. The date of reported variables vary according to the data release schedule of each source.

Some data are withheld by the federal government to avoid the disclosure of potentially confidential information. Headwaters Economics uses data from the U.S. Department of Commerce to estimate these data gaps. These values are indicated with tildes (~).

Additional Resources

This report uses information that appears in the following EPS reports: Socioeconomic Measures, Demographics, Agriculture, Mining, Service Sectors, Industries that Include Travel and Tourism, Government Employment, Non-Labor Income, Timber, Land Use, Amenities, Development and the Wildland-Urban Interface, Federal Land Payments. Consult these reports directly for more details and links to additional information.

Documentation explaining methods developed by Headwaters Economics for estimating disclosure gaps is available at headwaterseconomics.org/eps *(1)*.

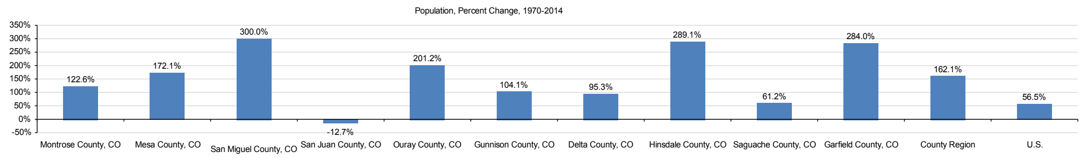
Data Sources

Various; see following pages for specifics.

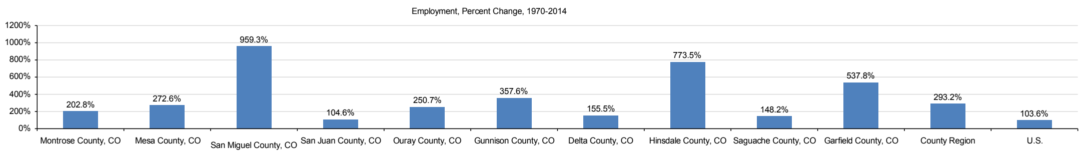
How have population, employment, and personal income changed?

This page describes percent change in population, employment, and real personal income.

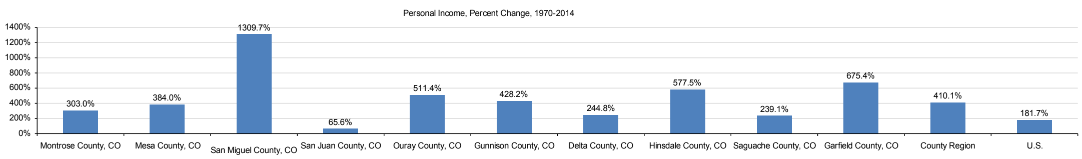
- Between 1970 and 2014, San Miguel County, CO had the largest percent change in population (300%), and San Juan County, CO had the smallest (-12.7%).



- Between 1970 and 2014, San Miguel County, CO had the largest percent change in employment (959.3%), and the U.S. had the smallest (103.6%).



- Between 1970 and 2014, San Miguel County, CO had the largest percent change in personal income (1309.7%), and San Juan County, CO had the smallest (65.6%).



Data Sources: U.S. Department of Commerce. 2015. Bureau of Economic Analysis, Regional Economic Accounts, Washington, D.C.

How have population, employment, and personal income changed?

What do we measure on this page?

This page describes percent change in population, employment, and real personal income.

Why is it important?

One measure of economic performance is whether a geography is growing or declining. Standard measures of growth and decline are population, employment, and real personal income.

The information on this page helps to understand whether geographies are growing or declining at different rates, and makes it easy to see if there are discrepancies between changes in population, employment, and real personal income. If population and employment are growing faster than real personal income, for example, it may be worthwhile to do further research on whether this because growth has been in low-wage industries and occupations. Alternatively, if personal income is growing faster than employment, it may be because of growth in high-wage industries and occupations and/or non-labor income sources.

Methods

The Bureau of Economic Analysis reports data either by place or residence or by place of work. Population and personal income data on this page are reported by place of residence, and employment data by place of work.

Additional Resources

The EPS Demographics report provides additional information on population dynamics.

The EPS Socioeconomic Measures report provides additional information on employment and personal income.

For details on Bureau of Economic Analysis terms, see: bea.gov/regional/definitions *(2)*.

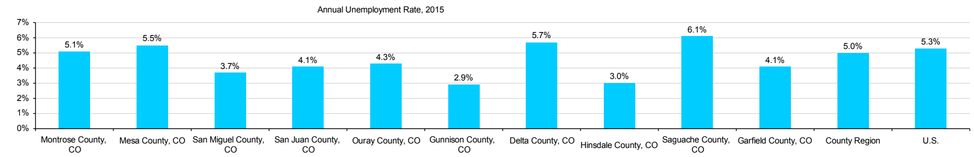
Data Sources

U.S. Department of Commerce. 2015. Bureau of Economic Analysis, Regional Economic Accounts, Washington, D.C.

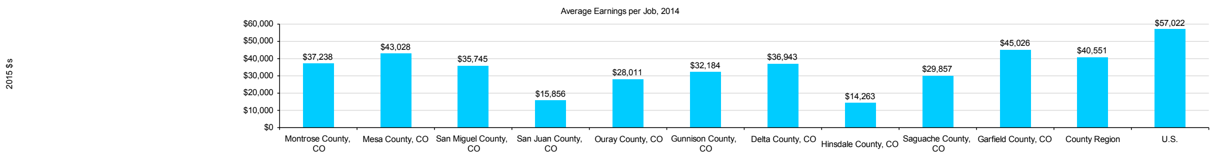
How do unemployment, earnings, and per capita income vary across geographies?

This page describes differences in three measures of individual prosperity (unemployment, average earnings per job, and per capita income).

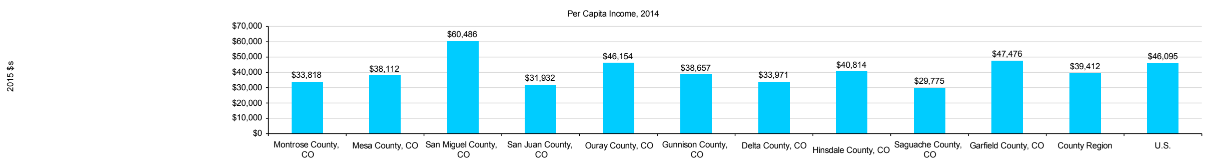
- In 2015, Saguache County, CO had the highest unemployment rate (6.1%), and Gunnison County, CO had the lowest (2.9%).



- In 2014, the U.S. had the highest average earnings per job ($57,022), and Hinsdale County, CO had the lowest ($14,263).



- In 2014, San Miguel County, CO had the highest per capita income ($60,486), and Saguache County, CO had the lowest ($29,775).



Data Sources: U.S. Department of Commerce. 2015. Bureau of Economic Analysis, Regional Economic Accounts, Washington, D.C.; U.S. Department of Labor. 2016. Bureau of Labor Statistics, Local Area Unemployment Statistics, Washington, D.C.

Study Guide and Supplemental Information

How do unemployment, earnings, and per capita income vary across geographies?

What do we measure on this page?

This page describes differences in three measures of individual prosperity (unemployment, average earnings per job, and per capita income).

Unemployment Rate: The number of people who are jobless, looking for jobs, and available for work divided by the labor force.

Average Earnings per Job: Total earnings divided by total employment. Full-time and part-time jobs are counted at equal weight. Employees, sole proprietors, and active partners are included.

Per Capita Income: Total personal income (from labor and non-labor sources) divided by total population.

Why is it important?

All three statistics presented on this page are important indicators of economic well-being. It's a good idea to use several indicators together when measuring economic health.

The annual unemployment rate is the number of people actively seeking but not finding work as a percent of the labor force. This figure can go up during national recessions and/or when more localized economies are affected by area downturns. There can be significant seasonal variations in unemployment, which can be viewed by looking at seasonally unadjusted unemployment rates.

Average earnings per job is an indicator of the quality of local employment. A higher average earning per job indicates that there are relatively more high-wage occupations. It can be useful to consider earnings against local cost of living indicators.

Per capita income is considered one of the most important measures of economic well-being. However, it can be misleading. Per capita income is total personal income divided by population. Because total personal income includes non-labor income sources (dividends, interest, rent, and transfer payments), it is possible for per capita income to be relatively high due to the presence of retirees and people with investment income. And because per capita income is calculated using total population and not the labor force as in average earnings per job, it is possible for per capita income to be relatively low when there are a disproportionate number of children and/or elderly people in the population.

Methods

For regions, which are aggregations of geographies, the following indicators were calculated as:

Unemployment Rate: The sum of total unemployment for all geographies, divided by the sum of the labor force for all geographies.
Average Earnings per Job: The sum of wage and salary disbursements plus other labor and proprietors' income for all geographies, divided by total full-time and part-time employment for all geographies.
Per Capita Income: The sum of total personal income for all geographies divided by the sum of total population for all geographies.

Some data are withheld by the federal government to avoid the disclosure of potentially confidential information. Headwaters Economics uses data from the U.S. Department of Commerce to estimate these data gaps.

Additional Resources

To see how these measures have changed over time, run the EPS Socioeconomic Measures report.

For more information on unemployment, see the Bureau of Labor Statistics resources on this topic, available at: bls.gov/cps/faq.htm#Ques3 *(3)*.

To investigate the possible impact of non-labor income sources on total personal income, run the EPS Non-Labor report.

The Monthly Labor Review Online, published by the Bureau of Labor statistics, contains several issues related to explaining earnings and wages, by industry, sex, and education achievement. See: bls.gov/opub/mlr/indexe.htm#Earnings_and_wages *(4)*.

For a glossary of terms used by the Bureau of Economic Analysis, see: http://www.bea.gov/glossary/glossary.cfm *(5)*.

Documentation explaining methods developed by Headwaters Economics for estimating disclosure gaps is available at headwaterseconomics.org/eps *(1)*.

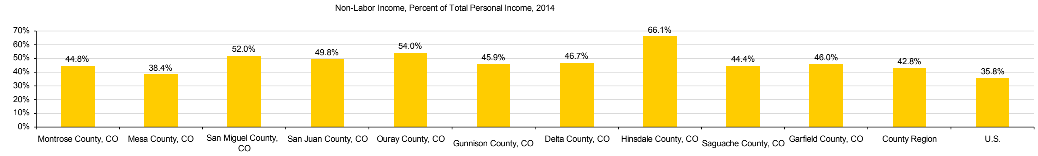
Data Sources

U.S. Department of Commerce. 2015. Bureau of Economic Analysis, Regional Economic Accounts, Washington, D.C.; U.S. Department of Labor. 2016. Bureau of Labor Statistics, Local Area Unemployment Statistics, Washington, D.C.

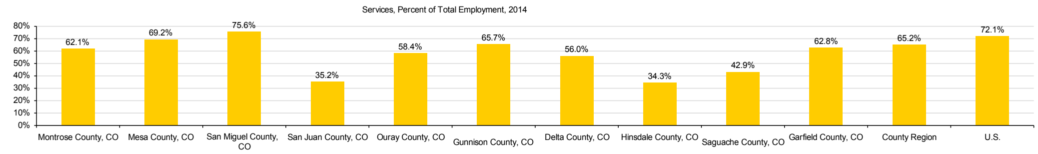
How do non-labor income and employment in services and government vary across geographies?

This page describes differences in non-labor income (e.g., government transfer payments, and investment and retirement income) and employment in services and government.

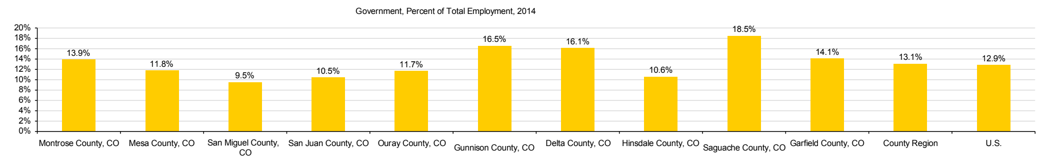
- In 2014, Hinsdale County, CO had the largest percent of total personal income from non-labor income sources (66.1%), and the U.S. had the smallest (35.8%).



- In 2014, San Miguel County, CO had the largest percent of total jobs in services (75.6%), and Hinsdale County, CO had the smallest (34.3%).



- In 2014, Saguache County, CO had the largest percent of total jobs in government (18.5%), and San Miguel County, CO had the smallest (9.5%).



Data Sources: U.S. Department of Commerce. 2015. Bureau of Economic Analysis, Regional Economic Accounts, Washington, D.C.

How do non-labor income and employment in services and government vary across geographies?

What do we measure on this page?

This page describes differences in non-labor income (e.g., government transfer payments, and investment and retirement income) and employment in services and government.

Non-Labor Income: Consists of dividends, interest and rent (money earned from investments), and transfer payments (includes government retirement and disability insurance benefits, medical payments such as mainly Medicare and Medicaid, income maintenance benefits, unemployment insurance benefits, etc.). Non-labor income is reported by place of residence.

Services: Consists of employment in the following sectors: Utilities, Wholesale Trade, Retail Trade, Transportation & Warehousing Information, Finance & Insurance, Real Estate & Rental & Leasing, Professional, Scientific, & Tech., Mgmt. of Companies & Enterprises, Administrative & Support Services, Educational Services, Health Care & Social Assistance, Arts, Entertainment, & Recreation, Accommodation & Food Services, and Other Services.

Government: Consists of all federal, state, and local government agencies and government enterprises.

Why is it important?

In many counties non-labor income (e.g., retirement and investment income, government transfer payments) can be more than a third of all personal income. As the baby boomer generation retires, this source of income will continue to grow. A high dependence on non-labor income can be an indication of an aging population and/or the attraction of people with investment income. Public lands activities may affect these constituents.

Nationally, services account for more than 99 percent of new jobs growth since 1990. If services are a large proportion of existing jobs, and also a large portion of new jobs, it may be worth looking into whether and how public lands relate to service industries. For example, public lands may play a role in creating a setting that attracts and retains service-related businesses. Or it may be that the recreational and environmental amenities of public lands serve to attract "footloose" service occupations (i.e., people who can work anywhere). A shift towards a service-based economy may be associated with a shift in values and expectations regarding how public lands should be managed and could place new demands on public land resources.

Government can be a major employer in some geographies, particularly in rural areas or where significant government facilities are located, such as Forest Service and Bureau of Land Management offices, military bases, prisons, or research facilities. Government jobs often pay high wages and offer good benefits. Federal employment related to public lands provide relatively stable and high wage jobs in many communities.

Methods

Some data are withheld by the federal government to avoid the disclosure of potentially confidential information. Headwaters Economics uses data from the U.S. Department of Commerce to estimate these data gaps.

Additional Resources

To learn more about the role of non-labor income, see the EPS Non-Labor report.
To learn more about the role of service industries, see the EPS Services report.
To learn more about the role of government employment, see the EPS Government report.

For a glossary of terms used by the Bureau of Economic Analysis, see: bea.gov/glossary/glossary.cfm *(5)*.

Documentation explaining methods developed by Headwaters Economics for estimating disclosure gaps is available at headwaterseconomics.org/eps *(1)*.

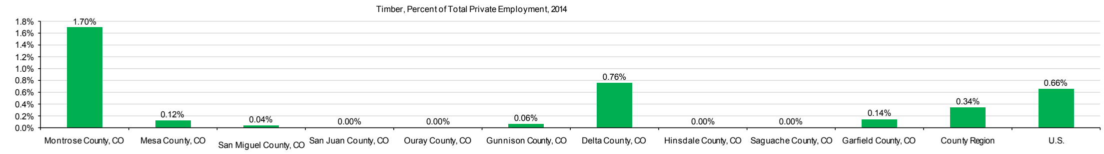
Data Sources

U.S. Department of Commerce. 2015. Bureau of Economic Analysis, Regional Economic Accounts, Washington, D.C.

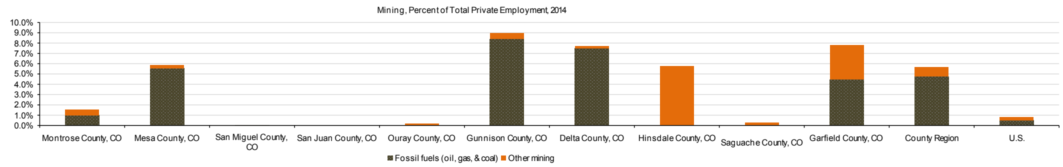
How does employment in commodity sectors vary across geographies?

This page describes employment in industries that have the potential for being associated with the commodity use of public lands: timber, mining (including oil, natural gas, and coal), and agriculture. We refer to these sectors combined as "commodity sectors."

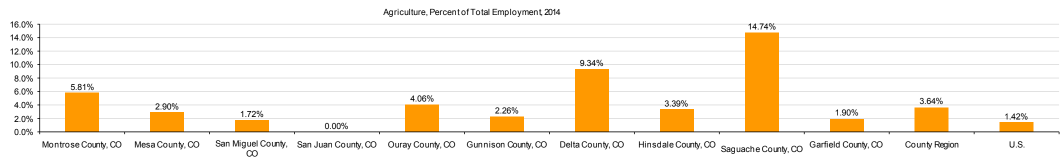
- In 2014, Montrose County, CO had the largest percent of total jobs in timber (1.7%), and San Juan County, CO had the smallest (0%).



- In 2014, Gunnison County, CO had the largest percent of total jobs in mining of fossil fuels (8.38%), and San Juan County, CO had the smallest (0%).
- In 2014, Hinsdale County, CO had the largest percent of total jobs in mining unrelated to fossil fuels (5.76%), and San Miguel County, CO had the smallest (0%).



- In 2014, Saguache County, CO had the largest percent of total jobs in agriculture (14.74%), and San Juan County, CO had the smallest (0%).



Data Sources: U.S. Department of Commerce. 2015. Bureau of Economic Analysis, Regional Economic Accounts, Washington, D.C.; U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.

Study Guide and Supplemental Information

How does employment in commodity sectors vary across geographies?

What do we measure on this page?

This page describes employment in industries that have the potential for being associated with the commodity use of public lands: timber, mining (including oil, natural gas, and coal), and agriculture. We refer to these sectors combined as "commodity sectors."

Commodity Sectors: Consists of employment in timber, mining (including oil, gas ,and coal), and agriculture. These are sectors of the economy that have the potential to use federal public lands (for example, for timber harvesting, energy development, and grazing) for the extraction of commodities.

Timber: Jobs associated with growing and harvesting, sawmills and paper mills, and wood products manufacturing.

Mining: Jobs associated with oil and gas extraction, coal mining, metals mining, and nonmetallic minerals mining.

Agriculture: Jobs associated with all forms of agriculture, including farming and ranching.

Why is it important?

Public lands can play a key role in stimulating local employment by providing opportunities for commodity extraction.

Timber industries have played an important role in some geographies, particularly those with significant Forest Service lands. The information on this page helps to answer if this is the case and whether there are differences between geographies. Further investigation may be needed to understand whether proposed activities on public lands could affect this sector.

In some parts of the country mining, including fossil fuel development (oil, natural gas, and coal), is a significant employer. Information on this page helps explain if that is the case in the geographies selected, and whether they differ from one another. Additional research is needed to understand whether proposed activities on public lands affect this sector.

Farming and ranching can be a significant component of employment in some geographies. Information on this page helps to explain which areas are more and less dependent on this sector. Further research is needed to understand how proposed activities on public lands could affect this sector.

Methods

We use County Business Patterns as a data source for timber and mining because, compared to other sources, it has fewer data gaps (instances when the federal government will not release information to protect confidentiality of individual businesses). It also includes both full and part-time employment. The disadvantage of County Business Patterns data is that they do not include employment in government, agriculture, railroads, or the self-employed and as a result under-count the size of industry sectors. Also, County Business Patters data are based on mid-March employment and do not take into account seasonal fluctuations. For these reasons, the data are most useful for showing long-term trends, displaying differences between geographies, and showing the relationship between sectors over time.

We use the Bureau of Economic Analysis as a data source for agriculture because County Business Patterns data do not include agriculture. However, the Bureau of Economic Analysis data include proprietors, which are not included in County Business Patterns data. As a result, the data for agriculture, and timber and mining are not strictly comparable. The latest year for each data source may vary due to different data release schedules.

Some data are withheld by the federal government to avoid the disclosure of potentially confidential information. Headwaters Economics uses data from the U.S. Department of Commerce to estimate these data gaps.

Additional Resources

To learn more about the role of timber employment, run the EPS Timber report.
To learn more about the role of mining and oil and gas employment, run the EPS Mining report.
To learn more about the role of agricultural employment, run the EPS Agriculture report.

Documentation explaining methods developed by Headwaters Economics for estimating disclosure gaps is available at headwaterseconomics.org/eps *(1)*.

Data Sources

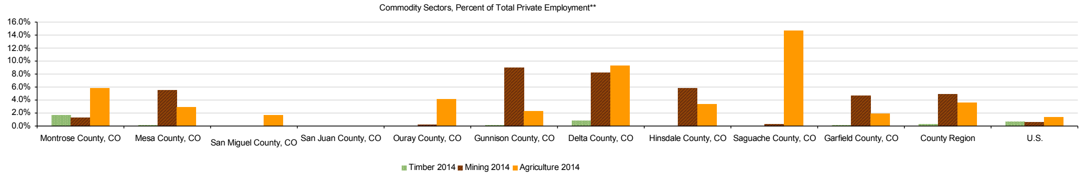
U.S. Department of Commerce. 2015. Bureau of Economic Analysis, Regional Economic Accounts, Washington, D.C.; U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.

How does employment in commodity sectors and in industries that include travel and tourism, vary across geographies?

This page describes differences in employment for all commodity sectors combined across geographies. It also shows differences in employment for industries that have the potential of being associated with travel and tourism.

Commodity Sectors: Consist of employment in timber, mining (including oil, gas, and coal), and agriculture. These are sectors of the economy that have the potential to use federal public lands (for example, for timber harvesting, energy development, and grazing and recreation) for the extraction of commodities.

- Delta County, CO had the largest percent of total jobs in commodity sectors (18.3%), and San Juan County, CO had the smallest (0%).
- Mining was the largest component of commodity sector employment (4.9% of total jobs) in the County Region, and timber was the smallest component (0.3% of total jobs).

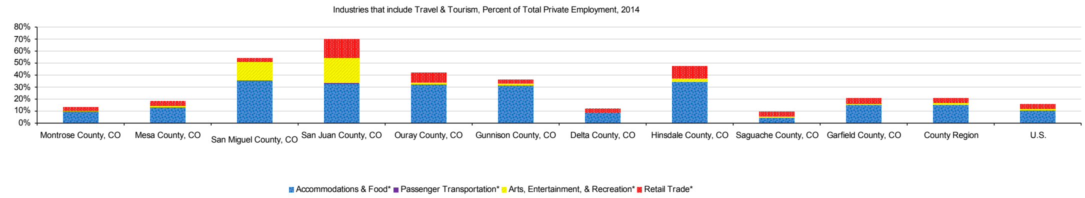


** Data for timber and mining are from County Business Patterns which excludes proprietors, government, agriculture, and railroad. Data for agriculture are from Bureau of Economic Analysis. The latest year for each data source may vary due to different data release schedules.

Travel and Tourism: Consists of sectors that provide goods and services to visitors to the local economy, as well as to the local population. These industries are: retail trade; passenger transportation; arts, entertainment and recreation; and accommodation and food services. It is not known, without additional research such as surveys, what exact proportion of the jobs in these sectors is attributable to expenditures by visitors, including business and pleasure travelers, versus by local residents. Some researchers refer to these sectors as "tourism-sensitive." They could also be called "travel and tourism-potential sectors" because they have the potential of being influenced by expenditures by non-locals.

- In 2014, San Juan County, CO had the largest percent of total jobs in industries that include travel and tourism (70%), and Saguache County, CO had the smallest (9.5%).
- In 2014, accommodations & food* was the largest component of travel and tourism-related employment (15% of total jobs) in County Region, and passenger transportation* was the smallest (0.3% of total jobs).

* Charted values do not represent the entirety of these sectors, rather their components typically related to travel & tourism.



Data Sources: U.S. Department of Commerce. 2015. Bureau of Economic Analysis, Regional Economic Accounts, Washington, D.C.; U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.

How does employment in commodity sectors and in industries that include travel and tourism, vary across geographies?

What do we measure on this page?

This page describes differences in employment for all commodity sectors combined across geographies. It also shows differences in employment for industries that have the potential of being associated with travel and tourism.

Commodity Sectors: Consists of employment in timber, mining (including oil, gas, and coal), and agriculture. These are sectors that have the potential to use federal public lands (e.g., for timber harvesting, energy development, grazing, and recreation) for the extraction of commodities.

Travel and Tourism: Consists of sectors that provide goods and services to visitors to the local economy, as well as to the local population. These industries are: retail trade; passenger transportation; arts, entertainment and recreation; and accommodation and food services. The exact proportion of jobs in these sectors attributable to expenditures by visitors, including business and pleasure travelers, is not known without additional research such as surveys. Some researchers refer to these sectors as “tourism-sensitive.” They could also be called “travel and tourism-potential sectors” because they have the potential of being influenced by expenditures by non-locals. In this report, they are referred to as "industries that include travel and tourism."

Why is it important?

Public lands can play a key role in stimulating local employment by providing opportunities for commodity extraction. Timber, mining, and agriculture are together referred to in this report as commodity sectors because they have the potential for using public lands for the extraction of commodities. For example, timber may be harvested from Forest Service lands, and oil and gas development and cattle grazing may occur on Bureau of Land Management lands. While it is not possible to measure the exact number of jobs that rely on the commodity use of public lands, it is important to understand the relative size of these sectors to put the economy related to commodity extraction in perspective. For example, a county with 90 percent of its employment in the commodity sectors has a higher chance of being impacted by decisions that permit (or restrict) timber, mining, and grazing activities on public lands than a county where only 10 percent of the workforce is in these sectors.

Public lands can also play an important role in stimulating local employment by providing opportunities for recreation. Communities adjacent to public lands can benefit economically from visitors who spend money in hotels, restaurants, ski resorts, gift shops, and elsewhere. While the information in this report is not an exact measure of the size of travel and tourism sectors, and it does not measure the type and amount of recreation on public lands, it can be used to understand whether travel and tourism-related economic activity is present and if there are differences between geographies.

Methods

We use County Business Patterns (CBP) as a data source for timber and mining. Compared to other sources, it has fewer data gaps (instances when the federal government will not release data to protect confidentiality of individual businesses). It also includes both full and part-time employment. A disadvantage of CBP data is that they do not include employment in government, agriculture, railroads, or the self-employed and as a result under-count the size of industry sectors. Also, CBP data are based on mid-March employment and do not take into account seasonal fluctuations. For these reasons, the data are most useful for showing long-term trends, displaying differences between places, and showing relationships between sectors over time.

We use the Bureau of Economic Analysis (BEA) as a data source for agriculture because CBP data do not include agriculture. However, the BEA data include proprietors, which are not included in CBP. As a result, the data for agriculture, and timber and mining are not strictly comparable. The latest year for each data source may vary due to different data release schedules.

There is no single industrial classification for travel and tourism under the North American Industrial Classification System (NAICS). However, there are sectors that, at least in part, provide goods and services to visitors to a local economy. These industries include: retail trade; passenger transportation; arts, entertainment and recreation; and accommodation and food services. To understand the absolute size of employment in travel and tourism would require detailed knowledge, obtained through surveys and other means, of the proportion of a sector's employment that is directly attributable to pleasure travelers.

Some data are withheld by the federal government to avoid the disclosure of potentially confidential information. Headwaters Economics uses supplemental data from the U.S. Department of Commerce to estimate these data gaps.

Additional Resources

To learn more about commodity sectors, see the EPS reports on timber, mining, and agriculture.

To learn more about the recreation-related components of the economy and the methods used to estimate employment in this portion of the economy, see the EPS Travel and Tourism report.

Documentation explaining methods developed by Headwaters Economics for estimating disclosure gaps is available at headwaterseconomics.org/eps *(1)*.

Data Sources

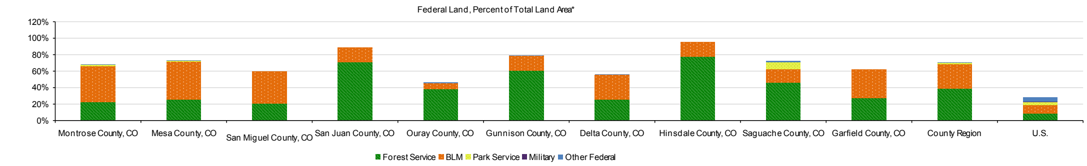
U.S. Department of Commerce. 2015. Bureau of Economic Analysis, Regional Economic Accounts, Washington, D.C.; U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.

What is the extent and type of federal land, and how significant are federal land payments?

This page describes differences in the percent of federal land ownership by agency, the share of federal lands managed primarily for natural, cultural, and recreational features ("Type A"), and the percent of county revenue from payments related to federal lands.

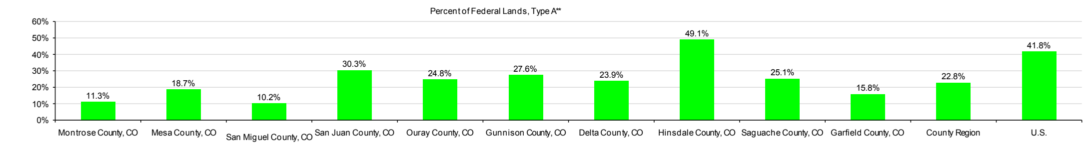
- Hinsdale County, CO had the largest percent of total land area in federal ownership (95.3%), and the U.S. had the smallest (28.2%).
- Forest Service lands were the largest component of federal land ownership (38.8%) in County Region, and Military lands were the smallest (0%).

* Data source and year vary depending on the selected geography.

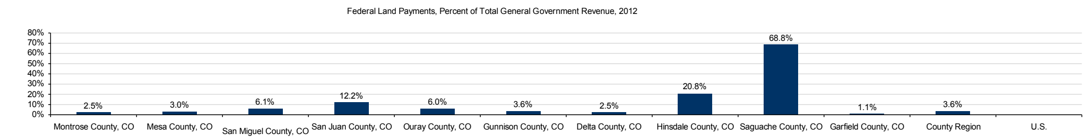


- Hinsdale County, CO had the largest percent of federal lands in Type A (49.1%), and San Miguel County, CO had the smallest (10.2%).

** Type A federal lands are explained in the study guide. Data source and year vary depending on the selected geography.



- In FY 2012, Saguache County, CO had the largest percent of total general government revenue from federal land payments (68.8%), and Garfield County, CO had the smallest (1.1%).



Data Sources: NASA MODIS Land Cover Type Yearly L3 Global 1km MOD12Q1, 2006; U.S. Geological Survey, Gap Analysis Program. 2016. Protected Areas Database of the United States (PADUS) version 1.4; U.S. Department of Commerce. 2014. Census Bureau, Governments Division, Washington, D.C.

Study Guide and Supplemental Information

What is the extent and type of federal land, and how significant are federal land payments?

What do we measure on this page?

This page describes differences in the percent of federal land ownership by agency, the share of federal lands managed primarily for natural, cultural, and recreational features ("Type A"), and the percent of county revenue from payments related to federal lands.

Type A : Federal public lands that are managed primarily for natural, cultural, and recreational features. There can be exceptions (e.g., oil and gas development in a particular National Monument), but generally these lands are less likely to be used for commodity production than other federal land types. These lands include National Parks and Preserves (NPS), Wilderness (NPS, FWS, FS, BLM), National Conservation Areas (BLM), National Monuments (NPS, FS, BLM), National Recreation Areas (NPS, FS, BLM), National Wild and Scenic Rivers (NPS), Waterfowl Production Areas (FWS), Wildlife Management Areas (FWS), Research Natural Areas (FS, BLM), Areas of Critical Environmental Concern (BLM), and National Wildlife Refuges (FWS). These definitions of land classifications are not legal or agency approved and adopted classifications, and are only provided for comparative purposes.
NPS = National Park Service; FS = Forest Service; BLM = Bureau of Land Management; FWS = Fish and Wildlife Service.

Why is it important?

In some geographies, particularly in the West, more than half of the land base can be federal public lands. Understanding the makeup of the land base in an area is important because some actions on federal lands may affect the local economy, particularly if federal lands are a large portion of the land base.

Some federal public lands prohibit most forms of commercial use and development. These include National Parks, Wilderness, and National Monuments, for example. Since these lands are managed primarily for their non-commercial values (i.e., scenery, wildlife, recreation) they potentially play a different economic role than public lands more commonly associated with commodity sectors.

Geographies with federal public lands receive payments from the federal government related to these lands (e.g., Payments in Lieu of Taxes [PILT], the 25% Fund, Secure Rural Schools, and others). If these payments are a significant portion of the local county's budget, then activities on public lands may have the potential to affect the fiscal well-being of a county. Depending on the type of payments a county receives, the fiscal health of the county may also be dependent on the level of appropriations from Congress.

Additional Resources

To learn more about land ownership and development patterns, see the EPS Land Use report.

To learn more about the role of environmental amenities in economic development, see the EPS Amenities report.

To learn more about the importance of federal payments to counties, see the EPS Federal Land Payments report.

For examples of literature on the economic role of environmental amenities, see:

Booth, D.E. 1999. "Spatial Patterns in the Economic Development of the Mountain West." Growth and Change 30(3): 384-405.

Duffy-Deno, K.T. 1998. "The Effect of Federal Wilderness on County Growth in the Intermountain Western United States." Journal of Regional Science 38(1): 109-136.
Lorah, P., R. Southwick. 2003. “Environmental Protection, Population Change, and Economic Development in the Rural Western United States." Population and Environment 24(3): 255-272.

McGranahan, D.A. 1999. Natural Amenities Drive Rural Population Change. Economic Research Service, U.S. Department of Agriculture, Food and Rural Economics Division. Washington, D.C. ers.usda.gov/publications/aer-agricultural-economic-report/aer781.aspx *(6)*.

Rasker, R. 2006. "An Exploration Into the Economic Impact of Industrial Development Versus Conservation on Western Public Lands." Society & Natural Resources 19(3): 191-207.
Rudzitis, G., H.E. Johansen. 1991. "How Important is Wilderness? Results from a United States Survey." Environmental Management 15(2): 227-233.

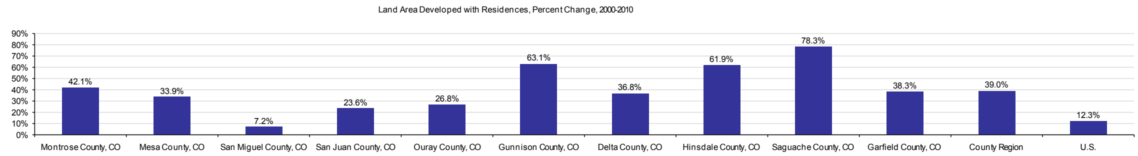
Data Sources

NASA MODIS Land Cover Type Yearly L3 Global 1km MOD12Q1, 2006; U.S. Geological Survey, Gap Analysis Program. 2016. Protected Areas Database of the United States (PADUS) version 1.4; U.S. Department of Commerce. 2014. Census Bureau, Governments Division, Washington, D.C.

How much private land has been developed, including in the wildland-urban interface (WUI)?

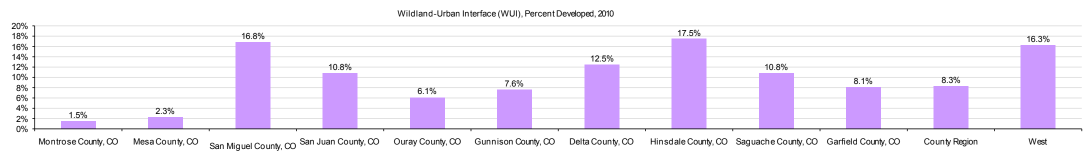
This page describes differences in the change in residential development on private lands, and the proportion of the wildland-urban interface (WUI) that is developed with homes.

- Between 2000 and 2010, Saguache County, CO had the largest percent change in residential land area developed (78.3%), and San Miguel County, CO had the smallest (7.2%).



Wildland-Urban Interface (WUI): This information is available only for the 11 western public lands states (not including Alaska and Hawaii). WUI is defined as private forestlands that are within 500 meters of public forestlands. We use the threshold of 500 meters to identify both existing and potential WUI since guidelines for the amount of defensible space necessary to protect homes from wildfire range from 40 to 500 meters around a home. We focus on adjacency to public forests since roughly 70 percent of western forests are publicly owned and since wildfire is a natural disturbance in many of these forests, creating a potential risk to adjacent private lands.

- In 2010, Hinsdale County, CO had the largest proportion of the wildland-urban interface that is developed (17.5%), and Montrose County, CO had the smallest (1.5%).



Data Sources: Theobald, DM. 2013. Land use classes for ICLUS/SERGoM v2013. Unpublished report, Colorado State University; Gude, P.H., Rasker, R., and van den Noort, J. 2008. Potential for Future Development on Fire-Prone Lands. Journal of Forestry 106(4):198-205; U.S. Department of Commerce. 2011. TIGER/Line 2010 Census Blocks and 2010 Summary File 1, Washington, D.C.

How much private land has been developed, including in the wildland-urban interface (WUI)?

What do we measure on this page?

This page describes differences in the change in residential development on private lands, and the proportion of the wildland-urban interface (WUI) that is developed with homes.

This information is available only for the 11 western public lands states (not including Alaska and Hawaii).

Wildland-Urban Interface (WUI): Defined as private forestlands that are within 500 meters of public forestlands. We use the threshold of 500 meters to identify both existing and potential WUI since guidelines for the amount of defensible space necessary to protect homes from wildfire range from 40 to 500 meters around a home. We focus on adjacency to public forests since roughly 70 percent of western forests are publicly owned and since wildfire is a natural disturbance in many of these forests, creating a potential risk to adjacent private lands.

Why is it important?

Public lands are influenced by land management actions on private land, particularly by the development of lands within the wildland-urban interface.

Development of homes adjacent to fire-prone federal public lands poses several challenges to land management agencies. These include: the rising cost of protecting homes from wildland fire; the opportunity cost of spending a significant portion of the agency's budget on firefighting, which means fewer funds are available for restoration, recreation, research, and other activities; and increased danger to wildland firefighters. When protecting homes is a priority, this also means that it is sometimes not possible for the agencies to allow otherwise beneficial fires to burn, even those that could reduce fuel loads.

Additional Resources

For additional information on land ownership, management, cover, and development, see the EPS Land Use report.

For online resources related to the wildland-urban interface (WUI) and a paper on proposed solutions to the rising cost of firefighting (including a review of literature on the subject), see: headwaterseconomics.org/wildfire *(7)*.

For a description of the methods used to define and measure the wildland-urban interface, see: Gude, P., R. Rasker and van den Noort, J. 2008. “Potential for Future Development on Fire-Prone Lands.” Journal of Forestry. June: 198-205.

Data Sources

Theobald, DM. 2013. Land use classes for ICLUS/SERGoM v2013. Unpublished report, Colorado State University; Gude, P.H., Rasker, R., and van den Noort, J. 2008. Potential for Future Development on Fire-Prone Lands. Journal of Forestry 106(4):198-205; U.S. Department of Commerce. 2011. TIGER/Line 2010 Census Blocks and 2010 Summary File 1, Washington, D.C.

Data Sources

The EPS Services report uses published statistics from government sources that are available to the public and cover the entire country. All data used in EPS can be readily verified by going to the original source. The contact information for databases used in this profile is:

- **County Business Patterns**
  Census Bureau, U.S. Department of Commerce
  http://www.census.gov/epcd/cbp/view/cbpview.html
  Tel. 301-763-2580
- **Regional Economic Information System**
  Bureau of Economic Analysis, U.S. Department of Commerce
  http://bea.gov/bea/regional/data.htm
  Tel. 202-606-9600
- **Local Area Unemployment Statistics**
  Bureau of Labor Statistics, U.S. Department of Labor
  http://www.bls.gov/lau
  Tel. 202-691-6392

The EPS-HDT Summary report also Geographic Information Systems (GIS) derived data to show more accurate statistics for land ownership. The contact information of the GIS data sources follow:

- **TIGER/Line County Boundaries 2012**
  Bureau of the Census, U.S. Department of Commerce
  http://www.census.gov/geo/maps-data/data/tiger.html
- **Protected Areas Database v 1.3 2012**
  U.S. Geological Survey, Gap Analysis Program
  http://gapanalysis.usgs.gov/padus/

Methods

EPS core approaches

EPS is designed to focus on long-term trends across a range of important measures. Trend analysis provides a more comprehensive view of changes than spot data for select years. We encourage users to focus on major trends rather than absolute numbers.

EPS displays detailed industry-level data to show changes in the composition of the economy over time and the mix of industries at points in time.

EPS employs cross-sectional benchmarking, comparing smaller geographies such as counties to larger regions, states, and the nation, to give a sense of relative performance.

EPS allows users to aggregate data for multiple geographies, such as multi-county regions, to accommodate a flexible range of user-defined areas of interest and to allow for more sophisticated cross-sectional comparisons.

Adjusting dollar figures for inflation

Because a dollar in the past was worth more than a dollar today, data reported in current dollar terms should be adjusted for inflation. The U.S. Department of Commerce reports personal income figures in terms of current dollars. All income data in EPS are adjusted to real (or constant) dollars using the Consumer Price Index. Figures are adjusted to the latest date for which the annual Consumer Price Index is available.

Data gaps and estimation

Some data are withheld by the federal government to avoid the disclosure of potentially confidential information. Headwaters Economics uses supplemental data from the U.S. Department of Commerce to estimate these data gaps. These are indicated in italics in tables. Documentation explaining methods developed by Headwaters Economics for estimating disclosure gaps is available at headwaterseconomics.org/eps.

Links to Additional Resources

For more information about EPS see:

headwaterseconomics.org/EPS

Web pages listed under Additional Resources include:

Throughout this report, references to on-line resources are indicated with italicized numbers in parentheses. These resources are provided as hyperlinks here.

1 headwaterseconomics.org/eps
2 www.bea.gov/regional/definitions
3 www.bls.gov/cps/faq.htm#Ques3
4 www.bls.gov/opub/mlr/indexe.htm#Earnings_and_wages
5 www.bea.gov/glossary/glossary.cfm
6 www.ers.usda.gov/publications/aer-agricultural-economic-report/aer781.aspx
7 headwaterseconomics.org/wildfire

A Profile of Public Land Amenities

County Region

Selected Geographies:

Montrose County, CO; Mesa County, CO; San Miguel County, CO; San Juan County, CO; Ouray County, CO; Gunnison County, CO; Delta County, CO; Hinsdale County, CO; Saguache County, CO; Garfield County, CO

Benchmark Geographies:

U.S.

Produced by

Economic Profile System

EPS

November 28, 2016

About the Economic Profile System (EPS)

EPS is a free, easy-to-use software application that produces detailed socioeconomic reports of counties, states, and regions, including custom aggregations.

EPS uses published statistics from federal data sources, including Bureau of Economic Analysis and Bureau of the Census, U.S. Department of Commerce; and Bureau of Labor Statistics, U.S. Department of Labor.

The Bureau of Land Management and Forest Service have made significant financial and intellectual contributions to the operation and content of EPS.

See headwaterseconomics.org/EPS for more information about the other tools and capabilities of EPS.

For technical questions, contact Patty Gude at eps@headwaterseconomics.org, or 406-599-7425.

headwaterseconomics.org

Headwaters Economics is an independent, nonprofit research group. Our mission is to improve community development and land management decisions in the West.

www.blm.gov

The Bureau of Land Management, an agency within the U.S. Department of the Interior, administers 249.8 million acres of America's public lands, located primarily in 12 Western States. It is the mission of the Bureau of Land Management to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations.

www.fs.fed.us

The Forest Service, an agency of the U.S. Department of Agriculture, administers national forests and grasslands encompassing 193 million acres. The Forest Service's mission is to achieve quality land management under the "sustainable multiple-use management concept" to meet the diverse needs of people while protecting the resource. Significant intellectual, conceptual, and content contributions were provided by the following individuals: Dr. Pat Reed, Dr. Jessica Montag, Doug Smith, M.S., Fred Clark, M.S., Dr. Susan A. Winter, and Dr. Ashley Goldhor-Wilcock.

Table of Contents

Note to Users:

This is one of fourteen reports that can be created and downloaded from EPS Web. You may want to run another EPS report for either a different geography or topic. Topics include land use, demographics, specific industry sectors, the role of non-labor income, the wildland-urban interface, the role of amenities in economic development, and payments to county governments from federal lands. Throughout the reports, references to online resources are indicated in parentheses. These resources are provided as hyperlinks on each report's final page. The EPS reports are downloadable as Excel, PDF, and Word documents. For further information and to download reports, go to:

headwaterseconomics.org/eps

What is the breakdown of land ownership?

This page describes the land area (in acres) and the share of the area that is private and that is managed by various public agencies.

Land Ownership (Acres)

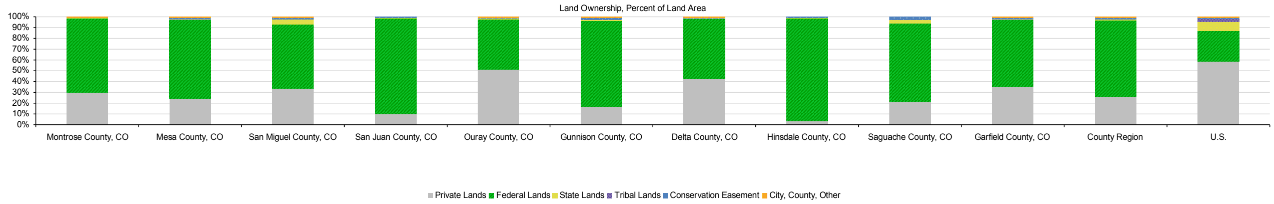
	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Total Area	1,435,422	2,138,287	824,791	248,513	347,015	2,086,164	735,108	718,815	2,028,983	1,891,716	12,454,814	2,301,106,907
Private Lands	443,170	537,788	284,091	26,868	179,826	367,654	316,429	28,800	450,453	673,242	3,308,321	1,364,048,727
Conservation Easement	1,193	36,226	11,652	18	1,337	44,643	3,339	2,184	43,824	25,029	169,445	19,026,854
Federal Lands	980,863	1,559,551	491,307	220,374	160,923	1,652,801	409,983	685,373	1,473,376	1,176,684	8,811,235	649,455,740
Forest Service	328,032	551,634	173,218	176,429	132,182	1,269,353	189,272	559,415	937,383	516,862	4,833,780	192,507,338
BLM	622,182	981,360	318,089	43,945	25,727	380,270	219,944	125,958	336,673	659,516	3,713,664	242,951,818
National Park Service	28,398	20,487	0	0	0	0	0	0	168,677	0	217,562	78,773,678
Military	0	0	0	0	0	0	0	0	0	0	0	22,945,136
Other Federal	2,251	6,070	0	0	3,014	3,178	767	0	30,643	306	46,229	112,277,770
State Lands	9,677	3,856	34,347	1,253	4,807	19,945	4,969	2,457	61,329	16,425	159,065	194,258,469
State Trust Lands*	1	1,252	18,924	1,253	286	4,678	0	0	59,311	0	85,705	46,116,200
Other State	9,676	2,604	15,423	0	4,521	15,267	4,969	2,457	2,018	16,425	73,360	148,142,269
Tribal Lands	0	0	0	0	0	0	0	0	0	0	0	66,666,114
City, County, Other	519	867	3,395	0	122	1,120	388	0	0	336	6,747	7,650,993

Percent of Total

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Private Lands	30.9%	25.2%	34.4%	10.8%	51.8%	17.6%	43.0%	4.0%	22.2%	35.6%	26.6%	59.3%
Conservation Easement	0.1%	1.7%	1.4%	0.0%	0.4%	2.1%	0.5%	0.3%	2.2%	1.3%	1.4%	0.8%
Federal Lands	68.3%	72.9%	59.6%	88.7%	46.4%	79.2%	55.8%	95.3%	72.6%	62.2%	70.7%	28.2%
Forest Service	22.9%	25.8%	21.0%	71.0%	38.1%	60.8%	25.7%	77.8%	46.2%	27.3%	38.8%	8.4%
BLM	43.3%	45.9%	38.6%	17.7%	7.4%	18.2%	29.9%	17.5%	16.6%	34.9%	29.8%	10.6%
National Park Service	2.0%	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	8.3%	0.0%	1.7%	3.4%
Military	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.0%
Other Federal	0.2%	0.3%	0.0%	0.0%	0.9%	0.2%	0.1%	0.0%	1.5%	0.0%	0.4%	4.9%
State Lands	0.7%	0.2%	4.2%	0.5%	1.4%	1.0%	0.7%	0.3%	3.0%	0.9%	1.3%	8.4%
State Trust Lands*	0.0%	0.1%	2.3%	0.5%	0.1%	0.2%	0.0%	0.0%	2.9%	0.0%	0.7%	2.0%
Other State	0.7%	0.1%	1.9%	0.0%	1.3%	0.7%	0.7%	0.3%	0.1%	0.9%	0.6%	6.4%
Tribal Lands	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.9%
City, County, Other	0.0%	0.0%	0.4%	0.0%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%	0.1%	0.3%

* Most state trust lands are held in trust for designated beneficiaries, principally public schools. Managers typically lease and sell these lands for a diverse range of uses to generate revenues for the beneficiaries.

- Hinsdale County, CO has the largest share of federal public lands (95.3%), and the U.S. has the smallest (28.2%).
- The U.S. has the largest share of state public lands (8.4%), and Mesa County, CO has the smallest (0.2%).
- The U.S. has the largest share of private lands (59.3%), and Hinsdale County, CO has the smallest (4%).



Data Sources: U.S. Geological Survey, Gap Analysis Program. 2016. Protected Areas Database of the United States (PADUS) version 1.4

Study Guide and Supplemental Information

What is the breakdown of land ownership?

What do we measure on this page?

This page describes the land area (in acres) and the share of the area that is private and that is managed by various public agencies.

Public Land Amenities: The qualities of public lands that make a region an attractive place to live, recreate, and work. They may consist, for example, of scenic vistas, recreational opportunities, and wildlife habitat. For some communities, surrounding public lands may serve an economic role by creating a setting that attracts and retains people and businesses. For others, the recreational opportunities may attract tourists. And for some, the opportunities to hunt, fish, and view wildlife may be important to local residents and serve as a magnet that keeps them from leaving.

Why is it important?

Public lands provide recreational, environmental, and lifestyle amenities that can stimulate growth. While amenities alone are typically not sufficient to foster growth, they have increasingly been shown to contribute to population growth and economic development.

Many factors can contribute to economic growth, including access to raw materials, workforce quality, availability of investment capital, and transportation networks. In recent decades, amenities have also become increasingly important for people who can choose where to live and work, and for businesses that are not subject to location constraints. Employers now advertise public land amenities to attract and retain a talented workforce. Communities are taking advantage of nearby public lands to attract new businesses, as well as retirement and investment income. Thus, amenities provided by public lands can be considered an economic asset. For a public lands manager, this means proposed activities should be evaluated in the context of how they may impact public lands amenities and, in turn, an economy that may be dependent on these resources.

Methods

This report displays a number of indicators that are commonly present when public land amenities play a role in economic development. No single indicator is sufficient proof of an economic contribution by public lands amenities. Rather, when these indicators are taken as a whole, and when combined with the relevant peer-reviewed scientific literature, they can provide guidance on how to include in a planning document the idea and data that one of the economic contributions of public lands is a setting that attracts and retains people and business. The information in this report may have to be supplemented with additional resources, such as surveys of area residents and business leaders, to discern whether and how public land amenities play an economic role in an area.

No publicly available federal database contains land ownership area statistics. The data presented in this report were calculated using Geographic Information System (GIS) tools. Two GIS datasets were utilized: U.S. Census Bureau's TIGER/Line County Boundaries 2012: census.gov/geo/www/tiger/tgrshp2012/tgrshp2012.html *(2)* and U.S. Geological Survey's Protected Areas Database (PADUS) version 1.3: gapanalysis.usgs.gov/padus/ *(3)*. Although every attempt was made to use the best available land ownership data, the data sometimes has errors or becomes outdated. Please report any inaccuracies to eps@headwaterseconomics.org.

Additional Resources

For a general analysis on the role of amenities in economic development, see: McGranahan, D. A. 1999. “Natural Amenities Drive Rural Population Change.” Economic Research Service, U.S. Department of Agriculture, Food and Rural Economics Division. AER781: ers.usda.gov/publications/aer-agricultural-economic-report/aer781.aspx *(1)*.

For an analysis of the economic role of protected public lands, see: Eichman H, G. L. Hunt, J. Kerkvliet, and A.J. Plantinga. 2010. "Local Employment Growth, Migration, and Public Land Policy: Evidence from the Northwest Forest Plan." Journal of Agricultural and Resource Economics. 35(2): 316-333.

For a review of the literature on the relationship between public land amenities and economic development and migration, see: Garber-Yonts, B. E. 2004. "The Economics of Amenities and Migration in the Pacific Northwest: Review of Selected Literature with Implications for National Forest Management." USDA Forest Service, General Technical Report (PNW-617): 01-54.

For an example of a survey conducted to assess the public’s perceptions of quality of life and how public lands actions may affect these, see: Reed, P. and G. Brown. 2003. "Public land management and quality of life in neighboring communities - The Chugach National Forest planning experience." Forest Science. 49(4): 479-498.

Data Sources

U.S. Geological Survey, Gap Analysis Program. 2016. Protected Areas Database of the United States (PADUS) version 1.4; Rasker, R. 2006. "An Exploration Into the Economic Impact of Industrial Development Versus Conservation on Western Public Lands." Society and Natural Resources. 19(3): 191-207

What are the different types of federal lands?

This page describes the size (in acres) and share of federal public lands managed for various purposes under differing statutory authority (see study guide text for more details on federal public land management classifications). For purposes of this section, federal public lands have been defined below as Type A, B, or C in order to more easily distinguish lands according to primary or common uses and/or conservation functions, activities, permitted transportation uses, and whether they have a special designation (often through Congressional action).

Type A: National Parks and Preserves (NPS), Wilderness (NPS, FWS, FS, BLM), National Conservation Areas (BLM), National Monuments (NPS, FS, BLM), National Recreation Areas (NPS, FS, BLM), National Wild and Scenic Rivers (NPS, FS, BLM), Waterfowl Production Areas (FWS), Wildlife Management Areas (FWS), Research Natural Areas (FS, BLM), Areas of Critical Environmental Concern (BLM), and National Wildlife Refuges (FWS).

Type B: Wilderness Study Areas (NPS, FWS, FS, BLM), Inventoried Roadless Areas (FS).

Type C: Public Domain Lands (BLM), O&C Lands (BLM), National Forests and Grasslands (FS).

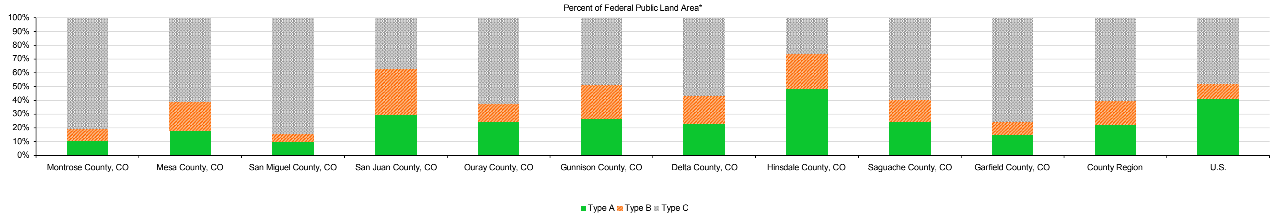
NPS = National Park Service; FS = Forest Service; BLM = Bureau of Land Management; FWS = Fish and Wildlife

Relative Management Designations of Federal Lands (Acres)*

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Total Area of Type A, B, and C	981,556	1,556,772	491,500	220,898	158,018	1,663,336	411,978	685,882	1,470,611	1,176,540	8,817,091	623,478,537
Type A	111,397	290,837	50,092	67,025	39,195	458,808	98,658	337,018	368,513	186,084	2,007,627	260,397,439
Type B	83,076	327,483	29,694	73,521	21,505	402,468	81,640	173,835	232,273	107,918	1,533,413	66,039,395
Type C	787,083	938,452	411,714	80,352	97,318	802,060	231,680	175,029	869,825	882,538	5,276,051	297,041,703
Percent of Total												
Type A	11.3%	18.7%	10.2%	30.3%	24.8%	27.6%	23.9%	49.1%	25.1%	15.8%	22.8%	41.8%
Type B	8.5%	21.0%	6.0%	33.3%	13.6%	24.2%	19.8%	25.3%	15.8%	9.2%	17.4%	10.6%
Type C	80.2%	60.3%	83.8%	36.4%	61.6%	48.2%	56.2%	25.5%	59.1%	75.0%	59.8%	47.6%

* Year for data varies by geography and source. See data sources below for more information.

- Hinsdale County, CO has the largest share of Type A land (49.1%), and San Miguel County, CO has the smallest (10.2%).
- San Juan County, CO has the largest share of Type B land (33.3%), and San Miguel County, CO has the smallest (6%).
- San Miguel County, CO has the largest share of Type C land (83.8%), and Hinsdale County, CO has the smallest (25.5%).



Data Sources: U.S. Geological Survey, Gap Analysis Program. 2016. Protected Areas Database of the United States (PADUS) version 1.4; Rasker, R. 2006. "An Exploration Into the Economic Impact of Industrial Development Versus Conservation on Western Public Lands." Society and Natural Resources. 19(3): 191-207.

Study Guide and Supplemental Information

What are the different types of federal lands?

What do we measure on this page?

This page describes the size (in acres) and share of federal public lands managed for various purposes under differing statutory authority. For purposes of this section, federal public lands have been defined below as Type A, B, or C in order to more easily distinguish lands according to primary or common uses and/or conservation functions, activities, permitted transportation uses, and whether they have a special designation (often through Congressional action).

Type A lands tend to have more managerial and commercial use restrictions than Type C lands, represent smaller proportions of total land management areas (except within Alaska), and have a designation status less easily changed than Type B lands. In most other respects Type B lands are similar to Type A lands in terms of activities allowed. Type C lands generally have no special designations, represent the bulk of federal land management areas, and may allow a wider range of uses or compatible activities -often including commercial resource utilization such as timber production, mining and energy development, grazing, recreation, and large-scale watershed projects and fire management options (especially within the National Forest System and Public Domain lands of the BLM).

As more popularly described: Type A lands are areas having uncommon bio-physical and/or cultural character worth preserving; Type B lands are areas with limited development and motorized transportation worth preserving; and Type C lands are areas where the landscape may be altered within the objectives and guidelines of multiple use.

Why is it important?

Some types of federal lands, such as National Parks and Wilderness, can be associated with above average economic growth. These lands by themselves do not guarantee economic growth. But when combined with other factors, such as an educated workforce and access to major markets via airports, they have been shown to be statistically significant predictors of growth.

Methods

The classifications offered on this page are not absolute categories. They are categories of relative degrees of management priority, categorized by land designation. Lands such as Wilderness and National Monuments, for example, are generally more likely to be managed for conservation and recreation, even though there may exist exceptions (e.g., a pre-existing mine in a Wilderness area or oil and gas development in a National Monument). Forest Service and BLM lands without designations such as Wilderness or National Monuments are more likely to allow commercial activities (e.g., mining, timber harvesting), even though there are exceptions.

Land defined as either Type A, B, or C includes areas managed by the National Park Service, the Forest Service, the Bureau of Land Management, or the Fish and Wildlife Service. Lands administered by other federal agencies (including the Army Corps of Engineers, Bureau of Reclamation, Department of Agriculture, Department of Defense, Department of Energy, and Department of Transportation) were not classified into Type A, B, or C. Therefore, the total acreage of Type A, B, and C lands may not add to the Total Federal Land Area reported on page 1. Private lands and areas managed by state agencies and local government are not included in this classification. These definitions (Type A, B, and C) of land classifications are not legal or agency-approved, and are provided only for comparative purposes. A caveat: The amount of acreage in particular land types may not be the only indicator of quality. For example, Wild and Scenic Rivers may provide amenity values far greater than their land acreage would indicate.

Additional Resources

Studies, articles and literature reviews on the economic contribution of protected public lands are available from: headwaterseconomics.org/land/reports/protected-lands-value *(4)*.

See also: Lorah, P. and R. Southwick. 2003. "Environmental Protection, Population Change, and Economic Development in the Rural Western United States" Population and Environment. 24(3): 255-272; and Holmes, P. and W. Hecox. 2002. “Does Wilderness Impoverish Rural Areas?” International Journal of Wilderness. 10(3): 34-39.

For an analysis on the effect on local economies, in particular on resource-based industries, from Wilderness designations, see: Duffy-Deno, K. T.. 1998. "The Effect of Federal Wilderness on County Growth in the Intermountain Western United States." Journal of Regional Science. 38(1): 109-136.

For the results of a national survey of residents in counties with Wilderness, see: Rudzitis, G. and H.E. Johansen. 1991. "How Important is Wilderness? Results from a United States Survey." Environmental Management. 15(2): 227-233.

For analysis of the role of transportation in high-amenity areas, see: Rasker, R., P.H. Gude, J.A. Gude, J. van den Noort. 2009. “The Economic Importance of Air Travel in High-Amenity Rural Areas.” Journal of Rural Studies. 25(2009): 343-353.

Data Sources

U.S. Geological Survey, Gap Analysis Program. 2016. Protected Areas Database of the United States (PADUS) version 1.4; Rasker, R. 2006. "An Exploration Into the Economic Impact of Industrial Development Versus Conservation on Western Public Lands." Society and Natural Resources. 19(3): 191-207

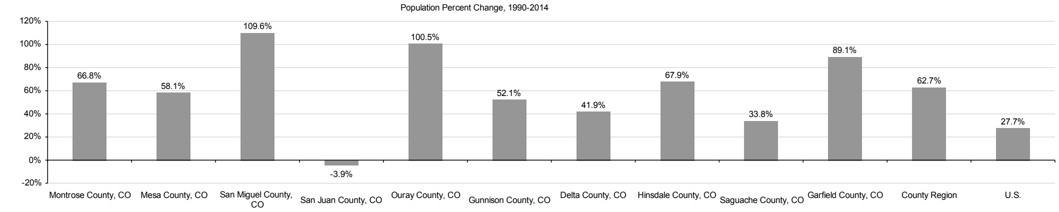
What are population trends?

This page compares the size of the population and population change since 1990.

Population Change, 1990-2014

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Population 1990	24,507	93,757	3,741	749	2,309	10,340	21,053	468	4,632	30,379	191,935	249,622,814
Population 2000	33,599	117,631	6,609	562	3,775	14,068	27,877	791	5,939	44,257	255,108	282,162,411
Population 2014	40,873	148,255	7,840	720	4,629	15,725	29,870	786	6,196	57,461	312,355	318,857,056
Population Change 1990-2014	16,366	54,498	4,099	-29	2,320	5,385	8,817	318	1,564	27,082	120,420	69,234,242
Percent Change 1990-2014	66.8%	58.1%	109.6%	-3.9%	100.5%	52.1%	41.9%	67.9%	33.8%	89.1%	62.7%	27.7%

- Between 1990 and 2014, San Miguel County, CO had the largest percent change in population (109.6%), and San Juan County, CO has the smallest (-3.9%).



Data Sources: U.S. Department of Commerce. 2015. Bureau of Economic Analysis, Regional Economic Accounts, Washington, D.C.

What are population trends?

What do we measure on this page?

This page compares the size of the population and population change since 1990.

Why is it important?

Rapid population increase may indicate that amenities on public lands play a role stimulating growth in an area. This trend can be seen in many counties and regions during the 1990s and early 2000s (see the Additional Resources citations referenced throughout this report for more information on amenity-led migration).

Population growth by itself is not sufficient evidence that the amenities of public lands contribute to growth. This indicator should be considered together with all other indicators in this report, along with the recommended additional reading, as resources that help the user to understand amenity-driven growth and how to write about it for specific geographies. This work may have to be supplemented with additional resources, such as surveys of local residents and businesses.

Additional Resources

For a discussion of population and economic growth in relation to amenities and the restructuring of the economy that began to take place in the 1980s, see: Rudzitis, G. 1989. "Migration, Places, and Nonmetropolitan Development." Urban Geography. 10(4): 396-411.

For a discussion of the relationship between environmental amenities and population growth, see: Hunter, L. M., J. D. Boardman, and J.M.S. Onge. 2005. "The Association Between Natural Amenities, Rural Population Growth, and Long-Term Residents' Economic Well-Being." Rural Sociology. 70(4): 452-469.

See also: Nelson, P. B. 1997. "Migration, Sources of Income, and Community Change in the Non-Metropolitan Northwest." Professional Geographer. 49(4): 419-430.

For analysis of the reasons for migration to the rural West, see: Cromartie, J.B. and J.M. Wardwell. 1999. "Migrants Settling Far and Wide in the Rural West." Rural Development Perspectives. 14(2): 2-8.

For a critical examination of whether amenities play a role in development (including a review of the literature), see: Gottlieb, P.D. 1994. "Amenities as an Economic Development Tool: Is there Enough Evidence?" Economic Development Quarterly. 8(3): 270-285.

Data Sources

U.S. Department of Commerce. 2015. Bureau of Economic Analysis, Regional Economic Accounts, Washington, D.C.

How have the components of population changed?

This page describes components of population change. Total population change is the sum of natural change (births minus deaths) and migration (international plus domestic).

Population Change, 2000-2015

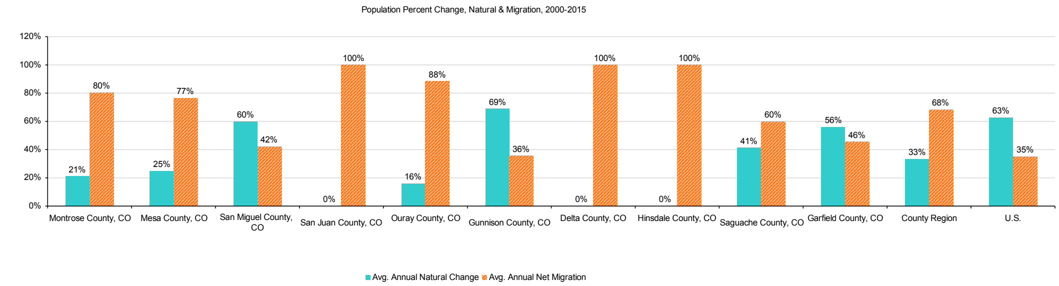
	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Population Change, 2000-2015	7,346	31,025	1,263	142	915	2,061	2,063	-16	273	13,836	58,908	na
Avg. Annual Population Change	550	2,192	107	-2	69	149	190	-2	87	1,035	438	2,260,183
Avg. Annual Natural Change	117	544	64	3	11	103	-1	6	36	579	146	1,417,311
Avg. Annual Births	489	1,820	80	5	33	165	336	8	76	868	388	3,520,285
Avg. Annual Deaths	372	1,277	16	2	23	62	337	2	40	289	242	2,102,974
Avg. Annual Net Migration	442	1,678	45	-4	61	53	199	-8	52	473	299	788,430
Avg. Annual International Mig.	46	93	25	0	2	16	42	0	22	190	44	788,430
Avg. Annual Domestic Mig.	395	1,585	20	-5	59	36	158	-8	30	282	255	na
Avg. Annual Residual	-9	-30	-2	0	-3	-6	-8	0	-1	-16	-8	63,517

Percent of Population Change from 2000-2015

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Avg. Annual Natural Change	21.3%	24.8%	59.8%	0.0%	15.9%	69.1%	0.0%	0.0%	41.4%	55.9%	33.3%	62.7%
Avg. Annual Net Migration	80.4%	76.6%	42.1%	100.0%	88.4%	35.6%	100.0%	100.0%	59.8%	45.7%	68.3%	34.9%

Note that percentages may not add to 100% due to residual in estimating process.

- From 2000 to 2015, Gunnison County, CO had the largest share of population change from natural change (69.1%), and San Juan County, CO had the smallest (0%).
- From 2000 to 2015, San Juan County, CO had the largest share of population change from migration (100%), and the U.S. had the smallest (34.9%).



Data Sources: U.S. Department of Commerce. 2016. Census Bureau, Population Division, Washington, D.C.

Study Guide and Supplemental Information

How have the components of population changed?

What do we measure on this page?

This page describes components of population change. Total population change is the sum of natural change (births minus deaths) and migration (international plus domestic).

The purpose of this page is to discern how much of the growth in population is due to net in-migration. In the figure Population Change, Natural and Migration, a migration bar (yellow) that is above zero indicates positive net migration; a migration bar below zero indicates negative net migration.

Why is it important?

A growing body of literature has shown that federal public lands can play a role in stimulating amenity migration, defined as the permanent movement to a locality by people who have been influenced to move in part by the presence of environmental, recreational, social, and cultural amenities.

It is useful to understand the components of population change because they show whether growth (or decline) is led by migration, and if it derives from international or internal migration. If migration accounts for significant population growth, it may be helpful to look for linkages with other potential amenity variables such as a rise in relatively footloose business (such as services) and the growth of non-labor income (from investments and retirement). Subsequent pages of this report explore these and other potential amenity variables. The Additional Resources offered below also help to explain reasons for in-migration, especially as they relate to amenities provided by public lands.

In-migration by itself is not sufficient evidence that public land amenities contribute to growth. This indicator should be taken together with all other indicators in this report, along with the recommended additional reading, as resources that help the user understand amenity-driven growth for specific geographies. This work may have to be supplemented with additional resources, such as surveys of local residents and businesses. In addition, there are other reasons for migration that may not be related to amenities, such as the migration of oil and gas workers into an area for fossil fuels production.

Methods

The U.S. Census Bureau makes a minor statistical correction, called a "residual," as part of its estimates of foreign born emigrants. Because of this correction, natural change plus net migration may not add to total population.

Note: International Migration consists of people who have moved into the local geography directly from a foreign country.

Additional Resources

For a discussion of the role of amenities in people’s migration decisions, see: Knapp, T. A. and P. E. Graves. 1989. "On the Role of Amenities in Models of Migration and Regional Development." Journal of Regional Science. 29(1): 71-87.

For a regional example of the causes and consequences of “amenity migration," see: Loeffler, R. and, E. Steinicke. 2007. "Amenity Migration in the U.S. Sierra Nevada.” Geographical Review. 97(1): 67-88.

For a review of the theory that people decide where to live first and then create jobs, see: Vias, A. C. 1996. “Jobs Follow People in the Rural Rocky Mountain West.” Rural Development Perspectives. 14(2): 14-23.

A book on the international phenomena of people moving to places for their amenities: Moss, A.G.L. 2006. The Amenity Migrants: Seeking and Sustaining Mountains and Their Cultures. Cromwell Press. Trowbridge, pp. 55-72.

For a glossary of terms used by the Bureau of the Census, see: census.gov/popest/about/terms.html *(5)*.

For methods used by the Bureau of the Census, see: census.gov/popest/methodology/index.html *(6)*.

Data Sources

U.S. Department of Commerce. 2016. Census Bureau, Population Division, Washington, D.C.

How have residential development patterns changed?

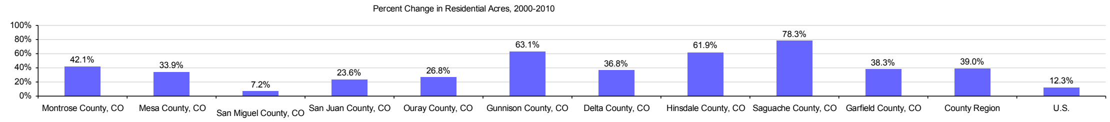
This page describes differences in the conversion of open space to residential development and residential acres per person, and the percent of homes that are second homes.

Residential Development 2000-2010

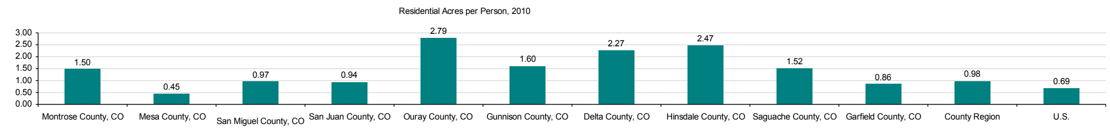
	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Residential Acres 2000	43,344	48,695	6,678	542	9,812	15,054	51,245	1,285	5,218	35,084	216,957	190,918,648
Residential Acres 2010	61,591	65,197	7,156	670	12,437	24,560	70,117	2,081	9,305	48,519	301,633	214,475,717
Change in Res. Acres 2000-2010	18,247	16,502	478	128	2,625	9,506	18,872	796	4,087	13,435	84,676	23,557,069
Percent Change	42.1%	33.9%	7.2%	23.6%	26.8%	63.1%	36.8%	61.9%	78.3%	38.3%	39.0%	12.3%
Residential Acres/Person, 2000	1.29	0.41	1.01	0.96	2.60	1.07	1.84	1.62	0.88	0.79	0.85	0.67
Residential Acres/Person, 2010	1.50	0.45	0.97	0.94	2.79	1.60	2.27	2.47	1.52	0.86	0.98	0.69
Change in Res. Ac./Person 2000-2010	0.21	0.03	-0.04	-0.02	0.19	0.53	0.43	0.85	0.64	0.07	0.12	0.02
Total Residential Units 2014*	18,280	63,230	6,697	728	3,068	11,500	14,520	1,447	3,889	23,333	146,692	132,741,033
Second Homes in 2014*	254	1,696	2,536	278	752	3,808	1,052	917	643	1,039	12,975	5,267,667
Percent Second Homes	1.4%	2.7%	37.9%	38.2%	24.5%	33.1%	7.2%	63.4%	16.5%	4.5%	8.8%	4.0%

* The data in this table are calculated by ACS using annual surveys conducted during 2010-2014 and are representative of average characteristics during this period.

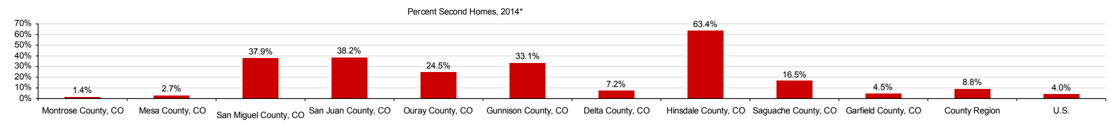
- From 2000 to 2010, Saguache County, CO had the largest percent change in residential development (78.3%), and San Miguel County, CO had the smallest (7.2%).



- From 2000 to 2010, Ouray County, CO had the largest average acreage in residential development per person (2.79 acres), and Mesa County, CO had the smallest (0.45 acres).



- In 2000, Hinsdale County, CO had the largest share of second homes as a percent of total homes (63.4%), and Montrose County, CO had the smallest (1.4%).



Data Sources: Theobald, DM. 2013. Land use classes for ICLUS/SERGoM v2013. Unpublished report, Colorado State University; U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.

Study Guide and Supplemental Information

How have residential development patterns changed?

What do we measure on this page?

This page describes differences in the conversion of open space to residential development and residential acres per person, and the percent of homes that are second homes.

The rate of development is expressed as the percent change in acres used for residential development from 2000 to 2010 (the latest years available from the Decennial Census). Land consumption is expressed in terms of residential acres per person. These figures refer only to residential development and do not include lot sizes greater than 40 acres. Per capita consumption of land used for housing is a measure of the pattern of development. Areas with negative values of change in residential acres/person indicate more dense development in 2010 than in 2000. Large positive values of change indicate that an area was substantially more sprawled in 2010 than it was in 2000.

Second Homes: These are residences intended for use only in certain seasons or for weekends or other occasional use throughout the year.

Why is it important?

One of the characteristics of growth that is associated with the presence of public land amenities is a rapid conversion of open space (including agricultural lands) for residential development, and a relatively high proportion of homes as second homes.

Residential development by itself is not sufficient evidence that the amenities of public lands contribute to growth. This indicator should be taken together with all other indicators in this report, along with the recommended additional reading, as resources that help the user understand amenity-driven growth and how to write about it for specific geographies. This work may have to be supplemented with additional resources, such as surveys of local residents and businesses.

Methods

Comparisons are made between 2000 and 2010. These are the latest published data available from the Decennial Census.

Additional Resources

The effect of housing development on protected public lands is analyzed by: Radeloff, V.C., S.I. Stewart, T.J. Hawbaker, U. Gimmi, A.M. Pidgeon, C.H. Flather, R.B. Hammer and D.P. Helmers. 2010. “Housing Growth in and Near United States Protected Areas Limits Their Conservation Value." Proceeding of the National Academy of Sciences of the United States of America. 107(2): 940-945. See: pnas.org/content/107/2/940 *(7)*.

For an analysis of the reasons for a loss of open space, see: Kline, J. D. 2006. "Public Demand for Preserving Local Open Space." Society & Natural Resources 19(7): 645-659. Also: Vias, A. C., J. I. Carruthers. 2005. "Regional Development and Land Use Change in the Rocky Mountain West, 1982-1997" Growth and Change 36(2): 244-272.

For an analysis of the ecological effects of exurban development, see: Hansen, A. J., R. L. Knight, J.M. Marzluff, S. Powell, K. Brown, P.H. Gude, and K. Jones. 2005. “Effects of Exurban Development on Biodiversity: Patterns, Mechanisms, and Research Needs." Ecological Applications. 15(6): 1893-1905. See also: Also: Gude, P.H., Hansen, A.J., Rasker, R., Maxwell, B. 2006. "Rates and Drivers of Rural Residential Development in the Greater Yellowstone." Landscape and Urban Planning. 77: 131-151.

For a discussion of the importance of population density in analyzing the impacts of exurban development, see: Theobald, D. M., et al. (2001). "Land-Use Dynamics Beyond the American Urban Fringes." Geographical Review. 91(3): 544-564.

For West-wide data and analyses on housing patterns in wildfire prone areas, run the EPS Development and the Wildland-Urban Interface report.

Data Sources

Theobald, DM. 2013. Land use classes for ICLUS/SERGoM v2013. Unpublished report, Colorado State University; U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.

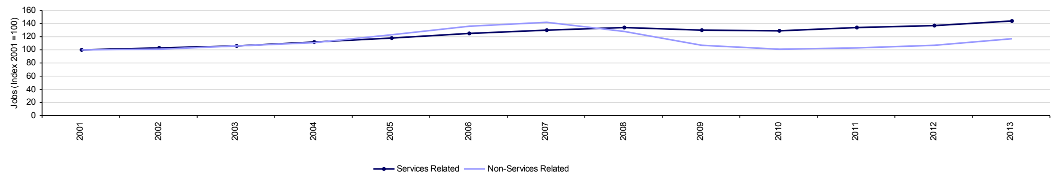
How important are service sectors?

This page describes the number of jobs and share of total jobs in services related industries and non-services related industries.

Services Related Employment, 2014

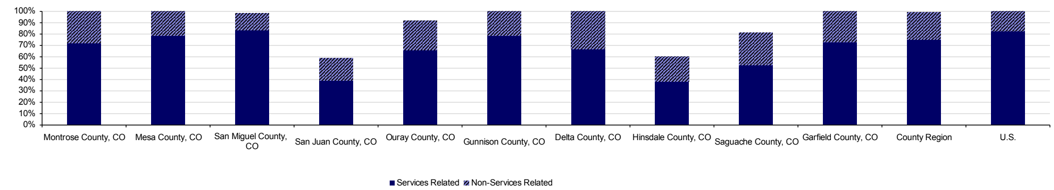
	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Total Non-Government Employment	19,201	76,022	7,532	676	2,958	10,365	12,432	765	2,429	33,185	165,565	161,768,800
Services Related	~13,839	~59,644	~6,292	~266	~1,955	~8,153	~8,307	~294	~1,278	~24,262	~124,290	133,893,000
Non-Services Related	~5,362	~16,378	~1,126	~132	~764	~2,212	~4,125	~166	~694	~8,923	~39,882	27,875,800
Percent of Total												
Services Related	~72.1%	~78.5%	~83.5%	~39.3%	~66.1%	~78.7%	~66.8%	~38.4%	~52.6%	~73.1%	~75.1%	82.8%
Non-Services Related	~27.9%	~21.5%	~14.9%	~19.5%	~25.8%	~21.3%	~33.2%	~21.7%	~28.6%	~26.9%	~24.1%	17.2%

Services & Non-Services Related Jobs, County Region



- In 2014, San Miguel County, CO had the largest share of total jobs in services related industries (83.5%), and Hinsdale County, CO had the smallest (38.4%).

Services & Non-Services Related Jobs, Percent of Total Non-Government Employment, 2014



Data Sources: U.S. Department of Commerce. 2015. Bureau of Economic Analysis, Regional Economic Accounts, Washington, D.C.

How important are service sectors?

What do we measure on this page?

This page describes the number of jobs and share of total jobs in services related industries and non-services related industries.

Services: Consists of the following sectors: Utilities; Wholesale Trade; Retail Trade; Transportation & Warehousing Information; Finance & Insurance; Real Estate, Rental & Leasing; Professional, Scientific, & Tech., Mgmt. of Companies & Enterprises; Administrative & Support Services; Educational Services; Health Care & Social Assistance; Arts, Entertainment, & Recreation; Accommodation & Food Services; and Other Services.

Non-Services: Consists of the following sectors: Mining; Construction; Manufacturing; and Agriculture, Forestry, Fishing, and Hunting.

Why is this important?

One characteristic of growth associated with the presence of public land amenities is above average growth in services occupations and businesses. Some services related jobs are associated with a growth in recreation and tourism. There are also services occupations and businesses that, due to telecommunications technology and transportation networks, are relatively "footloose," i.e., able to move to locations in part for quality of life reasons, including the amenities provided by public lands. Examples of potentially footloose occupations and businesses include architects, software developers, engineers, financial and management consultants, and researchers.

A growth in services by itself is not sufficient evidence that the amenities of public lands contribute to growth. This indicator should be taken together with all other indicators in this report, along with the recommended additional reading, as resources that help the user understand amenity-driven growth and how to write about it for specific geographies. This work may have to be supplemented with additional resources, such as surveys of local residents and businesses.

Methods

Some data are withheld by the federal government to avoid the disclosure of potentially confidential information. Headwaters Economics uses data from the U.S. Department of Commerce to estimate these data gaps. These values are indicated with tildes (~).

Additional Resources

For more detail on the various components of services, run the EPS Services report. For more information on industries that include travel and tourism (and include some service industries), run the EPS Travel and Tourism report.

For an analysis of the relationship between amenities and the growth of service-based economies, see: Shumway, J. M., S. M. Otterstrom. 2001. "Spatial Patterns of Migration and Income Change in the Mountain West: The Dominance of Service-Based, Amenity-Rich Counties." Professional Geographer. 53(4): 492-502.

See also: Beyers, W. and D. Lindahl. 1996. "Lone Eagles and High Fliers in the Rural Producer Services." Rural Development Perspectives. 11: 2-10; and Beyers, W. B., P. B. Nelson. 2000. "Contemporary Development Forces in the Nonmetropolitan West: New Insights from Rapidly Growing Communities." Journal of Rural Studies. 16(4): 459-474.

For an analysis of the growth of “footloose” and knowledge-based industries, whose owners are attracted by amenities, see Rasker, R., P.H. Gude, J.A. Gude, J. van den Noort. 2009. “The Economic Importance of Air Travel in High-Amenity Rural Areas.” Journal of Rural Studies. 25(2009): 343-353.

Data Sources

U.S. Department of Commerce. 2015. Bureau of Economic Analysis, Regional Economic Accounts, Washington, D.C.

How important is non-labor income?

This page describes components of non-labor income and compares non-labor income to labor earnings. It also shows how non-labor income has changed over time compared to labor earnings.

Components of Non-Labor Income, 2014 (Thousands of 2015 $s)

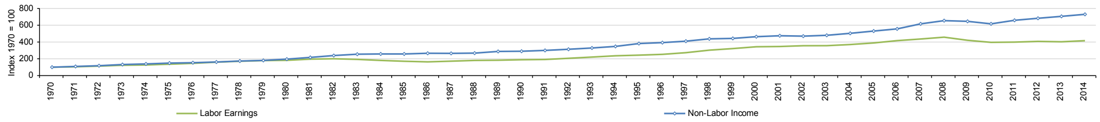
	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Total Personal Income	1,382,238	5,650,362	474,212	22,991	213,645	607,876	1,014,709	32,080	184,487	2,728,025	12,310,626	14,697,830,833
Non-Labor Income	619,853	2,168,749	246,615	11,451	115,280	279,283	473,716	21,210	81,862	1,255,546	5,273,567	5,257,679,672
Dividends, Interest, and Rent	287,595	1,055,119	219,352	7,354	81,928	205,281	215,682	14,630	37,415	955,264	3,079,622	2,726,011,415
Age-Related Transfer Payments	206,823	636,267	18,380	2,751	25,525	44,828	167,503	5,035	24,416	167,790	1,299,317	1,433,863,498
Hardship-Related Transfer Payment	94,512	322,975	4,896	920	4,917	16,955	64,073	663	16,150	93,420	619,481	804,197,432
Other Transfer Payments	30,923	154,388	3,987	300	2,911	12,219	26,457	839	3,880	39,072	274,977	293,607,328
Labor Earnings	762,385	3,481,613	227,596	11,540	98,365	328,593	540,992	10,870	102,626	1,472,479	7,037,059	9,440,151,161

Percent of Total

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Non-Labor Income	44.8%	38.4%	52.0%	49.8%	54.0%	45.9%	46.7%	66.1%	44.4%	46.0%	42.8%	35.8%
Dividends, Interest, and Rent	20.8%	18.7%	46.3%	32.0%	38.3%	33.8%	21.3%	45.6%	20.3%	35.0%	25.0%	18.5%
Age-Related Transfer Payments	15.0%	11.3%	3.9%	12.0%	11.9%	7.4%	16.5%	15.7%	13.2%	6.2%	10.6%	9.8%
Hardship-Related Transfer Payment	6.8%	5.7%	1.0%	4.0%	2.3%	2.8%	6.3%	2.1%	8.8%	3.4%	5.0%	5.5%
Other Transfer Payments	2.2%	2.7%	0.8%	1.3%	1.4%	2.0%	2.6%	2.6%	2.1%	1.4%	2.2%	2.0%
Labor Earnings	55.2%	61.6%	48.0%	50.2%	46.0%	54.1%	53.3%	33.9%	55.6%	54.0%	57.2%	64.2%

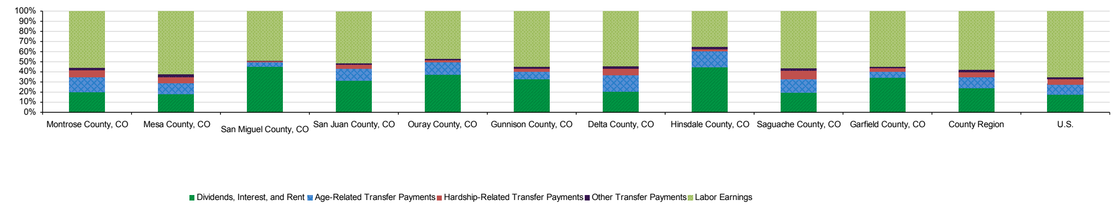
- From 1970 to 2014, non-labor income in the County Region grew by 630 percent. Over the same period, labor income grew by 316 percent.

Non-Labor & Labor Income, County Region



- In 2014, Hinsdale County, CO had the largest share of total personal income in non-labor income (66.1%), and the U.S. had the smallest (35.8%).
- In 2014, County Region had the largest share of non-labor income in dividends, interest, and rent (25%), and the smallest share in other transfer payments (2.2%).

Non-Labor & Labor Income, Percent of Total Personal Income, 2014



Data Sources: U.S. Department of Commerce. 2015. Bureau of Economic Analysis, Regional Economic Accounts, Washington, D.C.

How important is non-labor income?

What do we measure on this page?

This page describes components of non-labor income and compares non-labor income to labor earnings. It also shows how non-labor income has changed over time compared to labor earnings.

Non-Labor Income: Dividends, interest, and rent (money earned from investments), and transfer payments (includes government retirement and disability insurance benefits, medical payments such as mainly Medicare and Medicaid, income maintenance benefits, unemployment insurance benefits, etc.) make up non-labor income. Non-labor income is reported by place of residence.

Dividends, Interest, and Rent: This includes personal dividend income, personal interest income, and rental income of persons with capital consumption adjustment that are sometimes referred to as "investment income" or "property income."

Age-Related Transfer Payments: This measures Medicare and retirement and disability insurance benefits.

Hardship-Related Transfer Payments: Payments associated with poverty and welfare, incl. Medicaid and income maintenance.

Other Transfer Payments: All other components of transfer payments not identified in age-related and income maintenance.

Labor Earnings: This represents net earnings by place of residence, which is earnings by place of work (the sum of wage and salary disbursements, supplements to wages and salaries, and proprietors' income) less contributions for government social insurance, plus an adjustment to convert earnings by place of work to a place of residence basis.

Why is this important?

One characteristic of population and income growth influenced by public land amenities is a rapid growth of non-labor income, in particular investment income (dividends, interest and rent) and age-related transfer payments. Because retirees are not tied to a place for work, they are relatively mobile and are often freer to choose where they live. Amenities provided by public lands can help to attract (and retain) retirees. This is particularly important as the baby boom generation (born 1946 to 1964) begins to retire.

Growth in non-labor income by itself is not sufficient evidence that public lands amenities contribute to growth. This indicator should be taken together with all other indicators in this report, along with the recommended additional reading, as resources to help the user understand amenity-driven growth. This work may be supplemented with additional resources, such as surveys of local residents.

Additional Resources

For further details on non-labor income run the EPS Non-Labor Income report.

To read about baby boomers and the attraction of places with amenities and a high quality of life, see: Cromartie, J. and P. Nelson. 2009. "Baby Boomer Migration and Its Impact of Rural America." Economic Research Report (ERR-70), available through the U.S. Department of Agriculture's Economic Research Service: www.ers.usda.gov/publications/err-economic-research-report/err79.aspx *(8)*.

For a discussion and analysis of the aging baby boom and amenity retirement migration, see: Haas, W. H., W. J. Serow. 2002. "The Baby Boom, Amenity Retirement Migration, and Retirement Communities: Will the Golden Age of Retirement Continue?" Research on Aging. 24(1): 150-164.

For a discussion of the relationship between amenities and an aging population, see:
Wright, S.D., M. Caserta and D.E. Lund. 2003. "Older Adults' Attitudes, Concerns, and Support for Environmental Issues in the "New West" The International Journal of Aging and Human Development. 57(2): 151-179.
Nelson, P.B. 1999. “Quality of Life, Nontraditional Income, and Economic Growth: New Development Opportunities for the Rural West.” Rural Development Perspectives. 14 (2), 32-37.
Walters, W.H. 2002. "Place Characteristics and Later-Life Migration." Research on Aging. 24(2): 243-277.
Conway, K.S. and A.J. Houtenville. 2003. "Out with the Old, In with the Old: A Closer Look at Younger Versus Older Elderly Migration.” Social Science Quarterly. 84(2): 309-328.
Clark, D.E., and W.J. Hunter. 1992. "The Impact of Economic Opportunity, Amenities and Fiscal Factors on Age-Specific Migration Rates.” Journal of Regional Science 32(3): 349-65.

Data Sources

U.S. Department of Commerce. 2015. Bureau of Economic Analysis, Regional Economic Accounts, Washington, D.C.

How important are industries associated with travel and tourism?

This page describes the number of jobs and share of total jobs in industries that include travel and tourism. It also shows employment trends in industries that include travel and tourism compared to all other industries.

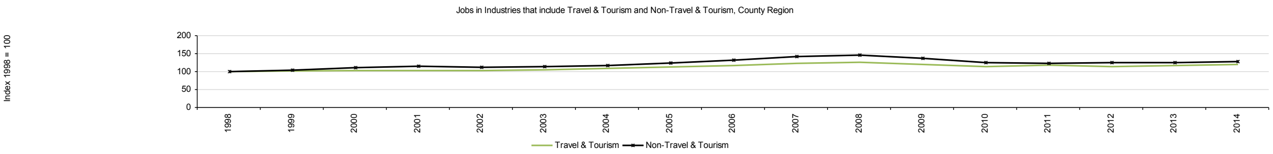
Industries that Include Travel & Tourism Employment, 2014

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Total Private Employment	11,560	50,695	4,688	197	1,041	6,171	6,738	139	790	18,937	100,956	121,079,879
Travel & Tourism Related	~1,511	~9,271	~2,536	~138	~439	~2,242	~802	~66	~75	~3,905	~20,985	18,806,854
Retail Trade	264	1,552	99	29	79	150	150	13	24	706	3,066	3,390,694
Passenger Transportation	~43	~155	~26	~1	~1	~20	~0	~0	~0	~71	~317	454,111
Arts, Entertainment, & Recreation	~122	~1,001	~760	~43	~21	~141	~26	~5	~15	~292	~2,426	2,170,121
Accommodation & Food	1,082	6,563	1,651	65	338	1,931	626	48	36	2,836	15,176	12,791,928
Non-Travel & Tourism	~10,049	~41,424	~2,152	~59	~602	~3,929	~5,936	~73	~715	~15,032	~79,971	102,273,025

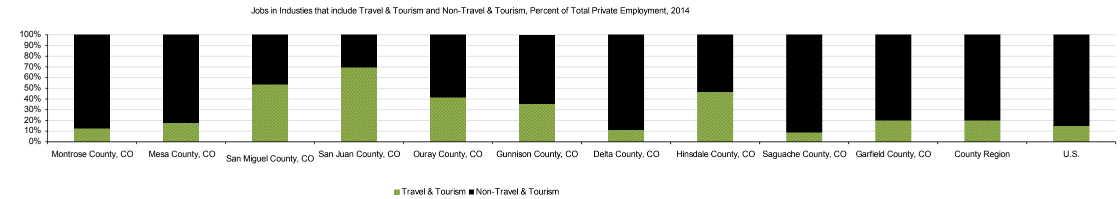
Percent of Total

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Travel & Tourism Related	~13.1%	~18.3%	~54.1%	~70.1%	~42.2%	~36.3%	~11.9%	~47.5%	~9.5%	~20.6%	~20.8%	15.5%
Retail Trade	2.3%	3.1%	2.1%	14.7%	7.6%	2.4%	2.2%	9.4%	3.0%	3.7%	3.0%	2.8%
Passenger Transportation	~0.4%	~0.3%	~0.6%	~0.5%	~0.1%	~0.3%	~0.0%	~0.0%	~0.0%	~0.4%	~0.3%	0.4%
Arts, Entertainment, & Recreation	~1.1%	~2.0%	~16.2%	~21.8%	~2.0%	~2.3%	~0.4%	~3.6%	~1.9%	~1.5%	~2.4%	1.8%
Accommodation & Food	9.4%	12.9%	35.2%	33.0%	32.5%	31.3%	9.3%	34.5%	4.6%	15.0%	15.0%	10.6%
Non-Travel & Tourism	~86.9%	~81.7%	~45.9%	~29.9%	~57.8%	~63.7%	~88.1%	~52.5%	~90.5%	~79.4%	~79.2%	84.5%

- From 1998 to 2014, industries associated with travel and tourism in the region grew by 20 percent. Over the same period, non-travel and tourism industries grew by 28 percent.



- In 2014, San Juan County, CO had the largest share of jobs in industries associated with travel and tourism (70.1%), and Saguache County, CO had the smallest (9.5%).



Data Sources: U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.

How important are industries associated with travel and tourism?

What do we measure on this page?

This page describes the number of jobs and share of total jobs in industries that include travel and tourism. It also shows employment trends in industries that include travel and tourism compared to all other industries.

Travel and Tourism: These sectors provide goods and services to visitors, as well as to the local population. It is not known, without additional research such as surveys, what exact proportion of the jobs in these sectors is attributable to expenditures by visitors, including business and pleasure travelers, versus by local residents. Some researchers refer to these sectors as “tourism-sensitive.” They could also be called “tourism-potential sectors” since they have potential of being influenced by expenditures by non-locals.

This page is useful for explaining whether sectors associated with travel or tourism are growing or shrinking, and whether there are differences across geographies. It is less useful as a measure of the absolute size of employment in travel and tourism. See methods.

Why is this important?

Public lands can play a role in stimulating local employment by providing opportunities for recreation. Communities adjacent to public lands benefit economically from visitors who spend money in hotels, restaurants, ski resorts, gift shops, and elsewhere. In addition, some migrants to communities with high levels of environmental and recreational amenities visit first as tourists and then return permanently with their families and businesses. Public lands can therefore also stimulate growth in non-tourism sectors via in-migration.

A growth in travel and tourism-related sectors by itself is not sufficient evidence that the amenities of public lands contribute to growth. This indicator should be taken together with all other indicators in this report, along with the recommended additional reading, as resources that help the user understand amenity-driven growth and how to write about it for specific geographies. This work may have to be supplemented with additional resources, such as surveys of local residents and businesses.

Methods

There is no single industrial classification for travel and tourism under the North American Classification System (NAICS). However, there are sectors that, at least in part, provide goods and services to visitors to a local economy. Specific industries that induce travel and tourism include portions of Retail Trade including Gasoline Stations, Clothing & Accessory Stores, and Miscellaneous Store Retailers; portions of Passenger Transportation including Air Transportation, and Scenic & Sightseeing Transportation; portions of Arts, Entertainment, & Recreation including Performing Arts & Spectator Sports, Museums, Parks, & Historical Sites, and Amusement, Gambling, & Recreation; and portions of Accommodation & Food Services including Accommodation, Food Services & Drinking Places.

Data on this page were obtained from County Business Patterns. We use this source because, compared to other sources, it has fewer data gaps*. It also includes both full and part-time employment. The disadvantage of County Business Patterns data is that it does not include employment in government, agriculture, railroads, or the self-employed. As a result, it under-counts the size of industry sectors. Also, County Business Patterns data are based on mid-March employment and do not take into account seasonal fluctuations. For these reasons, the data are most useful for showing long-term trends, displaying differences between geographies, and showing the relationship between sectors over time. The line chart begins in 1998 because that is the year the U.S. Census Bureau (and County Business Patterns) shifted to using the new North American Industrial Classification System (NAICS).

* Some data are withheld by the federal government to avoid the disclosure of potentially confidential information. Headwaters Economics uses data from the U.S. Department of Commerce to estimate these data gaps. These are indicated in *italics* in tables.

Additional Resources

For details on industries that include travel and tourism businesses, run the EPS Travel and Tourism report.

The list of NAICS codes associated with travel and tourism were obtained from: Marcouiller, D. W. and X. Xia. 2008. “Distribution of Income from Tourism-Sensitive Employment.” Tourism Economics. 14(3): 545-565: ingentaconnect.com/content *(9)*.

For a discussion about the relationship between recreation opportunities and economic growth, see: Johnson, K. M. and C. L. Beale. 2002. "Nonmetro Recreation Counties: Their identification and rapid growth." Rural America. 17(4): 12-19.

For an example of how tourism can stimulate permanent migration, see: Johnson, J. D. and R. Rasker. 1995. "The Role of Economic and Quality of Life Values in Rural Business Location." Journal of Rural Studies. 11(4): 405-416.

For a review of the importance of quality of life to business location decisions, see: Salvesen, D. and H. Renski. 2003. "The Importance of Quality of Life in the Location Decisions of New Economy Firms." Center for Urban and Regional Studies, University of North Carolina at Chapel Hill, available at: curs.unc.edu/curs-pdf-downloads/recentlyreleased/neweconomyreport.pdf *(10)*.

Data Sources

U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.

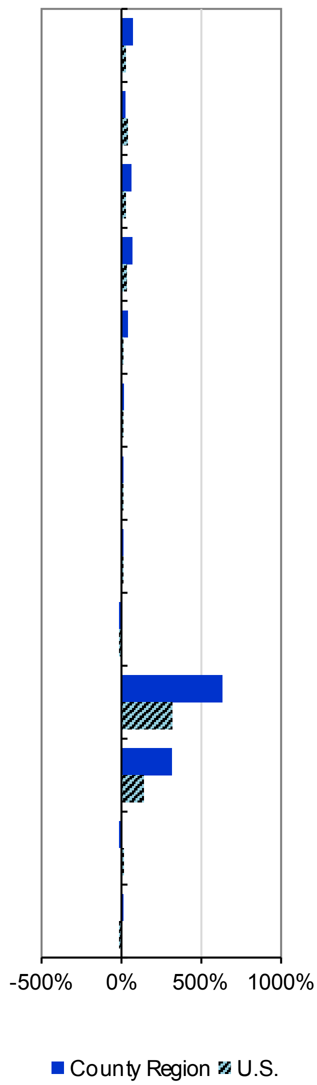
How do potential amenity indicators in the region compare to the U.S.?

This page compares the various indicators that, when taken as a whole (and when compared to published literature), offer ways of thinking about the economic contribution of public land amenities. The indicators are benchmarked against the U.S.

Summary of Potential Amenity Indicators, County Region Compared to the U.S..

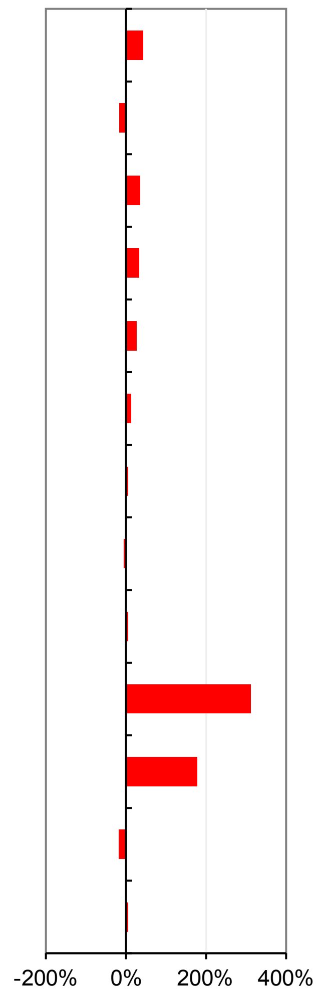
			Difference in Percent
Potential Indicators of Amenity Growth	County Region	U.S.	Difference
Federal Public Land (% Total Land Area*)	70.7%	28.2%	42.5%
Protected Federal Public Land (Class A % Fed. Land Area*)	22.8%	40.1%	-17.3%
Population (% Change 1990-2014	62.7%	27.7%	35.0%
Migration (% of Population Change 2000-2015	68.3%	34.9%	33.4%
Residential Acres (% Change of Total Land Area 2000-2010	39.0%	12.3%	26.7%
Residential Acres/Person (% Change 2000-2010)	15.0%	2.0%	13.0%
Second Homes (% of Total 2014)	8.8%	4.0%	4.8%
Services (% of Total Non-Government Jobs, Change 2001-2014	1.9%	4.9%	-3.0%
Non-Services (% of Total Non-Government Jobs, Change 2001-2014	-2.2%	-4.9%	2.7%
Non-Labor Income (% Change 1970-2014)	630.1%	318.1%	312.0%
Labor Earnings (% Change 1970-2014)	316.2%	138.4%	177.8%
Travel & Tourism (Jobs % Change 1998-2014)	-4.6%	14.0%	-18.6%
Non-Travel & Tourism (Jobs % Change 1998-2014)	1.3%	-2.2%	3.5%

County Region vs. U.S.



Difference in Percent

County Region vs. U.S.



Data Sources: U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.; U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.; Theobald, DM. 2013. Land use classes for ICLUS/SERGoM v2013. Unpublished report, Colorado State University; U.S. Geological Survey, Gap Analysis Program. 2016. Protected Areas Database of the United States (PADUS) version 1.4; U.S. Department of Commerce. 2016. Census Bureau, Population Division, Washington, D.C.; U.S. Department of Commerce. 2015. Bureau of Economic Analysis, Regional Economic Accounts, Washington, D.C.

Study Guide and Supplemental Information

How do potential amenity indicators in the region compare to the U.S.?

What do we measure on this page?

This page compares the various indicators that, when taken as a whole (and when compared to published literature), offer ways of thinking about the economic contribution of public land amenities. The indicators are benchmarked against the U.S.

The term "benchmark" in this report should not be construed as having the same meaning as in the National Forest Mgmt. Act (NFMA).

Why is this important?

Public land amenities are the qualities of public lands that make a region an attractive place to live, recreate, and work. This report offers a number of indicators that, when taken together, and when combined with the recommended additional resources (referenced in the Additional Resources sections throughout this report) can give the analyst information to write about whether -and how- the amenities on public lands contribute to the local and regional economy.

These indicators are presented in one figure on this page to make it easier to view all indicators together. If a geography has a high proportion of public lands, with many of these lands designated as Wilderness, National Park, and National Monument, etc. (Type A), then it is likely that the level of environmental and recreation amenities are high. If a geography also has experienced a high rate of population growth, with much of that coming from in-migration, combined with a conversion of lands for residential development and a high proportion of second homes, then it is likely that amenity-driven growth is taking place. In addition, if the economy of a geography has a high rate of growth in service industry jobs, travel and tourism-related sectors, and non-labor income, then amenities are likely to play a role in economic development.

Another way to see if it is likely that amenities are contributing to economic growth is to compare the selected region to the U.S. If many of the indicators in the region exceed the U.S., then this is additional evidence to consider.

Even when taken as a group, these indicators may not be sufficient evidence that the amenities of public lands contribute to growth. These indicators should be taken together with the recommended additional reading as resources that help the user understand amenity-driven growth and how to write about it for a specific geography. This work may have to be supplemented with additional resources, such as surveys of local residents and businesses.

Additional Resources

For an analysis of the wages people are willing to forego in order to live in proximity to amenities, see: Schmidt, L. and P. N. Courant. 2006. "Sometimes Close is Good Enough: The Value of Nearby Environmental Amenities." Journal of Regional Science. 46(5): 931-951.

For an analysis of the distribution of amenity-driven activity in the Intermountain West, comparing “New West” to “Old West” communities, see: Winkler, R., D. R. Field, A.E. Luloff, R.S. Krannich and T. Williams. 2007. "Social Landscapes of the Inter-Mountain West: A Comparison of 'Old West' and 'New West' Communities." Rural Sociology. 72(3): 478-501.

For a detailed discussion of the history and challenges of economic analysis related to federal public lands. See: Nelson, R. H. 2006. "Valuing Nature: Economic Analysis and Public Land Management, 1975–2000." American Journal of Economics and Sociology. 65(3): 525-557.

For results of a national survey of rural elected officials and their environmental and economic development attitudes, see: Foster, R. H. and M. K. McBeth. 1996. "Urban-Rural Influences in U.S. Environmental and Economic Development Policy." Journal of Rural Studies. 12(4): 387-397. The authors found that “Empirical studies have demonstrated the importance of environmental quality of life factors in the lives of rural residents” and that “[Rural-based officials were more likely to see the importance of environmental quality of life features in the lives of rural residents.”

For a discussion of the relationship between amenities and tourism, see: Marcouiller, D. W., K-K, Kim and S.C. Deller. 2004. "Natural Amenities, Tourism and Income Distribution." Annals of Tourism Research. 31(4): 1031-1050.

Data Sources

U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.; U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.; Theobald, DM. 2013. Land use classes for ICLUS/SERGoM v2013. Unpublished report, Colorado State University; U.S. Geological Survey, Gap Analysis Program. 2016. Protected Areas Database of the United States (PADUS) version 1.4; U.S. Department of Commerce. 2016. Census Bureau, Population Division, Washington, D.C.; U.S. Department of Commerce. 2015. Bureau of Economic Analysis, Regional Economic Accounts, Washington, D.C.

Data Sources

The EPS Amenities report uses a set of Geographic Information Systems (GIS) derived national data sources to represent land ownership and residential development. The contact information for these databases is:

- **TIGER/Line County Boundaries 2012**
  Bureau of the Census, U.S. Department of Commerce
  http://www.census.gov/geo/maps-data/data/tiger.html

- **Protected Areas Database v 1.3 2012**
  U.S. Geological Survey, Gap Analysis Program
  http://gapanalysis.usgs.gov/padus/

This EPS report also uses published statistics on population, employment, and personal income from government sources that are available to the public and cover the entire country. The contact information for these databases is:

- **County Business Patterns**
  Census Bureau, U.S. Department of Commerce
  http://www.census.gov/epcd/cbp/view/cbpview.html
  Tel. 301-763-2580

- **Population Estimates**
  Census Bureau, U.S. Department of Commerce
  http://www.census.gov/econ/nonemployer/index.html
  Tel. 301-763-2580

- **Regional Economic Information System**
  Bureau of Economic Analysis, U.S. Department of Commerce
  http://bea.gov/bea/regional/data.htm
  Tel. 202-606-9600

- **Decennial Census**
  Census Bureau, U.S. Department of Commerce
  http:/www.census.gov
  Tel. 303-969-7750

Methods

EPS core approaches

EPS is designed to focus on long-term trends across a range of important measures. Trend analysis provides a more comprehensive view of changes than spot data for select years. We encourage users to focus on major trends rather than absolute numbers.

EPS displays detailed industry-level data to show changes in the composition of the economy over time and the mix of industries at points in time.

EPS employs cross-sectional benchmarking, comparing smaller geographies such as counties to larger regions, states, and the nation, to give a sense of relative performance.

EPS allows users to aggregate data for multiple geographies, such as multi-county regions, to accommodate a flexible range of user-defined areas of interest and to allow for more sophisticated cross-sectional comparisons.

Adjusting dollar figures for inflation

Because a dollar in the past was worth more than a dollar today, data reported in current dollar terms should be adjusted for inflation. The U.S. Department of Commerce reports personal income figures in terms of current dollars. All income data in EPS are adjusted to real (or constant) dollars using the Consumer Price Index. Figures are adjusted to the latest date for which the annual Consumer Price Index is available.

Data gaps and estimation

Some data is withheld by the federal government to avoid the disclosure of potentially confidential information. Headwaters Economics uses supplemental data from the U.S. Department of Commerce to estimate these data gaps. These are indicated in italics in tables. Documentation explaining methods developed by Headwaters Economics for estimating disclosure gaps is available at headwaterseconomics.org/eps.

Links to Additional Resources

For more information about EPS see:

headwaterseconomics.org/EPS

Web pages listed under Additional Resources include:

Throughout this report, references to on-line resources are indicated with italicized numbers in parentheses. These resources are provided as hyperlinks here.

1 www.ers.usda.gov/publications/aer-agricultural-economic-report/aer781.aspx
2 www.census.gov/cgi-bin/geo/shapefiles/national-files
3 www.consbio.org/what-we-do/protected-areas-database-pad-version-4
4 headwaterseconomics.org/land/reports/protected-lands-value
5 www.census.gov/popest/about/terms.html
6 www.census.gov/popest/methodology/index.html
7 www.pnas.org/content/107/2/940
8 www.ers.usda.gov/publications/err-economic-research-report/err79.aspx
9 www.ingentaconnect.com/content
10 www.curs.unc.edu/curs-pdf-downloads/recentlyreleased/neweconomyreport.pdf

A Profile of Land Use

County Region

Selected Geographies:

Montrose County, CO; Mesa County, CO; San Miguel County, CO; San Juan County, CO; Ouray County, CO; Gunnison County, CO; Delta County, CO; Hinsdale County, CO; Saguache County, CO; Garfield County, CO

Benchmark Geographies:

U.S.

Produced by
Economic Profile System
EPS
November 28, 2016

About the Economic Profile System (EPS)

EPS is a free, easy-to-use software application that produces detailed socioeconomic reports of counties, states, and regions, including custom aggregations.

EPS uses published statistics from federal data sources, including Bureau of Economic Analysis and Bureau of the Census, U.S. Department of Commerce; and Bureau of Labor Statistics, U.S. Department of Labor.

The Bureau of Land Management and Forest Service have made significant financial and intellectual contributions to the operation and content of EPS.

See headwaterseconomics.org/EPS for more information about the other tools and capabilities of EPS.

For technical questions, contact Patty Gude at eps@headwaterseconomics.org, or 406-599-7425.

headwaterseconomics.org

Headwaters Economics is an independent, nonprofit research group. Our mission is to improve community development and land management decisions in the West.

www.blm.gov

The Bureau of Land Management, an agency within the U.S. Department of the Interior, administers 249.8 million acres of America's public lands, located primarily in 12 Western States. It is the mission of the Bureau of Land Management to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations.

www.fs.fed.us

The Forest Service, an agency of the U.S. Department of Agriculture, administers national forests and grasslands encompassing 193 million acres. The Forest Service's mission is to achieve quality land management under the "sustainable multiple-use management concept" to meet the diverse needs of people while protecting the resource. Significant intellectual, conceptual, and content contributions were provided by the following individuals: Dr. Pat Reed, Dr. Jessica Montag, Doug Smith, M.S., Fred Clark, M.S., Dr. Susan A. Winter, and Dr. Ashley Goldhor-Wilcock.

Table of Contents

Note to Users:

This is one of fourteen reports that can be created and downloaded from EPS Web. You may want to run another EPS report for either a different geography or topic. Topics include land use, demographics, specific industry sectors, the role of non-labor income, the wildland-urban interface, the role of amenities in economic development, and payments to county governments from federal lands. Throughout the reports, references to online resources are indicated in parentheses. These resources are provided as hyperlinks on each report's final page. The EPS reports are downloadable as Excel, PDF, and Word documents. For further information and to download reports, go to:
headwaterseconomics.org/eps

What is the breakdown of land ownership?

This page describes the land area (in acres) and the share of the area that is private and that is managed by various public agencies.

Land Ownership (Acres)

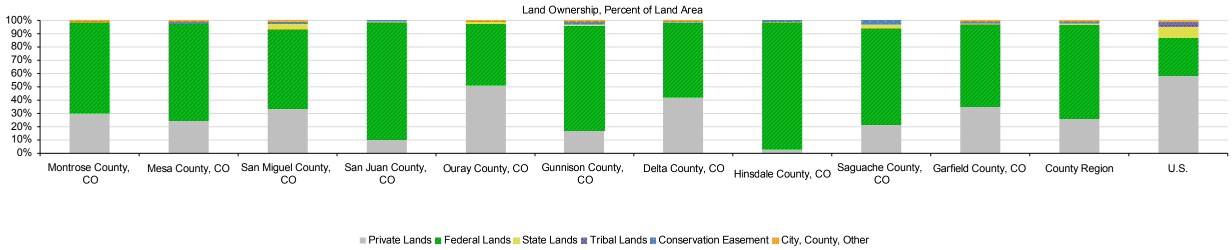
	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Total Area	1,435,422	2,138,287	824,791	248,513	347,015	2,086,164	735,108	718,815	2,028,983	1,891,716	12,454,814	2,301,106,907
Private Lands	443,170	537,788	284,091	26,868	179,826	367,654	316,429	28,800	450,453	673,242	3,308,321	1,364,048,727
Conservation Easement	1,193	36,226	11,652	18	1,337	44,643	3,339	2,184	43,824	25,029	169,445	19,026,854
Federal Lands	980,863	1,559,551	491,307	220,374	160,923	1,652,801	409,983	685,373	1,473,376	1,176,684	8,811,235	649,455,740
Forest Service	328,032	551,634	173,218	176,429	132,182	1,269,353	189,272	559,415	937,383	516,862	4,833,780	192,507,338
BLM	622,182	981,360	318,089	43,945	25,727	380,270	219,944	125,958	336,673	659,516	3,713,664	242,951,818
National Park Service	28,398	20,487	0	0	0	0	0	0	168,677	0	217,562	78,773,678
Military	0	0	0	0	0	0	0	0	0	0	0	22,945,136
Other Federal	2,251	6,070	0	0	3,014	3,178	767	0	30,643	306	46,229	112,277,770
State Lands	9,677	3,856	34,347	1,253	4,807	19,945	4,969	2,457	61,329	16,425	159,065	194,258,469
State Trust Lands*	1	1,252	18,924	1,253	286	4,678	0	0	59,311	0	85,705	46,116,200
Other State	9,676	2,604	15,423	0	4,521	15,267	4,969	2,457	2,018	16,425	73,360	148,142,269
Tribal Lands	0	0	0	0	0	0	0	0	0	0	0	66,666,114
City, County, Other	519	867	3,395	0	122	1,120	388	0	0	336	6,747	7,650,993

Percent of Total

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Private Lands	30.9%	25.2%	34.4%	10.8%	51.8%	17.6%	43.0%	4.0%	22.2%	35.6%	26.6%	59.3%
Conservation Easement	0.1%	1.7%	1.4%	0.0%	0.4%	2.1%	0.5%	0.3%	2.2%	1.3%	1.4%	0.8%
Federal Lands	68.3%	72.9%	59.6%	88.7%	46.4%	79.2%	55.8%	95.3%	72.6%	62.2%	70.7%	28.2%
Forest Service	22.9%	25.8%	21.0%	71.0%	38.1%	60.8%	25.7%	77.8%	46.2%	27.3%	38.8%	8.4%
BLM	43.3%	45.9%	38.6%	17.7%	7.4%	18.2%	29.9%	17.5%	16.6%	34.9%	29.8%	10.6%
National Park Service	2.0%	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	8.3%	0.0%	1.7%	3.4%
Military	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.0%
Other Federal	0.2%	0.3%	0.0%	0.0%	0.9%	0.2%	0.1%	0.0%	1.5%	0.0%	0.4%	4.9%
State Lands	0.7%	0.2%	4.2%	0.5%	1.4%	1.0%	0.7%	0.3%	3.0%	0.9%	1.3%	8.4%
State Trust Lands*	0.0%	0.1%	2.3%	0.5%	0.1%	0.2%	0.0%	0.0%	2.9%	0.0%	0.7%	2.0%
Other State	0.7%	0.1%	1.9%	0.0%	1.3%	0.7%	0.7%	0.3%	0.1%	0.9%	0.6%	6.4%
Tribal Lands	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.9%
City, County, Other	0.0%	0.0%	0.4%	0.0%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%	0.1%	0.3%

* Most state trust lands are held in trust for designated beneficiaries, principally public schools. Managers typically lease and sell these lands for a diverse range of uses to generate revenues for the beneficiaries.

- Hinsdale County, CO has the largest share of federal public lands (95.3%), and the U.S. has the smallest (28.2%).
- The U.S. has the largest share of state public lands (8.4%), and Mesa County, CO has the smallest (0.2%).
- The U.S. has the largest share of private lands (59.3%), and Hinsdale County, CO has the smallest (4%).



Data Sources: U.S. Geological Survey, Gap Analysis Program. 2016. Protected Areas Database of the United States (PADUS) version 1.4

What is the breakdown of land ownership?

What do we measure on this page?

This page describes the land area (in acres) and the share of the area that is private and that is managed by various public agencies.

Why is it important?

Decisions made by public land managers may influence the local economy, particularly if public lands represent a large portion of the land base. Agency management actions that affect water quality, access to recreation, scenery (as well as other quality of life amenities), and the extent and type of resource extraction are particularly important in areas where much of the land is managed by public agencies.

With a mix of land ownership, often across landscapes that share basic similarities, there is the potential for a mix of management priorities and actions. Federal and state land managers, private land owners, and others are constrained in different ways by laws and regulations that dictate how different lands can be managed. This can lead to adjacency challenges and opportunities.

In addition, where a large portion of land is owned and managed by federal agencies, local governments may rely heavily on PILT ("Payments in Lieu of Taxes") and revenue sharing payments (e.g., Forest Service Secure Rural Schools and Community Self-Determination Act or BLM Taylor Grazing Act payments).

Methods

No publicly available federal database contains statistics on the area of land by ownership. The data presented in this report were calculated using Geographic Information System (GIS) tools. Two primary GIS datasets were utilized to make the calculations: U.S. Census Bureau's TIGER/Line County Boundaries 2012: census.gov/geo/www/tiger/tgrshp2012/tgrshp2012.html *(1)* and U.S. Geological Survey's Protected Areas Database (PADUS) version 1.3: gapanalysis.usgs.gov/padus/ *(2)*.

Although every attempt was made to use the best available GIS land ownership dataset, the data sometimes has errors or becomes outdated. Please report any inaccuracies to eps@headwaterseconomics.org.

Additional Resources

For more information on payments made to counties from federal public lands, see the EPS Federal Land Payments report.

If accurate measurements of water surface area are needed, the U.S. Geological Survey's national hydrography dataset can be used: nhd.usgs.gov *(3)*.

Data Sources

U.S. Geological Survey, Gap Analysis Program. 2016. Protected Areas Database of the United States (PADUS) version 1.4; Rasker, R. 2006. "An Exploration Into the Economic Impact of Industrial Development Versus Conservation on Western Public Lands." Society and Natural Resources. 19(3): 191-207

What are the different types of Forest Service lands?

This page describes the size (in acres) and share of different Forest Service land designations.

U.S. Forest Service Land Types (Acres), 2009

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Total Area	1,435,422	2,138,287	824,791	248,513	347,015	2,086,164	735,108	718,815	2,028,983	1,891,716	12,454,814	2,301,106,907
Forest Service Lands	327,055	547,850	176,891	174,395	132,370	1,275,730	191,672	558,822	932,113	515,917	4,832,815	192,750,310
Unspecified Designated Area Type	298,340	547,850	146,185	108,465	94,868	847,593	191,672	258,097	801,286	348,461	3,642,817	146,630,207
National Wilderness	0	0	30,706	65,930	37,502	384,237	0	286,760	130,827	167,456	1,103,418	36,155,579
National Monument	0	0	0	0	0	0	0	0	0	0	0	3,661,327
National Recreation Area	0	0	0	0	0	0	0	0	0	0	0	2,950,660
National Game Refuge	0	0	0	0	0	0	0	0	0	0	0	1,198,099
National Wild River	0	0	0	0	0	0	0	0	0	0	0	568,059
National Recreation River	0	0	0	0	0	0	0	0	0	0	0	398,207
National Scenic River	0	0	0	0	0	0	0	0	0	0	0	289,617
National Scenic Area	0	0	0	0	0	0	0	0	0	0	0	230,459
Primitive Area	0	0	0	0	0	0	0	0	0	0	0	173,762
National Volcanic Monument	0	0	0	0	0	0	0	0	0	0	0	167,427
Special Management Area	28,715	0	0	0	0	0	0	13,965	0	0	42,680	164,707
Protection Area	0	0	0	0	0	0	0	0	0	0	0	45,051
Recreation Management Area	0	0	0	0	0	43,900	0	0	0	0	43,900	43,900
National Scenic and Wildlife Area	0	0	0	0	0	0	0	0	0	0	0	39,171
Scenic Recreation Area	0	0	0	0	0	0	0	0	0	0	0	12,645
National Botanical Area	0	0	0	0	0	0	0	0	0	0	0	8,256
National Scenic and Research Area	0	0	0	0	0	0	0	0	0	0	0	6,637
National Historic Area	0	0	0	0	0	0	0	0	0	0	0	6,540

Percent of Total

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Forest Service Lands	22.8%	25.6%	21.4%	70.2%	38.1%	61.2%	26.1%	77.7%	45.9%	27.3%	38.8%	8.4%
Unspecified Designated Area Type	20.8%	25.6%	17.7%	43.6%	27.3%	40.6%	26.1%	35.9%	39.5%	18.4%	29.2%	6.4%
National Wilderness	0.0%	0.0%	3.7%	26.5%	10.8%	18.4%	0.0%	39.9%	6.4%	8.9%	8.9%	1.6%
National Monument	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%
National Recreation Area	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
National Game Refuge	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
National Wild River	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
National Recreation River	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
National Scenic River	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
National Scenic Area	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Primitive Area	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
National Volcanic Monument	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Special Management Area	2.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.9%	0.0%	0.0%	0.3%	0.0%
Protection Area	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Recreation Management Area	0.0%	0.0%	0.0%	0.0%	0.0%	2.1%	0.0%	0.0%	0.0%	0.0%	0.4%	0.0%
National Scenic and Wildlife Area	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Scenic Recreation Area	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
National Botanical Area	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
National Scenic and Research Area	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
National Historic Area	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

County specific acreages for Forest Service National Game Refuges are not available for the following states: Arkansas, Florida, Georgia, Louisiana, North Carolina, South Carolina, and Tennessee.

Data Sources: USDA, FS - Land Areas Report 2009, Oracle LAR Database

What are the different types of Forest Service lands?

What do we measure on this page?

This page describes the size (in acres) and share of different Forest Service land designations.

Note: All acreages on this page were reported by the U.S. Forest Services' Land Areas Report 2009. The total acreage of Forest Service land on this page may differ from that reported on previous page due to differences in values reported by the data sources.

Why is it important?

These data allow the user to see the range and scale of Forest Service land designations. This information is a useful way to see whether any Forest Service lands have special designations that may affect management considerations. Different types of designation may impact the economic value and uses of associated lands.

Methods

County specific acreages for Forest Service National Game Refuges are not available for the following states: Arkansas, Florida, Georgia, Louisiana, North Carolina, South Carolina, and Tennessee.

Additional Resources

A copy of the most recent Forest Service Land Areas Report, including detailed tables, is available at:fs.fed.us/land/staff/lar/2009/lar09index.html *(4)*.

Forest Service Land Areas Report definitions of terms are available at: fs.fed.us/land/staff/lar/definitions_of_terms.htm *(5)*.

Data Sources

USDA, FS - Land Areas Report 2009, Oracle LAR Database

What are the different types of federal lands?

This page describes the size (in acres) and share of federal public lands managed for various purposes under differing statutory authority (see study guide text for more details on federal public land management classifications). For purposes of this section, federal public lands have been defined below as Type A, B, or C in order to more easily distinguish lands according to primary or common uses and/or conservation functions, activities, permitted transportation uses, and whether they have a special designation (often through Congressional action).

Type A: National Parks and Preserves (NPS), Wilderness (NPS, FWS, FS, BLM), National Conservation Areas (BLM), National Monuments (NPS, FS, BLM), National Recreation Areas (NPS, FS, BLM), National Wild and Scenic Rivers (NPS, FS, BLM), Waterfowl Production Areas (FWS), Wildlife Management Areas (FWS), Research Natural Areas (FS, BLM), Areas of Critical Environmental Concern (BLM), and National Wildlife Refuges (FWS).

Type B: Wilderness Study Areas (NPS, FWS, FS, BLM), Inventoried Roadless Areas (FS).

Type C: Public Domain Lands (BLM), O&C Lands (BLM), National Forests and Grasslands (FS).

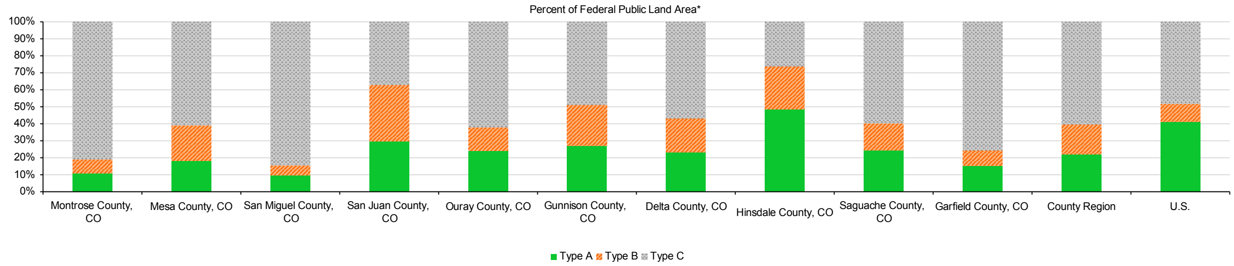
NPS = National Park Service; FS = Forest Service; BLM = Bureau of Land Management; FWS = Fish and Wildlife

Relative Management Designations of Federal Lands (Acres)*

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Total Area of Type A, B, and C	981,556	1,556,772	491,500	220,898	158,018	1,663,336	411,978	685,882	1,470,611	1,176,540	8,817,091	623,478,537
Type A	111,397	290,837	50,092	67,025	39,195	458,808	98,658	337,018	368,513	186,084	2,007,627	260,397,439
Type B	83,076	327,483	29,694	73,521	21,505	402,468	81,640	173,835	232,273	107,918	1,533,413	66,039,395
Type C	787,083	938,452	411,714	80,352	97,318	802,060	231,680	175,029	869,825	882,538	5,276,051	297,041,703
Percent of Total												
Type A	11.3%	18.7%	10.2%	30.3%	24.8%	27.6%	23.9%	49.1%	25.1%	15.8%	22.8%	41.8%
Type B	8.5%	21.0%	6.0%	33.3%	13.6%	24.2%	19.8%	25.3%	15.8%	9.2%	17.4%	10.6%
Type C	80.2%	60.3%	83.8%	36.4%	61.6%	48.2%	56.2%	25.5%	59.1%	75.0%	59.8%	47.6%

* Year for data varies by geography and source. See data sources below for more information.

- Hinsdale County, CO has the largest share of Type A land (49.1%), and San Miguel County, CO has the smallest (10.2%).
- San Juan County, CO has the largest share of Type B land (33.3%), and San Miguel County, CO has the smallest (6%).
- San Miguel County, CO has the largest share of Type C land (83.8%), and Hinsdale County, CO has the smallest (25.5%).



Data Sources: U.S. Geological Survey, Gap Analysis Program. 2016. Protected Areas Database of the United States (PADUS) version 1.4; Rasker, R. 2006. "An Exploration Into the Economic Impact of Industrial Development Versus Conservation on Western Public Lands." Society and Natural Resources. 19(3): 191-207.

Study Guide and Supplemental Information

What are the different types of federal lands?

What do we measure on this page?

This page describes the size (in acres) and share of federal public lands managed for various purposes under differing statutory authority. For purposes of this section, federal public lands have been defined below as Type A, B, or C in order to more easily distinguish lands according to primary or common uses and/or conservation functions, activities, permitted transportation uses, and whether they have a special designation (often through Congressional action).

Type A lands tend to have more managerial and commercial use restrictions than Type C lands, represent smaller proportions of total land management areas (except within Alaska), and have a designation status less easily changed than Type B lands. In most other respects Type B lands are similar to Type A lands in terms of activities allowed. Type C lands generally have no special designations, represent the bulk of federal land management areas, and may allow a wider range of uses or compatible activities -often including commercial resource utilization such as timber production, mining and energy development, grazing, recreation, and large-scale watershed projects and fire management options (especially within the National Forest System and Public Domain lands of the BLM).

As more popularly described: Type A lands are areas having uncommon bio-physical and/or cultural character worth preserving; Type B lands are areas with limited development and motorized transportation worth preserving; and Type C lands are areas where the landscape may be altered within the objectives and guidelines of multiple use.

Why is it important?

Some types of federal lands, such as National Parks and Wilderness, can be associated with above average economic growth. These lands by themselves do not guarantee economic growth. But when combined with other factors, such as an educated workforce and access to major markets via airports, they have been shown to be statistically significant predictors of growth.

Methods

The classifications offered on this page are not absolute categories. They are categories of relative degrees of management priority, categorized by land designation. Lands such as Wilderness and National Monuments, for example, are generally more likely to be managed for conservation and recreation, even though there may exist exceptions (e.g., a pre-existing mine in a Wilderness area or oil and gas development in a National Monument). Forest Service and BLM lands without designations such as Wilderness or National Monuments are more likely to allow commercial activities (e.g., mining, timber harvesting), even though there are exceptions.

Land defined as either Type A, B, or C includes areas managed by the National Park Service, the Forest Service, the Bureau of Land Management, or the Fish and Wildlife Service. Lands administered by other federal agencies (including the Army Corps of Engineers, Bureau of Reclamation, Department of Agriculture, Department of Defense, Department of Energy, and Department of Transportation) were not classified into Type A, B, or C. Therefore, the total acreage of Type A, B, and C lands may not add to the Total Federal Land Area reported on page 1. Private lands and areas managed by state agencies and local government are not included in this classification. These definitions (Type A, B, and C) of land classifications are not legal or agency-approved, and are provided only for comparative purposes. A caveat: The amount of acreage in particular land types may not be the only indicator of quality. For example, Wild and Scenic Rivers may provide amenity values far greater than their land acreage would indicate.

Additional Resources

Studies, articles and literature reviews on the economic contribution of protected public lands are available from: headwaterseconomics.org/land/reports/protected-lands-value *(6)*.

See also: Lorah, P. and R. Southwick. 2003. "Environmental Protection, Population Change, and Economic Development in the Rural Western United States" Population and Environment. 24(3): 255-272; and Holmes, P. and W. Hecox. 2002. “Does Wilderness Impoverish Rural Areas?” International Journal of Wilderness. 10(3): 34-39.

For an analysis on the effect on local economies, in particular on resource-based industries, from Wilderness designations, see: Duffy-Deno, K. T.. 1998. "The Effect of Federal Wilderness on County Growth in the Intermountain Western United States." Journal of Regional Science. 38(1): 109-136.

For the results of a national survey of residents in counties with Wilderness, see: Rudzitis, G. and H.E. Johansen. 1991. "How Important is Wilderness? Results from a United States Survey." Environmental Management. 15(2): 227-233.

For analysis of the role of transportation in high-amenity areas, see: Rasker, R., P.H. Gude, J.A. Gude, J. van den Noort. 2009. “The Economic Importance of Air Travel in High-Amenity Rural Areas.” Journal of Rural Studies. 25(2009): 343-353.

Data Sources

U.S. Geological Survey, Gap Analysis Program. 2016. Protected Areas Database of the United States (PADUS) version 1.4; Rasker, R. 2006. "An Exploration Into the Economic Impact of Industrial Development Versus Conservation on Western Public Lands." Society and Natural Resources. 19(3): 191-207

What is the breakdown of forest, grassland, and other land cover types?

This page describes the size (in acres) and share of various land cover types.

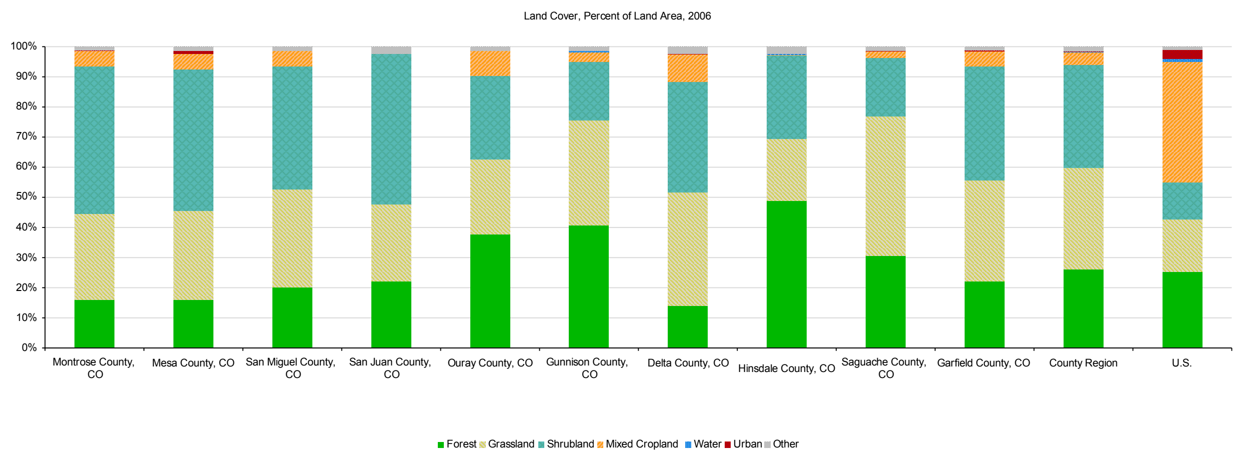
Land Cover (Acres), 2006

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Total Area	1,435,422	2,138,287	824,791	248,513	347,015	2,086,164	735,108	718,815	2,028,983	1,891,716	12,454,814	2,301,106,907
Forest	229,668	342,126	164,958	54,673	128,396	834,466	102,915	345,031	608,695	416,178	3,227,104	575,276,727
Grassland	401,918	620,103	263,933	62,128	83,284	709,296	271,990	143,763	913,042	624,266	4,093,724	391,188,174
Shrubland	689,003	983,612	329,916	121,771	93,694	396,371	264,639	194,080	385,507	699,935	4,158,528	276,132,829
Mixed Cropland	71,771	106,914	41,240	0	27,761	62,585	66,160	1,232	40,580	94,586	512,828	897,431,694
Water	247	247	0	0	0	11,616	247	1,971	247	0	14,576	23,011,069
Urban	1,484	20,012	0	0	0	247	988	0	3,707	4,698	31,135	69,033,207
Other	12,364	21,383	8,248	4,970	3,470	20,862	14,702	14,376	20,290	16,566	137,231	14,643,750

Percent of Total

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Forest	16.0%	16.0%	20.0%	22.0%	37.0%	40.0%	14.0%	48.0%	30.0%	22.0%	25.9%	25.0%
Grassland	28.0%	29.0%	32.0%	25.0%	24.0%	34.0%	37.0%	20.0%	45.0%	33.0%	32.9%	17.0%
Shrubland	48.0%	46.0%	40.0%	49.0%	27.0%	19.0%	36.0%	27.0%	19.0%	37.0%	33.4%	12.0%
Mixed Cropland	5.0%	5.0%	5.0%	0.0%	8.0%	3.0%	9.0%	0.2%	2.0%	5.0%	4.1%	39.0%
Water	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%	0.0%	0.3%	0.0%	0.0%	0.1%	1.0%
Urban	0.1%	0.9%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.2%	0.2%	0.2%	3.0%
Other	0.9%	1.0%	1.0%	2.0%	1.0%	1.0%	2.0%	2.0%	1.0%	0.9%	1.1%	0.6%

- Hinsdale County, CO has the largest share of forest cover (48%), and Delta County, CO has the smallest (14%).
- Saguache County, CO has the largest share of grassland cover (45%), and the U.S. has the smallest (17%).
- San Juan County, CO has the largest share of shrubland cover (49%), and the U.S. has the smallest (12%).



Data Sources: NASA MODIS Land Cover Type Yearly L3 Global 1km MOD12Q1, 2006.

What is the breakdown of forest, grassland, and other land cover types?

What do we measure on this page?

This page describes the size (in acres) and share of various land cover types.

The National Aeronautics and Space Administration's (NASA) Moderate Resolution Imaging Spectroradiometer (MODIS) Land Cover Type Classification identifies 17 classes of land cover. These classes were summarized into seven classes as follows:

Forest: This is an aggregate of the following NASA MODIS classes: Evergreen Needleleaf Forest, Evergreen Broadleaf Forest, Deciduous Needleleaf Forest, Deciduous Broadleaf Forest, and Mixed Forest

Grassland: This is an aggregate of the following NASA MODIS classes: Grasslands, Savannas

Shrubland: This is an aggregate of the following NASA MODIS classes: Closed Shrubland, Open Shrubland, and Woody Savannas.

Mixed Cropland: This is an aggregate of the following NASA MODIS classes: Croplands, and Cropland/Natural Vegetation Mosaic.

Water: This is the same in the original NASA MODIS classification.

Urban: This is Urban and Built-Up in the original NASA MODIS classification.

Other: This is an aggregate of the following NASA MODIS classes: Permanent Wetlands, Snow and Ice, Barren or Sparsely Vegetated, and Unclassified.

Why is it important?

The mix of land cover influences a range of socioeconomic and natural factors, including: potential and suitable economic activities, the potential for wildfire, the availability of different recreation opportunities, water storage, and other cultural and economic factors.

Methods

NASA's MODIS Land Cover Type data was selected because it is publicly available across the globe and has a relatively small number of general classes that were easily summarized.

Additional Resources

For more information about NASA's MODIS Land Cover Type data, see: modis-land.gsfc.nasa.gov/ *(7)*.

Landover data is available from many sources. Other commonly used datasets in the United States are the U.S. Geological Survey's National Land Cover Dataset and state and regional GAP datasets available from the U.S. Geological Survey's National Biological Information Infrastructure. Information about these and many other land cover datasets can be viewed at landcover.usgs.gov/landcoverdata.php *(8)*.

For information on wildfire, see the EPS Development and Wildland-Urban Interface report.

Data Sources

NASA MODIS Land Cover Type Yearly L3 Global 1km MOD12Q1, 2006

What are the trends in residential land-use conversion?

This page describes the area (in acres) used for housing and the rate at which this area is growing.

Urban/Suburban: Average residential lot size < 1.7 acres.

Exurban: Average residential lot size 1.7 - 40 acres.

Total Residential: Cumulative acres of land developed at urban/suburban and exurban densities.

Residential Development (Acres), 2000-2010

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Total Private Land	443,170	537,788	284,091	26,868	179,826	367,654	316,429	28,800	450,453	673,242	3,308,321	1,364,048,727
Total Residential, 2000	43,344	48,695	6,678	542	9,812	15,054	51,245	1,285	5,218	35,084	216,957	190,918,648
Urban/Suburban, 2000	4,013	16,748	1,122	189	459	2,515	3,090	314	621	4,658	33,729	31,001,465
Exurban, 2000	39,331	31,947	5,556	353	9,354	12,539	48,154	971	4,598	30,426	183,229	159,917,167
Total Residential, 2010	61,591	65,197	7,156	670	12,437	24,560	70,117	2,081	9,305	48,519	301,633	214,475,717
Urban/Suburban, 2010	5,470	21,016	1,627	171	713	3,198	3,692	385	744	6,929	43,945	37,816,640
Exurban, 2010	56,121	44,182	5,529	498	11,724	21,362	66,425	1,696	8,561	41,590	257,688	176,659,056
Percent Change in Total Residential	42.1%	33.9%	7.2%	23.6%	26.8%	63.1%	36.8%	61.9%	78.3%	38.3%	39.0%	12.3%

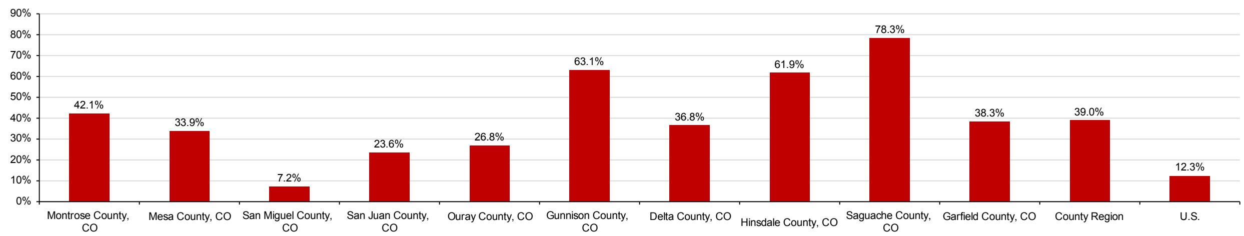
Percent of Total*

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Total Residential, 2000	9.8%	9.1%	2.4%	2.0%	5.5%	4.1%	16.2%	4.5%	1.2%	5.2%	6.6%	14.0%
Urban/Suburban, 2000	0.9%	3.1%	0.4%	0.7%	0.3%	0.7%	1.0%	1.1%	0.1%	0.7%	1.0%	2.3%
Exurban, 2000	8.9%	5.9%	2.0%	1.3%	5.2%	3.4%	15.2%	3.4%	1.0%	4.5%	5.5%	11.7%
Total Residential, 2010	13.9%	12.1%	2.5%	2.5%	6.9%	6.7%	22.2%	7.2%	2.1%	7.2%	9.1%	15.7%
Urban/Suburban, 2010	1.2%	3.9%	0.6%	0.6%	0.4%	0.9%	1.2%	1.3%	0.2%	1.0%	1.3%	2.8%
Exurban, 2010	12.7%	8.2%	1.9%	1.9%	6.5%	5.8%	21.0%	5.9%	1.9%	6.2%	7.8%	13.0%

* The percentages in this table represent the percent of private land developed at various housing densities, and should not sum to 100%.

Percent Change in Area, Total Residential Development, 2000-2010

- From 2000 to 2010, Saguache County, CO had the largest percent change in residential development (78.3%), and San Miguel County, CO had the smallest (7.2%).



Data Sources: Theobald, DM. 2013. Land use classes for ICLUS/SERGoM v2013. Unpublished report, Colorado State University.

Study Guide and Supplemental Information

What are the trends in residential land-use conversion?

What do we measure on this page?

This page describes the area (in acres) used for housing and the rate at which this area is growing.

Comparisons in development patterns are made between 2000 and 2010. The data can also be used to draw comparisons between geographies. These are the latest published data available from the Decennial Census.

Why is it important?

In the past decade, despite the downturn in the housing market, the conversion of open space and agricultural land to residential development has continued to occurred at a rapid pace in many parts of the U.S. The popularity of exurban lot sizes in much of the country has exacerbated this trend (low density development results in a larger area of land converted to residential development).

This pattern of development reflects a number of factors, including demographic trends, the increasingly "footloose" nature of economic activity, the availability and price of land, and preferences for homes on larger lots. These factors can place new demands on public land managers as development increasingly pushes up against public land boundaries. For example, human-wildlife conflicts and wildfire threats may become more serious issues for public land managers where development occurs adjacent to public lands. In addition, there may be new demands for recreation opportunities and concern about the commodity use of the landscape.

Geographies with a large percent change in the area of residential development often have experienced significant in-migration from more urbanized areas. Counties with a small percent change either experienced little growth or were already highly urbanized in 2000.

Methods

Statistics are provided for residential areas developed at relatively high densities (urban/suburban areas where the average residential lot sizes are less than 1.7 acres) and those developed at relatively low densities (exurban areas where the average lot sizes are between 1.7 and 40 acres). Urban/suburban areas, as shown here, combine “urban” housing densities (less than 0.25 acres per unit, and “suburban” housing densities (0.25–1.7 acres per unit). Urban and suburban are represented in one class because they often represent a small proportion of the land area within counties. Lot sizes greater than 40 acres are more typical of working agricultural landscapes and are not considered residential, and therefore are not discussed here.

Additional Resources

For an overview of past national land-use trends, see:

Brown, D.G., K.M. Johnson, T.R. Loveland, and D.M. Theobald. 2005. Rural land-use trends in the conterminous United States, 1950–2000. Ecological Applications 15: 1851–1863.

The following papers provide an overview of the ecological effects of residential development. The last two papers focus on the effects of land-use change on nearby protected landscapes:

Hansen, A.J., R. Knight, J. Marzluff, S. Powell, K. Brown, P. Hernandez, and K. Jones. 2005. Effects of exurban development on biodiversity: patterns, mechanisms, research needs. Ecological Applications 15:1893–1905.

Hansen, A.J., and R. DeFries. 2007. Ecological mechanisms linking protected areas to surrounding lands. Ecological Applications 17:974–988.

Gude, P.H., Hansen, A.J., Rasker, R., Maxwell, B. 2006. "Rates and Drivers of Rural Residential Development in the Greater Yellowstone." Landscape and Urban Planning. 77: 131-151.

For more information on development and wildfire, see the EPS Development and Wildland-Urban Interface report.

Data Sources

Theobald, DM. 2013. Land use classes for ICLUS/SERGoM v2013. Unpublished report, Colorado State University

What are the trends in residential land-use conversion?

This page describes the per capita area (in acres) used for housing and the rate at which this area is growing on a per capita basis.

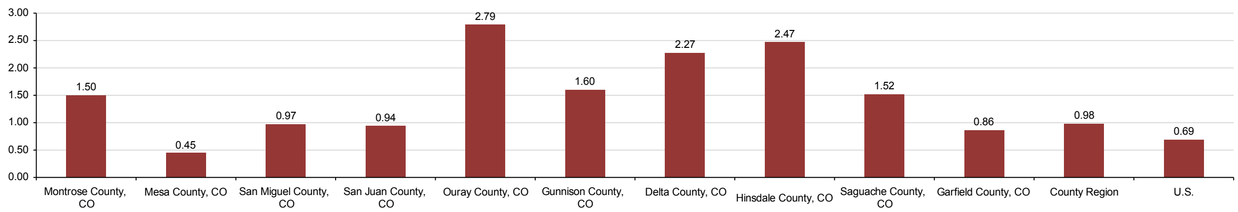
Population Density, 2000-2010

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Residential Acres/Person, 2000	1.29	0.41	1.01	0.96	2.60	1.07	1.84	1.62	0.88	0.79	0.85	0.67
Residential Acres/Person, 2010	1.50	0.45	0.97	0.94	2.79	1.60	2.27	2.47	1.52	0.86	0.98	0.69
Change in Residential Acres/Person, 2000-2010*	0.21	0.03	-0.04	-0.02	0.19	0.53	0.43	0.85	0.64	0.07	0.12	0.02
Private Acres/Person, 2010	10.76	3.68	38.60	37.90	40.40	24.01	10.24	34.20	73.39	11.99	10.70	4.37

* The percentages in this table represent the percent of private land developed at various housing densities, and should not sum to 100%.

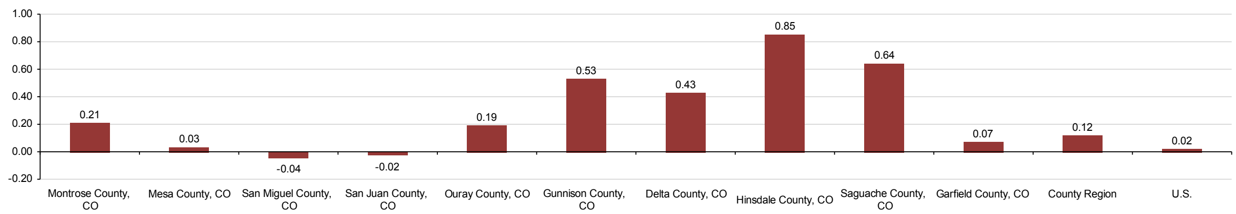
- In 2010, Saguache County, CO had the largest average acreage in residential development per person (73.39 acres), and Mesa County, CO had the smallest (3.68 acres).

Average Residential Acres per Person, 2010



- From 2000 to 2010, Hinsdale County, CO had the largest change in average acreage in residential development per person (0.85 acres), and San Miguel County, CO had the smallest (-0.04 acres).

Change in Average Residential Acres per Person, 2000-2010



Data Sources: Theobald, DM. 2013. Land use classes for ICLUS/SERGoM v2013. Unpublished report, Colorado State University.

What are the trends in residential land-use conversion?

What do we measure on this page?

This page describes the per capita area (in acres) used for housing and the rate at which this area is growing on a per capita basis.

Per capita consumption of land used for housing is a measure of the pattern of development (i.e., denser or more sprawling). Comparisons in development patterns are made between 2000 and 2010. The data can also be used to draw comparisons between geographies.

Areas with negative values of change in residential acres/person were more densely developed in 2010 than in 2000. Large positive values of change indicate that an area was substantially more sprawling in 2010 than it was in 2000. This latter trend indicates that exurban development has increased. These are the latest published data available from the Decennial Census.

Why is it important?

Population growth is often a key metric used to describe human effects on natural resources. However, in most geographies land consumption is outpacing population growth. In these areas, land consumption (the area of land used for residential development) is strongly related to wildlife habitat loss and the degree to which public lands are bordered by residential development. The impact of residential development on ecological processes and biodiversity on surrounding lands is widely recognized. They include changes in ecosystem size, with implications for minimum dynamic area, species–area effect, and trophic structure; altered flows of materials and disturbances into and out of surrounding areas; effects on crucial habitats for seasonal and migration movements and population source/sink dynamics; and exposure to humans through hunting, exotics species, and disease.

The degree to which development patterns have changed (becoming more or less dense) between 2000 and 2010 is shown in the table and figure on this page. It's important to note that a small change does not indicate that a county is not sprawling, but rather that the pattern of development has not changed substantially over the time period. Geographies with high positive values of change were more sprawled in 2010 than in 2000. In parts of the country where development was less dense in 2010 than in 2000, the primary reason is often the increasing popularity of exurban / large lot development. Outside of urban areas, development on exurban lots has increased sharply since the 1970s in many parts of the country.

The pattern of land consumption in 2010 shown in the top figure, Average Residential Acres per Person, is equally important as the change in land consumption shown in the bottom figure Change in Average Residential Acres per Person. Geographies where the average number of residential acres per person is greater than one acre have considerable sprawling development.

Methods

Land consumption is expressed as the average number of acres that each person uses for housing (the average lot size) within a geography. Importantly, these figures refer only to residential development and do not include farms or ranches greater than 40 acres. Population density is also displayed as the acres of private land per person.

Additional Resources

The following papers provide an overview of the ecological effects of residential development. The second paper focuses on the effects of land-use change on nearby protected landscapes:

Hansen, A.J., R. Knight, J. Marzluff, S. Powell, K. Brown, P. Hernandez, and K. Jones. 2005. Effects of exurban development on biodiversity: patterns, mechanisms, research needs. Ecological Applications 15:1893–1905.

Hansen, A.J., and R. DeFries. 2007. Ecological mechanisms linking protected areas to surrounding lands. Ecological Applications 17:974–988.

For more information on development and wildfire, see the EPS Development and Wildland-Urban Interface report.

Data Sources

Theobald, DM. 2013. Land use classes for ICLUS/SERGoM v2013. Unpublished report, Colorado State University

Data Sources

The EPS Land-Use report uses national data sources to represent land cover and residential development. In an effort to report more accurate statistics for land ownership, a compilation of state level data was used. All the data in this report were the result of calculations made in Geographic Information Systems (GIS). The contact information for databases used in this profile is:

- **TIGER/Line County Boundaries 2012**
  Bureau of the Census, U.S. Department of Commerce
  http://www.census.gov/geo/maps-data/data/tiger.html

- **Developed Areas 2000 and 2010**
  Theobald, DM. 2013. Land use classes for ICLUS/SERGoM v2013. Unpublished report, Colorado State University.

- **USDA, Forest Service**
  Land Areas Report 2009, Oracle LAR Database
  http://www.fs.fed.us/land/staff/lar/2009/lar09index.html

- **Protected Areas Database v 1.3 2012**
  U.S. Geological Survey, Gap Analysis Program
  http://gapanalysis.usgs.gov/padus/

- **MODIS Land Cover Type 2006**
  National Aeronautics and Space Administration
  http://modis-land.gsfc.nasa.gov/landcover.htm

Methods

EPS core approaches

EPS is designed to focus on long-term trends across a range of important measures. Trend analysis provides a more comprehensive view of changes than spot data for select years. We encourage users to focus on major trends rather than absolute numbers.

EPS displays detailed industry-level data to show changes in the composition of the economy over time and the mix of industries at points in time.

EPS employs cross-sectional benchmarking, comparing smaller geographies such as counties to larger regions, states, and the nation, to give a sense of relative performance.

EPS allows users to aggregate data for multiple geographies, such as multi-county regions, to accommodate a flexible range of user-defined areas of interest and to allow for more sophisticated cross-sectional comparisons.

For more information about EPS see:

headwaterseconomics.org/EPS

Web pages listed under Additional Resources include:

Throughout this report, references to on-line resources are indicated with italicized numbers in parentheses. These resources are provided as hyperlinks here.

1 www.census.gov/geo/www/tiger/tgrshp2012/tgrshp2012.html
2 gapanalysis.usgs.gov/padus/
3 www.nhd.usgs.gov
4 www.fs.fed.us/land/staff/lar/2009/lar09index.html
5 www.fs.fed.us/land/staff/lar/definitions_of_terms.htm
6 headwaterseconomics.org/land/reports/protected-lands-value
7 http://modis-land.gsfc.nasa.gov/
8 www.landcover.usgs.gov/landcoverdata.php

A Profile of Industries that Include Travel & Tourism

County Region

Selected Geographies:

Montrose County, CO; Mesa County, CO; San Miguel County, CO; San Juan County, CO; Ouray County, CO; Gunnison County, CO; Delta County, CO; Hinsdale County, CO; Saguache County, CO; Garfield County, CO

Benchmark Geographies:

U.S.

Produced by

Economic Profile System

EPS

November 28, 2016

About the Economic Profile System (EPS)

EPS is a free, easy-to-use software application that produces detailed socioeconomic reports of counties, states, and regions, including custom aggregations.

EPS uses published statistics from federal data sources, including Bureau of Economic Analysis and Bureau of the Census, U.S. Department of Commerce; and Bureau of Labor Statistics, U.S. Department of Labor.

The Bureau of Land Management and Forest Service have made significant financial and intellectual contributions to the operation and content of EPS.

See headwaterseconomics.org/EPS for more information about the other tools and capabilities of EPS.

For technical questions, contact Patty Gude at eps@headwaterseconomics.org, or 406-599-7425.

headwaterseconomics.org

Headwaters Economics is an independent, nonprofit research group. Our mission is to improve community development and land management decisions in the West.

www.blm.gov

The Bureau of Land Management, an agency within the U.S. Department of the Interior, administers 249.8 million acres of America's public lands, located primarily in 12 Western States. It is the mission of the Bureau of Land Management to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations.

www.fs.fed.us

The Forest Service, an agency of the U.S. Department of Agriculture, administers national forests and grasslands encompassing 193 million acres. The Forest Service's mission is to achieve quality land management under the "sustainable multiple-use management concept" to meet the diverse needs of people while protecting the resource. Significant intellectual, conceptual, and content contributions were provided by the following individuals: Dr. Pat Reed, Dr. Jessica Montag, Doug Smith, M.S., Fred Clark, M.S., Dr. Susan A. Winter, and Dr. Ashley Goldhor-Wilcock.

Table of Contents

Note to Users:

This is one of fourteen reports that can be created and downloaded from EPS Web. You may want to run another EPS report for either a different geography or topic. Topics include land use, demographics, specific industry sectors, the role of non-labor income, the wildland-urban interface, the role of amenities in economic development, and payments to county governments from federal lands. Throughout the reports, references to online resources are indicated in parentheses. These resources are provided as hyperlinks on each report's final page. The EPS reports are downloadable as Excel, PDF, and Word documents. For further information and to download reports, go to:

headwaterseconomics.org/eps

Which industries include travel & tourism jobs?

This page describes the number of jobs (full and part-time) and the share of total jobs in industries that include travel and tourism.

Travel and Tourism: Consists of sectors that provide goods and services to visitors to the local economy, as well as to the local population. These industries are: retail trade; passenger transportation; arts, entertainment, and recreation; and accommodation and food. It is not known, without additional research such as surveys, what exact proportion of the jobs in these sectors is attributable to expenditures by visitors, including business and pleasure travelers, versus by local residents. Some researchers refer to these sectors as "tourism-sensitive." They could also be called "travel and tourism-potential sectors" because they have the potential of being influenced by expenditures by non-locals. In this report, they are referred to as "industries that include travel and tourism."

Employment in Travel & Tourism, 2014

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Total Private Employment	11,560	50,695	4,688	197	1,041	6,171	6,738	139	790	18,937	100,956	121,079,879
Travel & Tourism Related	~1,511	~9,271	~2,536	~138	~439	~2,242	~802	~66	~75	~3,905	~20,985	18,806,854
Retail Trade	264	1,552	~99	~29	~79	150	~150	~13	~24	706	~3,066	3,390,694
Gasoline Stations	116	478	23	~7	~15	44	88	~7	~24	352	~1,154	904,084
Clothing & Accessory Stores	61	694	57	10	~8	67	~21	0	0	184	~1,102	1,736,053
Misc. Store Retailers	87	380	~19	~12	~56	39	41	6	0	170	~810	750,557
Passenger Transportation	~43	~155	~26	~1	~1	~20	0	0	0	~71	~317	454,111
Air Transportation	~43	120	~19	0	0	~20	0	0	0	~3	~205	428,799
Scenic & Sightseeing Transport	0	~35	~7	~1	~1	0	0	0	0	~68	~112	25,312
Arts, Entertainment, & Recreation	~122	~1,001	~760	~43	~21	~141	~26	~5	~15	~292	~2,426	2,170,121
Performing Arts & Spectator Sports	4	27	22	~1	~2	~27	16	0	~1	27	~127	474,256
Museums, Parks, & Historic Sites	~2	~47	~7	~7	~11	~14	~2	~4	0	~5	~99	143,298
Amusement, Gambling, & Rec.	116	927	~731	~35	~8	100	8	~1	~14	260	~2,200	1,552,567
Accommodation & Food	1,082	6,563	1,651	~65	338	~1,931	626	~48	~36	2,836	~15,176	12,791,928
Accommodation	108	1,064	842	~37	121	~826	33	~29	~3	836	~3,899	1,998,716
Food Services & Drinking Places	974	5,499	809	28	217	1,105	593	~19	33	2,000	~11,277	10,793,212
Non-Travel & Tourism	~10,049	~41,424	~2,152	~59	~602	~3,929	~5,936	~73	~715	~15,032	~79,971	102,273,025

Percent of Total

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Travel & Tourism Related	~13.1%	~18.3%	~54.1%	~70.1%	~42.2%	~36.3%	~11.9%	~47.5%	~9.5%	~20.6%	~20.8%	15.5%
Retail Trade	2.3%	3.1%	~2.1%	~14.7%	~7.6%	2.4%	~2.2%	~9.4%	~3.0%	3.7%	~3.0%	2.8%
Gasoline Stations	1.0%	0.9%	0.5%	~3.6%	~1.4%	0.7%	1.3%	~5.0%	~3.0%	1.9%	~1.1%	0.7%
Clothing & Accessory Stores	0.5%	1.4%	1.2%	5.1%	~0.8%	1.1%	~0.3%	0.0%	0.0%	1.0%	~1.1%	1.4%
Misc. Store Retailers	0.8%	0.7%	~0.4%	~6.1%	~5.4%	0.6%	0.6%	4.3%	0.0%	0.9%	~0.8%	0.6%
Passenger Transportation	~0.4%	~0.3%	~0.6%	~0.5%	~0.1%	~0.3%	0.0%	0.0%	0.0%	~0.4%	~0.3%	0.4%
Air Transportation	~0.4%	0.2%	~0.4%	0.0%	0.0%	~0.3%	0.0%	0.0%	0.0%	~0.0%	~0.2%	0.4%
Scenic & Sightseeing Transport	0.0%	~0.1%	~0.1%	~0.5%	~0.1%	0.0%	0.0%	0.0%	0.0%	~0.4%	~0.1%	0.0%
Arts, Entertainment, & Recreation	~1.1%	~2.0%	~16.2%	~21.8%	~2.0%	~2.3%	~0.4%	~3.6%	~1.9%	~1.5%	~2.4%	1.8%
Performing Arts & Spectator Sports	0.0%	0.1%	0.5%	~0.5%	~0.2%	~0.4%	0.2%	0.0%	~0.1%	0.1%	~0.1%	0.4%
Museums, Parks, & Historic Sites	~0.0%	~0.1%	~0.1%	~3.6%	~1.1%	~0.2%	~0.0%	~2.9%	0.0%	~0.0%	~0.1%	0.1%
Amusement, Gambling, & Rec.	1.0%	1.8%	~15.6%	~17.8%	~0.8%	1.6%	0.1%	~0.7%	~1.8%	1.4%	~2.2%	1.3%
Accommodation & Food	9.4%	12.9%	35.2%	~33.0%	32.5%	~31.3%	9.3%	~34.5%	~4.6%	15.0%	~15.0%	10.6%
Accommodation	0.9%	2.1%	18.0%	~18.8%	11.6%	~13.4%	0.5%	~20.9%	~0.4%	4.4%	~3.9%	1.7%
Food Services & Drinking Places	8.4%	10.8%	17.3%	14.2%	20.8%	17.9%	8.8%	~13.7%	4.2%	10.6%	~11.2%	8.9%
Non-Travel & Tourism	~86.9%	~81.7%	~45.9%	~29.9%	~57.8%	~63.7%	~88.1%	~52.5%	~90.5%	~79.4%	~79.2%	84.5%

The major industry categories (retail trade; passenger transportation; arts, entertainment, and recreation; and accommodation and food) in the table above are the sum of the sub-categories underneath them and as shown here do not represent NAICS codes. The data does not include employment in government, agriculture, railroads, or the self-employed because these are not reported by County Business Patterns. Estimates for data that were not disclosed are indicated with tildes (~).

Data Sources: U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.

Which industries include travel & tourism jobs?

What do we measure on this page?

This page describes the number of jobs (full and part-time) and the share of total jobs in industries that include travel and tourism.

Travel and Tourism: Consists of sectors that provide goods and services to visitors to the local economy, as well as to the local population. These industries are: retail trade; passenger transportation; arts, entertainment, and recreation; and accommodation and food. It is not known, without additional research such as surveys, what exact proportion of the jobs in these sectors is attributable to expenditures by visitors, including business and pleasure travelers, versus by local residents. Some researchers refer to these sectors as “tourism-sensitive.” They could also be called “travel and tourism-potential sectors” because they have the potential of being influenced by expenditures by non-locals. In this report, they are referred to as "industries that include travel and tourism."

The information on this page is useful for explaining whether sectors that are likely to be associated with travel or tourism exist, and whether there are differences between geographies. It is less useful as a measure of the absolute size of employment in travel and tourism. To know this would require detailed knowledge, obtained through surveys and other means, of the proportion of a sector's employment that is directly attributable to travelers.

Why is this Important?

Public lands can play a key role in stimulating local employment by providing opportunities for recreation. Communities adjacent to public lands can benefit economically from visitors who spend money in hotels, restaurants, ski resorts, gift shops, and elsewhere. While the information in this report is not an exact measure of the size of the travel and tourism sectors, and it does not measure the type and amount of recreation on public lands, it can be used to understand whether travel and tourism-related economic activity is present, how it has changed over time, and whether there are differences between geographies.

Methods

There is no single industrial classification for travel and tourism under the North American Industrial Classification System (NAICS). However, there are sectors that, at least in part, provide goods and services to visitors to a local economy. We reviewed the published literature to discern how others identified industries that are part of travel and tourism. These industries, which follow generally accepted standards, include (identified by 3-digit NAICS codes in parenthesis):
Components of Retail Trade: Gasoline Stations (447), Clothing and Accessory Stores (448), Miscellaneous Store Retailers (453; includes Gift, Novelty, and Souvenir)
Components of Passenger Transportation: Air Transportation (481), Scenic and Sightseeing Transportation (487)
Components of Arts, Entertainment, and Recreation: Performing Arts and Spectator Sports (711); Museums, Parks, and Historical Sites (712; includes National Parks, Conservation Areas); Amusement, Gambling, and Recreation (713; includes Golf Courses, Alpine and Cross Country Skiing Facilities)
Components of Accommodation and Food: Accommodation (721; includes ski resorts, hotels, casino hotels, campgrounds, guest ranches), Food Services and Drinking Places (722)

Data on this page were obtained from County Business Patterns. We use this source because, compared to other sources, it has fewer data gaps (instances when the federal government will not release information to protect confidentiality of individual businesses). It also includes both full and part-time employment. The disadvantage of County Business Patterns data is that it does not include employment in government, agriculture, railroads, or the self-employed and as a result under-count the size of industry sectors. Also, County Business Patterns data are based on mid-March employment and do not take into account seasonal fluctuations. For these reasons, the data are most useful for showing long-term trends, displaying differences between geographies, and showing the relationship between sectors over time.

Some data are withheld by the federal government to avoid the disclosure of potentially confidential information. Headwaters Economics uses data from the U.S. Department of Commerce to estimate these data gaps. These values are indicated with tildes (~).

Additional Resources

The list of NAICS codes associated with travel and tourism were obtained from: Marcouiller, D.W. and X. Xia. 2008. “Distribution of Income from Tourism-Sensitive Employment.” Tourism Economics. 14(3): 545-565. See: ingentaconnect.com/content *(1)*.
For a similar definition of travel and tourism, see: Wilkerson, C. 2003. “Travel and Tourism: An Overlooked Industry in the U.S. and Tenth District.” Economic Review. Federal Reserve Bank of Kansas City. Third Quarter: 45-71. See: kansascityfed.com/publicat/econrev/PDF/3q03wilk.pdf *(2)*.
Documentation explaining methods developed by Headwaters Economics for estimating disclosure gaps is available at headwaterseconomics.org/eps *(3)*.
Because of space limitations, additional travel and tourism resources are listed on subsequent pages.

Data Sources

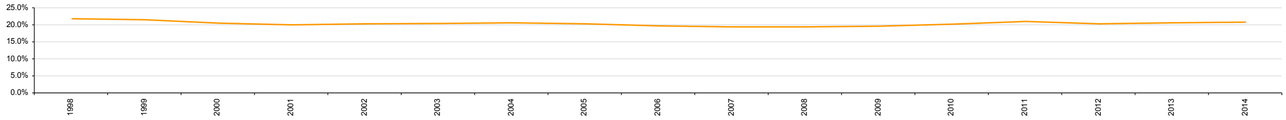
U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.

How have industries that include travel and tourism changed?

This page describes trends in industries that include travel and tourism as a percent of all jobs and compares industries containing travel and tourism to the rest of the economy. It also shows jobs in industries that include travel and tourism as a percent of total employment.

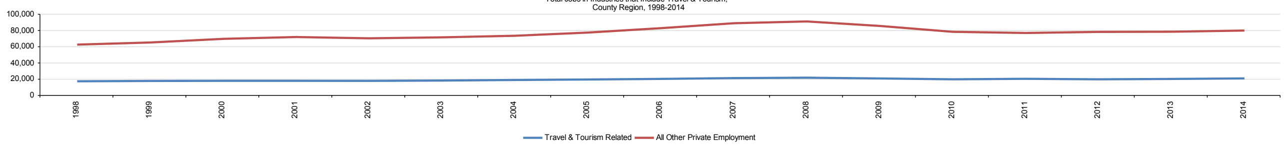
- In 1998, travel & tourism represented 22% of total employment. By 2014, travel & tourism represented 21% of total employment.

Percent of Total Private Employment in Industries that Include Travel & Tourism, County Region, 1998-2014



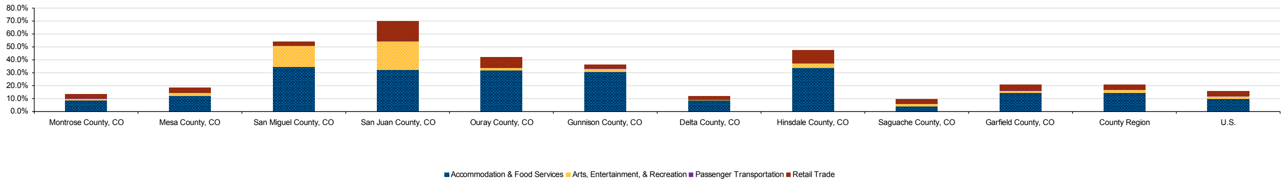
- From 1998 to 2014, travel & tourism employment grew from 17,425 to 20,985 jobs, a 20.4% increase.
- From 1998 to 2014, non-travel & tourism employment grew from 62,663 to 79,971 jobs, a 27.6% increase.

Total Jobs in Industries that Include Travel & Tourism, County Region, 1998-2014



- In, 2014, San Juan County, CO had the largest percent of total travel & tourism employment (70.1%), and Saguache County, CO had the smallest (9.5%).

Percent of Total Private Employment in Industries that Include Travel & Tourism, 2014



Data Sources: U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.

Study Guide and Supplemental Information

How have industries that include travel and tourism changed?

What do we measure on this page?

This page describes trends in industries that include travel and tourism as a percent of all jobs and compares industries containing travel and tourism to the rest of the economy. It also shows jobs in industries that include travel and tourism as a percent of total employment.

The figures on this page that show industries that include travel and tourism as a percent of total jobs do not indicate the size of all travel and tourism related activity. Rather, they show the size of sectors that generally contain travel and tourism as a component of the overall economy. The share of the sectors shown here that corresponds to travel and tourism activities will vary between geographies.

Why is it important?

In some geographies travel and tourism is a significant driver of the economy. This can be true for "resort" economies but also for other areas that have abundant natural and social amenities, and offer recreational opportunities. Public land resources are a primary draw for pleasure travelers in many of these geographies. In some of these places, travel and tourism-related employment is growing faster than overall employment. While pleasure travel and recreation are important economic activities in and of themselves, they also stimulate other forms of economic development when visitors move families and businesses to communities they first visited as tourists.

Methods

This page reports on data and trends in sectors that are most likely to include travel and tourism. The information is useful to understand whether sectors that are likely to be associated with travel and tourism are growing or declining. It is less useful as a measure of the absolute size of employment in travel and tourism. A detailed knowledge, obtained through surveys and other means, is required to determine the proportion of a sector's employment that is due to local expenditures versus expenditures from visitors. It may be useful to supplement the information in this report with surveys and data from: (1) state tourism offices, which sometimes track indicators such as tourism employment, hotel receipts, bed taxes, etc.; (2) local Chambers of Commerce and tourism promotion groups; and (3) Forest Service, Bureau of Land Management, Fish and Wildlife Service, and National Park Service offices. In addition, it may be useful to supplement published statistics with computer models such as IMPLAN.

The top two figures on this page start in 1998 because that is the year the Census Bureau (and County Business Patterns) shifted to using the new North American Industrial Classification System (NAICS). The major industry categories (retail trade; passenger transportation; arts, entertainment, and recreation; and accommodation and food) in the bottom figure are the sum of the sub-categories from the initial page of this report and as shown here do not represent NAICS codes. Some data are withheld by the federal government to avoid the disclosure of potentially confidential information. Headwaters Economics uses data from the U.S. Department of Commerce to estimate these data gaps.

Additional Resources

Daniel Stynes at the University of Michigan provides a web-based resource for how to measure the impacts of tourism, including surveys and computer models such as IMPLAN, as well as links to a number of useful databases and publications. See: mgm2impact.com/ *(4)*.

The Census Bureau conducts an Economic Census every five years for selected industries (the latest was in 2007). This database allows a user to search the 2002 and 2007 Economic Census for information on the number of establishments, sales, employees, and payroll, by selected industries at the county level for selected states. See: census.gov/econ/census07 *(5)*.

The Forest Service collects information on visitor satisfaction and use. Annual summary reports and individual forest and grassland reports are available from: fs.fed.us/recreation/programs/nvum *(6)*.

The U.S. Department of Commerce developed the U.S. Travel and Tourism Satellite Accounts to estimate the proportion of every sector in the economy that is attributable to travel and tourism at the national level. This information is useful for detecting sectors that have a higher potential to serve the needs of non-locals. The resulting ratios should not be applied to local economies. For more information, see: bea.gov/industry/iedguide.htm#ttsa *(7)*.

For more information on amenity-led migration, see the EPS Amenities report.

Data Sources

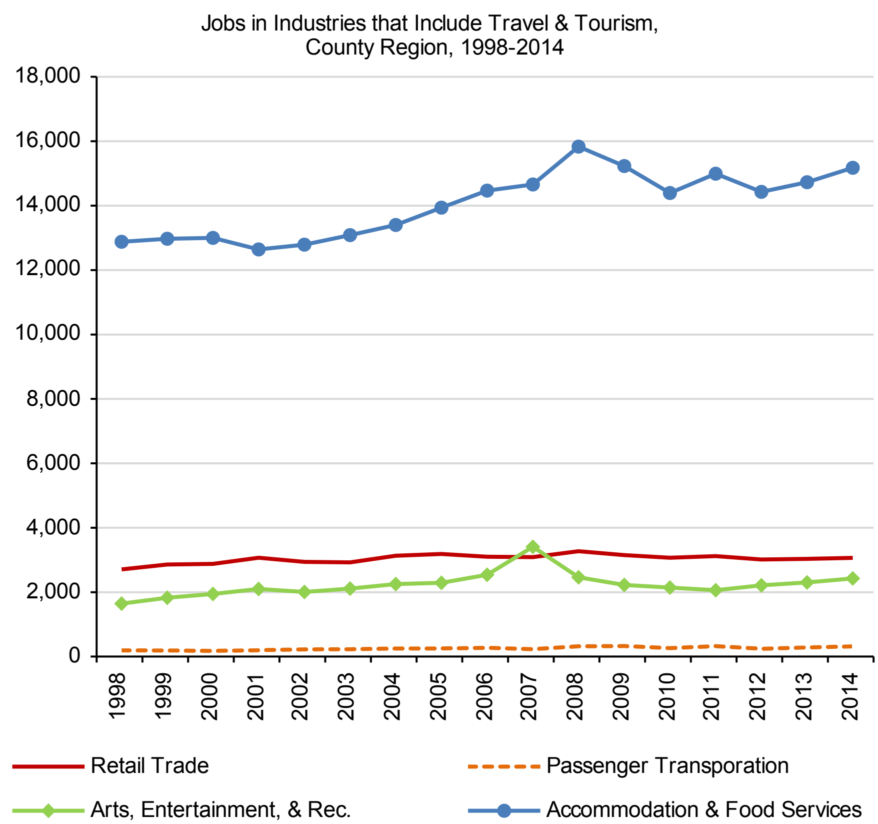
U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.

Which industries that include travel and tourism are changing the fastest?

This page describes the change in employment in sectors that include travel and tourism compared to the change in other sectors, and compares how the various industries that include travel and tourism have changed over time.

- From 1998 to 2014, travel & tourism employment grew by 3,560 jobs.
- From 1998 to 2014, non-travel & tourism employment grew by 17,308 jobs.

- From 1998 to 2014, retail trade grew from 2,708 to 3,066 jobs, a 13.2% increase.
- From 1998 to 2014, passenger transportation grew from 192 to 317 jobs, a 65.1% increase.
- From 1998 to 2014, arts, entertainment, and recreation grew from 1,645 to 2,426 jobs, a 47.5% increase.
- From 1998 to 2014, accommodation and food services grew from 12,880 to 15,176 jobs, a 17.8% increase.



Data Sources: U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.

Study Guide and Supplemental Information

Which industries that include travel and tourism are changing the fastest?

What do we measure on this page?

This page describes the change in employment in sectors that include travel and tourism compared to the change in other sectors, and compares how the various industries that include travel and tourism have changed over time.

Why is it important?

In some geographies travel and tourism is a significant driver of the economy. This can be true for "resort" economies but also for areas that have abundant natural and social amenities, and offer recreational opportunities. Public land resources are a primary draw for pleasure travelers in many of these geographies. In some of these places, travel and tourism-related employment is growing faster than overall employment. While pleasure travel and recreation are important economic activities in and of themselves, they also stimulate other forms of economic development when visitors move families and businesses to communities they first visited as tourists.

Methods

This page reports on data and trends in sectors that are most likely to include travel and tourism. The information is useful to understand whether sectors that are likely to be associated with travel and tourism are growing or declining. It is less useful as a measure of the absolute size of employment in travel and tourism. A detailed knowledge, obtained through surveys and other means, is required to determine the proportion of a sector's employment that is due to local expenditures versus expenditures from visitors.

Data on this page were obtained from County Business Patterns. We use this source because, compared to other sources, it has fewer data gaps (instances when the federal government will not release information to protect confidentiality of individual businesses). It also includes both full and part-time employment. The disadvantage of County Business Patterns data is that it does not include employment in government, agriculture, railroads, or the self-employed and as a result under-count the size of industry sectors. Also, County Business Patterns data are based on mid-March employment and do not take into account seasonal fluctuations. For these reasons, the data are most useful for showing long-term trends, displaying differences between geographies, and showing the relationship between sectors over time.

The charts on this page start in 1998 because that is the year the Census Bureau (and County Business Patterns) shifted to using the new North American Industrial Classification System (NAICS). The major industry categories displayed in the bottom figure are the sum of the sub-categories from the initial page of this report and as shown here do not represent NAICS codes. Some data are withheld by the federal government to avoid the disclosure of potentially confidential information. Headwaters Economics uses data from the U.S. Department of Commerce to estimate these data gaps.

Additional Resources

The Economic Research Service of the U.S. Dept. of Agriculture has developed a widely used classification system for identifying non-metropolitan recreation counties. See Johnson, K.M. and C.L. Beale. 2002. “Non-Metro Recreation Counties: Their Identification and Rapid Growth.” Rural America. 17(4):12-19; available at: ers.usda.gov/publications/ruralamerica/ra174/ra174b.pdf *(8)*.

A number of resources exist that help explain the importance of travel and tourism. See, for example:
Reeder, R.J. and D.M. Brown. 2005. Recreation, Tourism, and Rural Well-Being. U.S. Department of Agriculture, Economic Research Service. ERR-7. 33 pp. ers.usda.gov/publications/err7/err7.pdf *(9)*. Redder and Brown found that, compared to non-tourism dependent counties, those counties dependent on tourism have double the rate of employment growth; significantly higher levels of income and earnings per job; higher rates of population growth; lower rates of poverty; higher rates of education; better access to health care; but more expensive housing and higher rates of crime.

English, D.B.K., D.W. Marcouiller, and H.K. Cordell. 2000. “Tourism Dependence in Rural America: Estimates and Effects.” Society and Natural Resources. 13 (3): 185-202. The study found that counties relatively dependent on tourism, when compared to non-dependent counties, have the following characteristics: higher growth in per capita income; less economic diversity, fewer manufacturing jobs, in particular in wood products sectors; more expensive housing; faster population growth; and higher levels of education. They also found that average household income in tourism dependent counties was about the same as in non-dependent counties.

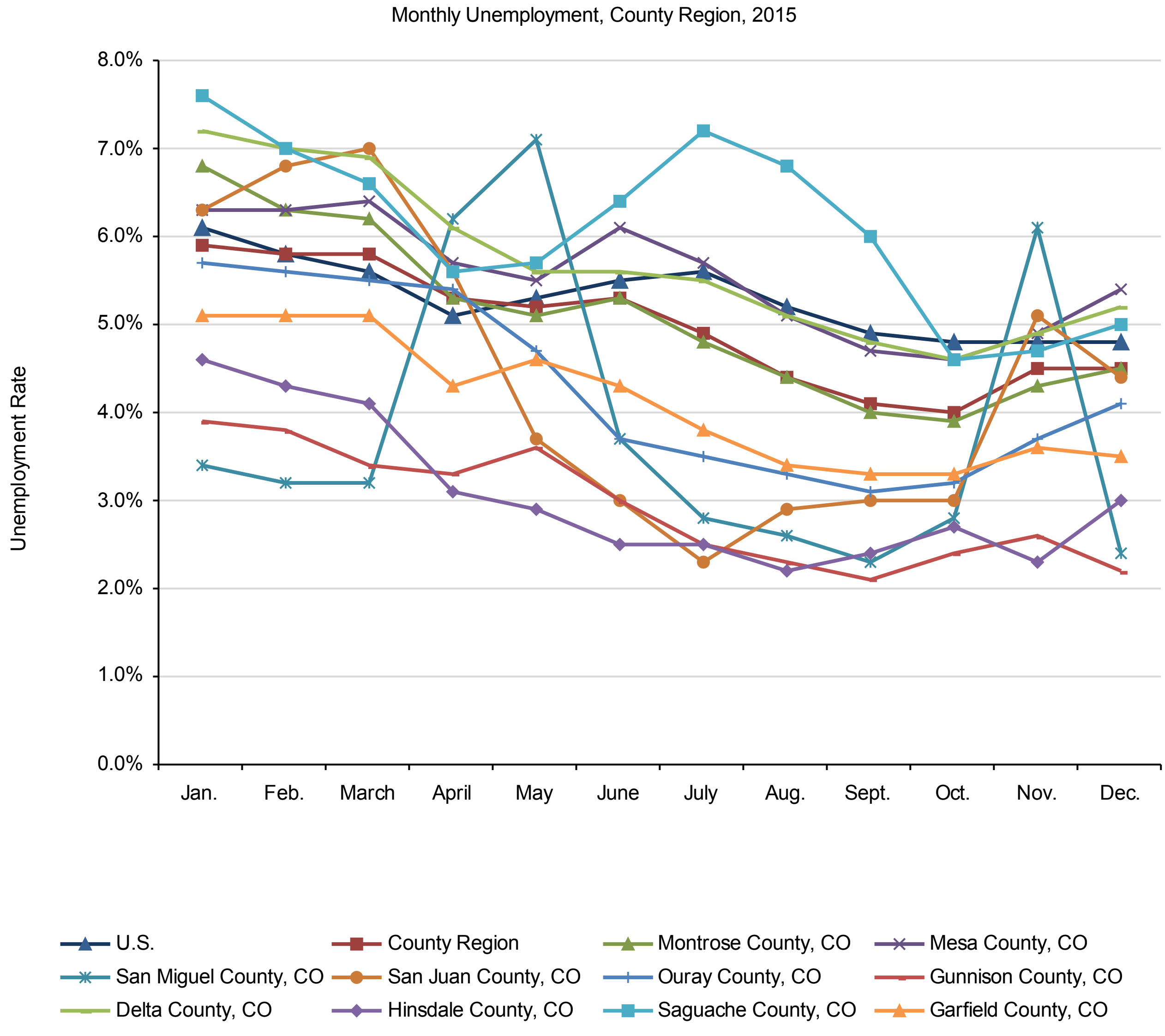
The Federal Reserve Bank of Kansas City has defined travel and tourism as consisting of: hotels, air travel, and amusement and recreation services. See Wilkerson, C. 2003. “Travel and Tourism: An Overlooked Industry in the U.S. and Tenth District.” Economic Review. Federal Reserve Bank of Kansas City. Third Quarter: 45-71. kansascityfed.com/publicat/econrev/PDF/3q03wilk.pdf *(2)*.
Wilkerson points out that travel and tourism related sectors outperformed the nation, including during recessions.
Snepenger D., J. Johnson and R. Rasker. 1994. "Travel Stimulated Entrepreneurial Migration." Journal of Travel Research. Vol. 34(1): 40-44. Snepenger et al. found that tourism can stimulate permanent migration of entrepreneurs.

Data Sources

U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.

To what extent is overall employment seasonal or part time?

This page describes differences in the seasonality of employment and part-time work for all industries.



- In 2015, San Miguel County, CO had the most change in unemployment (biggest absolute value of difference between min and max), and U.S. had the least (smallest absolute value of difference between min and max).

Data Sources: U.S. Department of Labor. 2016. Bureau of Labor Statistics, Local Area Unemployment Statistics, Washington, D.C.

To what extent is overall employment seasonal or part time?

What do we measure on this page?

This page describes differences in the seasonality of employment and part-time work for all industries.

People with jobs (full or part-time) are employed; people who are jobless, looking for jobs, and available for work are unemployed; and people who are neither employed or unemployed are not in the labor force.

Note: If many geographies are selected, it may be difficult to read the top figure on this page.

Why is it important?

Unemployment rate fluctuations reflect not only normal seasonal weather patterns that tend to be repeated year after year, but also the hiring and layoff patterns that accompany regular events such as the winter holiday and summer vacation season. It is possible that some seasonal workers may not live in the geography selected and therefore do not show in the unemployment figures. And seasonal unemployment also occurs in places that have a relatively high concentration in construction, fishing, and agriculture sectors.

Methods

The Bureau of Labor Statistics measures the seasonality of unemployment by tracking the change in month-to-month unemployment.

The County Business Patterns data used elsewhere in this report are based on mid-March employment and do not take into account seasonal fluctuations. March is a "shoulder" season for a number of tourism activities.

Additional Resources

For further analysis on long-term trends in unemployment, run the EPS Socioeconomic Measures report.

For detailed information on how the government measures unemployment, see: bls.gov/cps/cps_htgm.htm *(10)*.

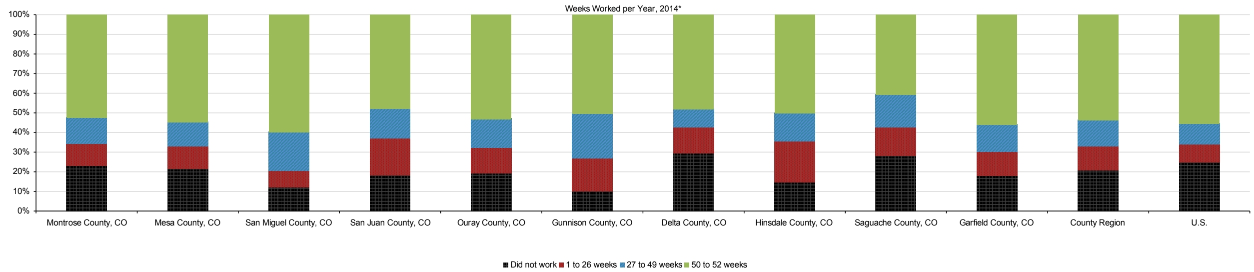
Data Sources

U.S. Department of Labor. 2016. Bureau of Labor Statistics, Local Area Unemployment Statistics, Washington, D.C.

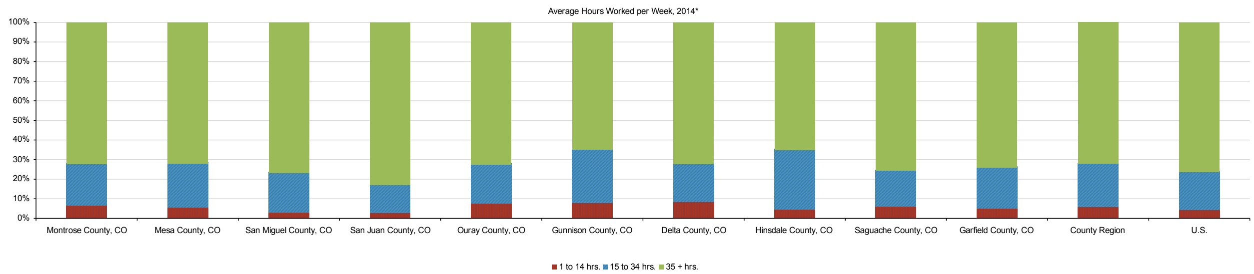
To what extent is overall employment seasonal or part time?

This page describes differences in the seasonality of employment and part-time work for all industries.

- In 2014, 33.4 percent of workers in County Region worked less than 40 weeks over the course of the year, compared to 34.5 percent for the U.S..



- In 2014, 22.3 percent of workers in the County Region worked less than 35 hours per week on average, compared to 18 percent for the the U.S..



Data Sources: U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.

To what extent is overall employment seasonal or part time?

What do we measure on this page?

This page describes differences in the seasonality of employment and part-time work for all industries.

Seasonal jobs are those that vary from season to season (for example, people working in ski resorts are often seasonal workers; as are farm workers who help with seasonal harvests). This is different from part-time workers, who may or may not be seasonal but who work less than 40 hours per week.

Why is it important?

Places that rely economically on tourism can have higher rates of seasonal unemployment and more part-time workers. While seasonal and part-time indicators by themselves are not measures of tourism, they can be used to complement other data in this report and from elsewhere to evaluate the nature and extent of tourism activities.

Methods

The Census Bureau provides two standard measures of part-time work: weeks worked per year and average hours worked per week. Values reported are those of individuals who reported working during 1999 and, therefore, do not include retirees, those unemployed for the entire year of 1999, or other individuals not seeking employment.

The County Business Patterns data used elsewhere in this report are based on mid-March employment and do not take into account seasonal fluctuations. March is a "shoulder" season for a number of tourism activities.

Additional Resources

Daniel Stynes at the University of Michigan provides a web-based resource for how to measure the impacts of tourism, including surveys and computer models such as IMPLAN, as well as links to a number of useful databases and publications. See: mgm2impact.com/ *(4)*.

The Census Bureau conducts an Economic Census every five years for selected industries (the latest was in 2007). This database allows a user to search the 2002 and 2007 Economic Census for information on the number of establishments, sales, employees, and payroll, by selected industries at the county level for selected states. See: census.gov/econ/census07 *(5)*.

The Forest Service collects information on visitor satisfaction and use. Annual summary reports and individual forest and grassland reports are available from: fs.fed.us/recreation/programs/nvum *(6)*.

The U.S. Department of Commerce developed the U.S. Travel and Tourism Satellite Accounts to estimate the proportion of every sector in the economy that is attributable to travel and tourism at the national level. This information is useful for detecting sectors that have a higher potential to serve the needs of non-locals. The resulting ratios should not be applied to local economies. For more information, see: bea.gov/industry/iedguide.htm#ttsa *(7)*.

Data Sources

U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.

How do wages in industries that include travel and tourism compare to wages in other sectors?

This page describes wages (in real terms) from employment in industries that include travel and tourism, including sub-sectors, compared to wages from employment in all non-travel and tourism sectors combined. It also describes the percent of jobs in each category. These are shown together to illustrate the relative wage levels in industries that include travel and tourism, including sub-sectors, and how many people are employed in each sub-sector.

Average Annual Wages, 2015 (2015 $s)

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
All Sectors	$36,713	$41,353	$40,554	$24,200	$35,618	$35,031	$33,178	$28,135	$29,790	$46,534	$40,618	$52,937
Private	$34,472	$40,287	$39,884	$20,639	$35,467	$33,014	$31,114	$26,804	$29,734	$46,997	$39,787	$52,874
Travel & Tourism	$16,911	$17,148	$29,800	$18,014	$20,042	$19,421	$13,857	$20,164	$13,032	$20,393	$19,154	$23,282
Retail Trade	$20,393	$18,679	$30,812	$13,715	$20,984	$18,991	$14,996	$0	$14,176	$21,603	$19,653	$22,287
Gasoline Stations	$21,312	$20,505	$27,727	na	na	$19,012	$16,885	na	$14,176	$22,286	$20,672	$20,279
Clothing & Accessories	$19,490	$15,984	$31,878	$21,533	na	$18,262	$12,803	$0	$0	$18,005	$17,571	$21,759
Misc. Store Retailers	$19,932	$20,148	$31,139	$11,481	$20,984	$19,986	$9,747	na	$0	$22,692	$20,423	$25,341
Passenger Transportation	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$75,131
Air Transportation	na	na	na	$0	$0	na	$0	$0	$0	na	$0	$78,126
Scenic & Sightseeing	$0	na	na	na	na	$0	$0	$0	$0	na	$0	$32,072
Arts, Entertainment, & Rec.	$0	$16,453	$27,917	$26,017	$21,188	$24,453	$24,084	$20,164	$0	$21,715	$22,096	$36,106
Performing Arts & Spectator Sports	na	$24,572	na	na	na	na	$39,949	$0	$0	$52,243	$29,577	$85,886
Museums, Parks, & Historic Sites	$0	$23,595	na	na	na	na	$0	$0	$0	$0	$23,595	$33,439
Amusement, Gambling, & Rec.	na	$14,898	$27,917	$26,017	$21,188	$24,453	$15,269	$20,164	na	$19,993	$21,670	$21,780
Accommodations & Food	$16,236	$16,891	$30,615	$16,960	$19,708	$16,965	$13,475	$0	$12,181	$19,995	$18,515	$19,416
Accommodation	$19,758	$21,107	$34,026	$21,008	$20,765	$20,123	$14,259	na	na	$24,753	$23,850	$29,617
Food Services & Drinking Places	$15,731	$16,035	$27,634	$15,482	$18,997	$15,879	$13,364	na	$12,181	$18,323	$16,994	$17,642
Non-Travel & Tourism	$37,292	$45,207	$46,023	$0	$44,690	$37,391	$30,928	$32,889	$30,248	$52,349	$44,465	$58,417
Government	$44,844	$47,189	$44,317	$55,114	$36,048	$41,777	$38,384	$30,948	$55,675	$44,620	$44,639	$53,289

This table shows wage data from the Bureau of Labor Statistics, which does not report data for proprietors or the value of benefits; the major industry categories (retail trade, passenger transportation; arts, entertainment, and recreation; and accommodation and food) are the sum of the sub-categories underneath them and as shown here do not represent NAICS codes.

Percent of Total Employment, 2015

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Private	78.4%	84.5%	84.9%	74.6%	77.7%	77.0%	71.5%	67.9%	67.4%	80.6%	81.3%	84.8%
Travel & Tourism	10.2%	14.8%	37.1%	43.0%	32.0%	30.0%	10.6%	2.6%	4.2%	15.3%	16.1%	13.4%
Retail Trade	1.7%	2.5%	1.9%	6.2%	5.1%	2.2%	1.5%	0.0%	1.8%	2.1%	2.2%	2.2%
Gasoline Stations	0.6%	0.8%	0.4%	na	na	0.7%	1.0%	na	1.8%	1.1%	0.9%	0.6%
Clothing & Accessories	0.3%	0.9%	1.1%	1.4%	na	0.9%	0.1%	0.0%	0.0%	0.4%	0.7%	1.0%
Misc. Store Retailers	0.7%	0.7%	0.4%	4.8%	5.1%	0.6%	0.3%	na	0.0%	0.5%	0.7%	0.6%
Passenger Transportation	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%
Air Transportation	na	na	na	0.0%	0.0%	na	0.0%	0.0%	0.0%	na	0.0%	0.3%
Scenic & Sightseeing	0.0%	na	na	na	na	0.0%	0.0%	0.0%	0.0%	na	0.0%	0.0%
Arts, Entertainment, & Rec.	0.0%	1.5%	11.3%	7.2%	2.8%	9.2%	0.2%	2.6%	0.0%	1.6%	2.2%	1.5%
Performing Arts & Spectator Sports	na	0.2%	na	na	na	na	0.1%	0.0%	0.0%	0.1%	0.1%	0.3%
Museums, Parks, & Historic Sites	0.0%	0.1%	na	na	na	na	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
Amusement, Gambling, & Rec.	na	1.2%	11.3%	7.2%	2.8%	9.2%	0.1%	2.6%	na	1.5%	2.0%	1.1%
Accommodations & Food	8.5%	10.8%	23.9%	29.6%	24.1%	18.5%	9.0%	0.0%	2.4%	11.6%	11.7%	9.3%
Accommodation	1.1%	1.8%	11.1%	7.9%	9.7%	4.7%	1.1%	na	na	3.0%	2.6%	1.4%
Food Services & Drinking Places	7.5%	9.0%	12.7%	21.6%	14.4%	13.8%	7.9%	na	2.4%	8.6%	9.1%	7.9%
Non-Travel & Tourism	61.5%	69.4%	37.5%	0.0%	16.7%	35.8%	54.6%	17.9%	42.5%	59.2%	60.6%	71.4%
Government	21.6%	15.5%	15.1%	1.0%	22.4%	23.0%	28.4%	32.1%	2.8%	19.4%	18.2%	15.2%

Data Sources: U.S. Department of Labor. 2016. Bureau of Labor Statistics, Quarterly Census of Employment and Wages, Washington, D.C.

How do wages in industries that include travel and tourism compare to wages in other sectors?

What do we measure on this page?

This page describes wages (in real terms) from employment in industries that include travel and tourism, including sub-sectors, compared to wages from employment in all non-travel and tourism sectors combined. It also describes the percent of jobs in each category. These are shown together to illustrate the relative wage levels in industries that include travel and tourism, including sub-sectors, and how many people are employed in each sub-sector.

The primary purpose of this page is to compare the average annual wages between sectors and to investigate the relative number of people employed in high and low-wage sectors.

Travel and Tourism: Consists of sectors that provide goods and services to visitors to the local economy, as well as to the local population. These industries are: retail trade; passenger transportation; arts, entertainment, and recreation; and accommodation and food. It is not known, without additional research such as surveys, what exact proportion of the jobs in these sectors is attributable to expenditures by visitors, including business and pleasure travelers, versus by local residents. Some researchers refer to these sectors as “tourism-sensitive.” They could also be called “travel and tourism-potential sectors” because they have the potential of being influenced by expenditures by non-locals. In this report, they are referred to as "industries that include travel and tourism."

Why is it important?

Industries that contain travel and tourism often pay relatively low wages, though this varies by industry sub-sector and by geography. Some important issues to consider are how travel and tourism-related industry wages compare to wages in other sectors, whether some components of the travel and tourism-related industry pay higher wages than others, and if there are significant wage differences between geographies. When comparing wage levels, it also useful to remember that many travel and tourism-related jobs are seasonal and/or part-time. Refer to the previous page of this report for more information on the extent to which work is seasonal and/or part-time.

Methods

This page reports on data in sectors that are more likely to include travel and tourism. The information is useful to understand the mix of sectors that are likely to be associated with travel and tourism. It is less useful as a measure of the absolute size of employment in travel and tourism. A detailed knowledge, obtained through surveys and other means, is required to determine the proportion of a sector's employment that is due to local expenditures versus expenditures from visitors.

The tables use wage and employment data from the Bureau of Labor Statistics, which does not report data for proprietors or the value of benefits. As a result, the percent of employment values may not exactly match those on earlier pages of this report from County Business Patterns.

The major industry categories (retail trade; passenger transportation; arts, entertainment, and recreation; and accommodation and food) are the sum of the sub-categories underneath them and as shown here do not represent NAICS codes. These are the same categories and sub-categories used in the initial pages of this report.

Depending on the geographies selected, some data may not be available due to disclosure restrictions.

Some data are withheld by the federal government to avoid the disclosure of potentially confidential information. Headwaters Economics uses custom data aggregations calculated from various NAICS codes. Occasionally, one or more data values underlying these aggregations are non-disclosed. These values are indicated with tildes (~).

Additional Resources

For an overview of how the Bureau of Labor Statistics treats employment, see: bls.gov/bls/employment.htm *(11)*.

For an overview of how the Bureau of Labor Statistics treats pay and benefits, see: bls.gov/bls/wages.htm *(12)*.

Employment and wage estimates are also available from the Bureau of Labor Statistics for over 800 occupations. Looking at travel and tourism by occupation, rather than by sector or industry, is helpful since wages can vary dramatically across occupations. For more information, see: bls.gov/oes *(13)*.

For more information on wages in non-travel and tourism industries run the EPS Socioeconomic Measures report.

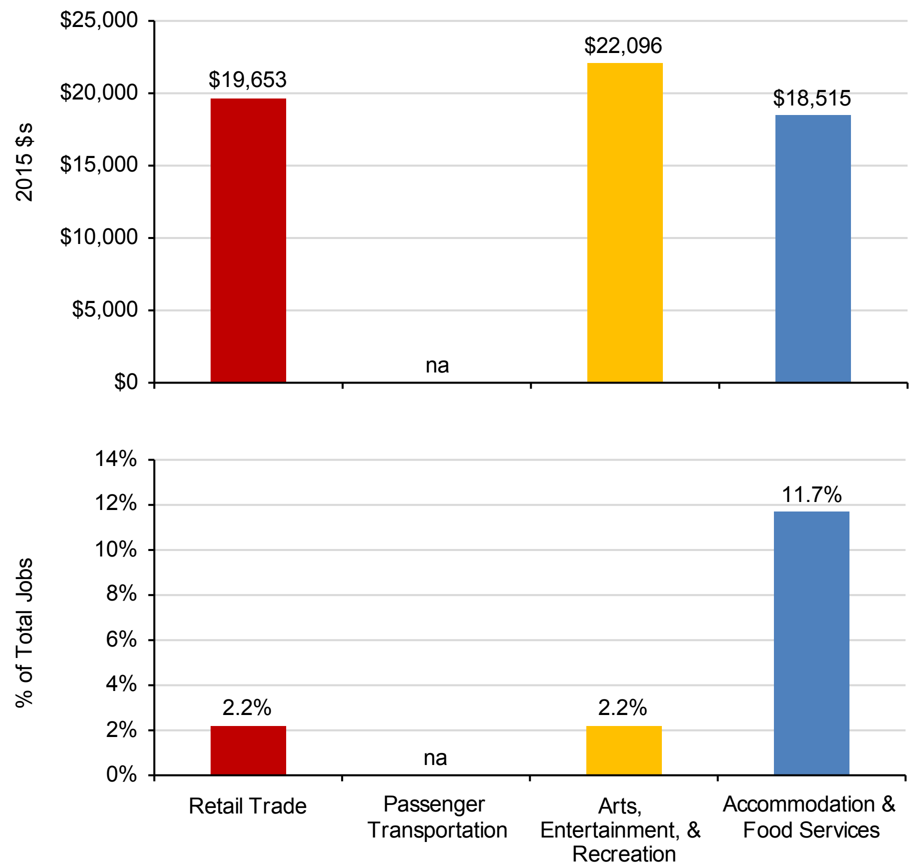
Data Sources

U.S. Department of Labor. 2016. Bureau of Labor Statistics, Quarterly Census of Employment and Wages, Washington, D.C.

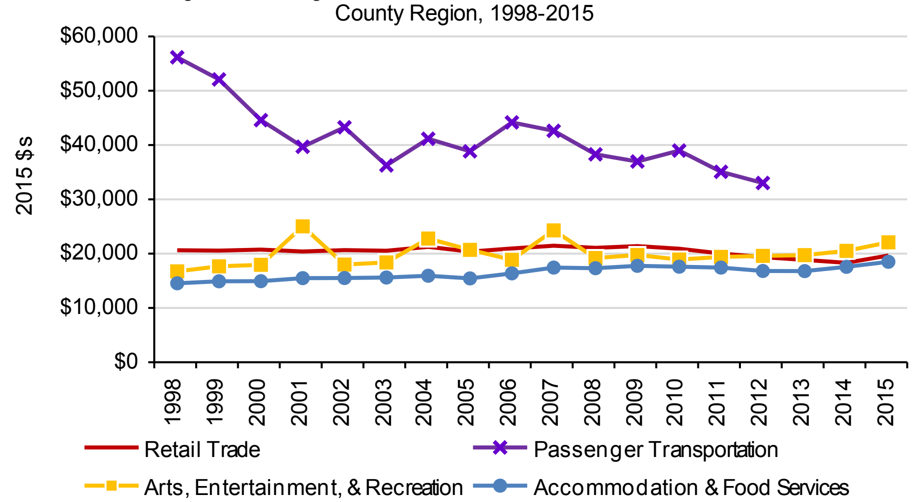
How do jobs and wages in industries that include travel and tourism compare?

This page describes average wages (in real terms) and employment levels in industries that include travel and tourism. It also shows average wage trends (in real terms) for industries that include travel and tourism at the regional level.

Avg. Annual Wages and Percent of Total Jobs in Industries that Include Travel & Tourism, County Region, 2015



Avg. Annual Wages in Industries that Include Travel & Tourism, County Region, 1998-2015



Data Sources: U.S. Department of Labor. 2016. Bureau of Labor Statistics, Quarterly Census of Employment and Wages, Washington, D.C.

How do jobs and wages in industries that include travel and tourism compare?

What do we measure on this page?

This page describes average wages (in real terms) and employment levels in industries that include travel and tourism. It also shows average wage trends (in real terms) for industries that include travel and tourism at the regional level.

The figure *Avg. Annual Wages and Percent of Total Jobs in Industries that Include Travel and Tourism* is useful for describing how many people are working in relatively high and low-wage travel and tourism-related industries. The figure *Avg. Annual Wages in Industries that Include Travel and Tourism* is useful for comparing wage trends by sector.

Why is it important?

While industries that include travel and tourism often pay relatively low wages, not all components of the travel and tourism-related industry pay the same wages or employ the same number of people. A significant increase in travel and tourism jobs that pay below the average for all industries will decrease overall average earnings per job. On the other hand, a significant increase in travel and tourism jobs that pay above the average for all industries will increase overall average earnings per job. A modest change in travel and tourism-related employment, especially when this is a small share of total employment, will not likely affect average earnings in a local area.

Methods

This page reports on data and trends in sectors that are more likely to include travel and tourism. The information is useful to understand whether sectors that are likely to be associated with travel and tourism are growing or declining. It is less useful as a measure of the absolute size of employment in travel and tourism. A detailed knowledge, obtained through surveys and other means, is required to determine the proportion of a sector's employment that is due to local expenditures versus expenditures from visitors.

The figures use wage and employment data from the Bureau of Labor Statistics, which does not report data for proprietors or the value of benefits. As a result, the percent of employment values may not exactly match those on initial pages of this report from County Business Patterns. The major industry categories (retail trade; passenger transportation; arts, entertainment, and recreation; and accommodation and food) are the sum of the sub-categories from the previous page of this report and as shown here do not represent NAICS codes. These are the same categories and sub-categories used in the initial pages of this report. The bottom figure on this page starts in 1998 to be consistent with the start date of figures on earlier pages of this report

Depending on the geographies selected, some data may not be available due to disclosure restrictions.

Additional Resources

For an overview of how the Bureau of Labor Statistics treats employment, see: bls.gov/bls/employment.htm *(11)*.

For an overview of how the Bureau of Labor Statistics treats pay and benefits, see: bls.gov/bls/wages.htm *(12)*.

If there are significant undisclosed data on this page, other sources for travel & tourism wage data include:

The Bureau of Labor Statistics' Quarterly Census of Employment and Wages, which has data for industries at the state level, is available at: data.bls.gov/pdq/VersionInfo.jsp?version=0.0.0 *(14)*.

The Bureau of Labor Statistics' Occupational Outlook Handbook, 2010-2011 Edition, which has detailed industry earnings and wages data at the national level, is available at: bls.gov/oco *(15)*.

The County Business Patterns database, which reports industry-level employment and payroll and can be used to estimate earnings, is available at: census.gov/econ/cbp/index.html *(16)*.

Data Sources

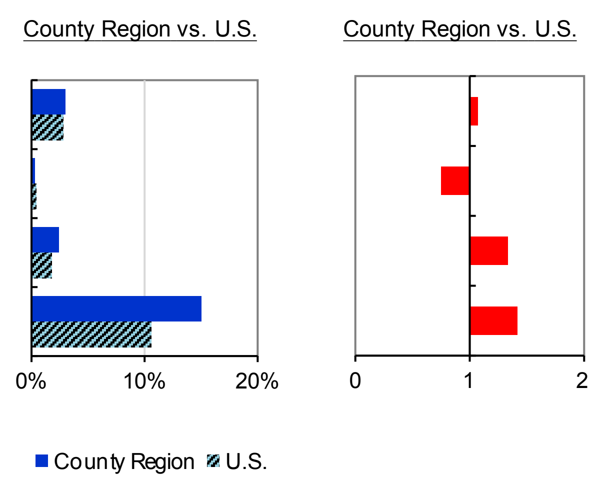
U.S. Department of Labor. 2016. Bureau of Labor Statistics, Quarterly Census of Employment and Wages, Washington, D.C.

How does regional employment in industries that include travel and tourism and other measures compare to the U.S.?

This page describes the difference in travel-and-tourism specialization between the region and the U.S. by comparing jobs in industry sectors that include travel and tourism as a share of total employment and with location quotients. It also shows other possible indicators of travel and tourism (part-time work and second homes) at the regional level.

Percent of Total Private Employment in Industry Sectors that Include Travel & Tourism, County Region vs. U.S., 2014

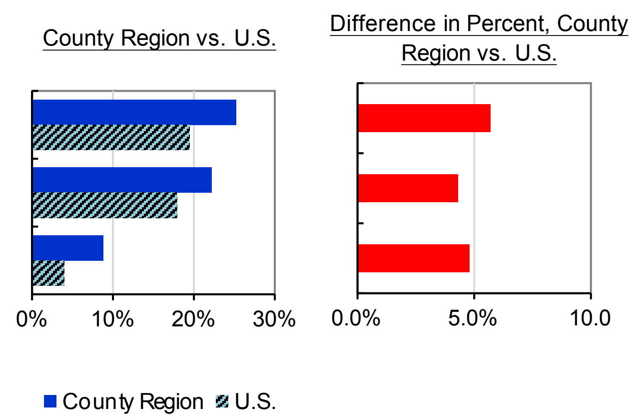
	Employment Share		Location Quotient
Industries Including Travel and Tourism	County Region	U.S.	
Retail Trade	3.0%	2.8%	1.1
Passenger Transportation	0.3%	0.4%	0.8
Arts, Entertainment, & Recreation	2.4%	1.8%	1.3
Accommodation & Food	15.0%	10.6%	1.4



- In 2014, accommodation & food had the highest location quotient score (1.4) and passenger transportation had the lowest (0.8).

Other Possible Measures of the Presence of Travel and Tourism, County Region vs. U.S., 2014*

Indicators of Seasonal Work and Housing	County Region	U.S.	Diff.
Part-Time Work (less than 50 weeks per year)	25.2%	19.5%	5.7%
Part-Time Work (less than 35 hours per week)	22.2%	17.9%	4.3%
Second Homes	8.8%	4.0%	4.8%



- In 2014, the difference between County Region and the U.S. in the percent of people working less than 40 weeks per year was 5.7%.
- In 2014, the difference between County Region and the U.S. in the percent of people working less than 35 hours per week was 4.3%.
- In 2014, the difference between County Region and the U.S. in the percent of homes which were second homes was 4.8%.

Data Sources: U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.; U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.

How does regional employment in industries that include travel and tourism and other measures compare to the U.S.?

What do we measure on this page?

This page describes the difference in travel-and-tourism specialization between the region and the U.S. by comparing jobs in industry sectors that include travel and tourism as a share of total employment and with location quotients. It also shows other possible indicators of travel and tourism (part-time work and second homes) at the regional level.

Location quotient: A ratio that compares an industry's share of total employment in a region to the national share. More precisely, it is the percent of local employment in a sector divided by the percent employment in the same sector in the U.S. In other words, it is a ratio that measures specialization, using the U.S. as a benchmark. A location quotient of more than 1.0 means the local area is more specialized in that sector relative to the U.S. A location quotient of less than 1.0 means it is less specialized.

The term "benchmark" in this report should not be construed as having the same meaning as in the National Forest Management Act (NFMA).

Why is it important?

Geographies with economies that focus on travel and tourism may have a competitive advantage in this area, but can also be sensitive to business cycles and other changes (e.g., a rise in fuel costs) that affect pleasure travel and recreation spending. Public lands represent a tremendous scenic and recreational resource, and travel and tourism activities related to these lands can benefit local communities and in some cases diversify rural economies that have historically been tied to commodity production. The growth of travel and tourism activities is also associated with in-migration that can lead to business relocation and new business development across a range of business sectors.

A useful way to think about location quotients is as a measure of whether a place or geography produces enough goods or services from an industry to satisfy local demand for those goods or services. Results above or below the 1.0 standard indicate the degree to which a place or geography may import or export a good or service. Although there is no precise cutoff, location quotients above 2.0 indicate a strong industry concentration (and that an area is likely exporting goods or services) and those less than .5 indicate a weak industry concentration (and that an area is likely importing goods or services). A few caveats: (1) A large location quotient for a particular sector does not necessarily mean that sector is a significant contributor to the economy. (2) LQs greater than 1.0 only suggest potential export capacity when compared to the U.S. and do not take into account local demand. Local demand may be greater than a national average, and therefore all goods and services may be consumed locally (i.e., not exported). (3) LQs can change from year to year. (4) LQs can vary when income or wage data are used rather than employment.

Methods

LQ = (ei/e) divided by (Ei/E)
Where: ei = Local employment in industry i; e = Total local employment; Ei = U.S. employment in industry i; E = Total U.S. employment.
The number of second homes is not available as a single variable from the Census Bureau. We have calculated second homes as a percent of total homes as follows: seasonally occupied homes (Census SF1 H005005) are added to other vacant homes (Census SF1 H005007) and then divided by total homes. By this definition, second homes do not include homes that are vacant because they are for rent or sale.
Some data are withheld by the federal government to avoid the disclosure of potentially confidential information. Headwaters Economics uses data from the U.S. Department of Commerce to estimate these data gaps. These values are indicated with tildes (~).

Additional Resources

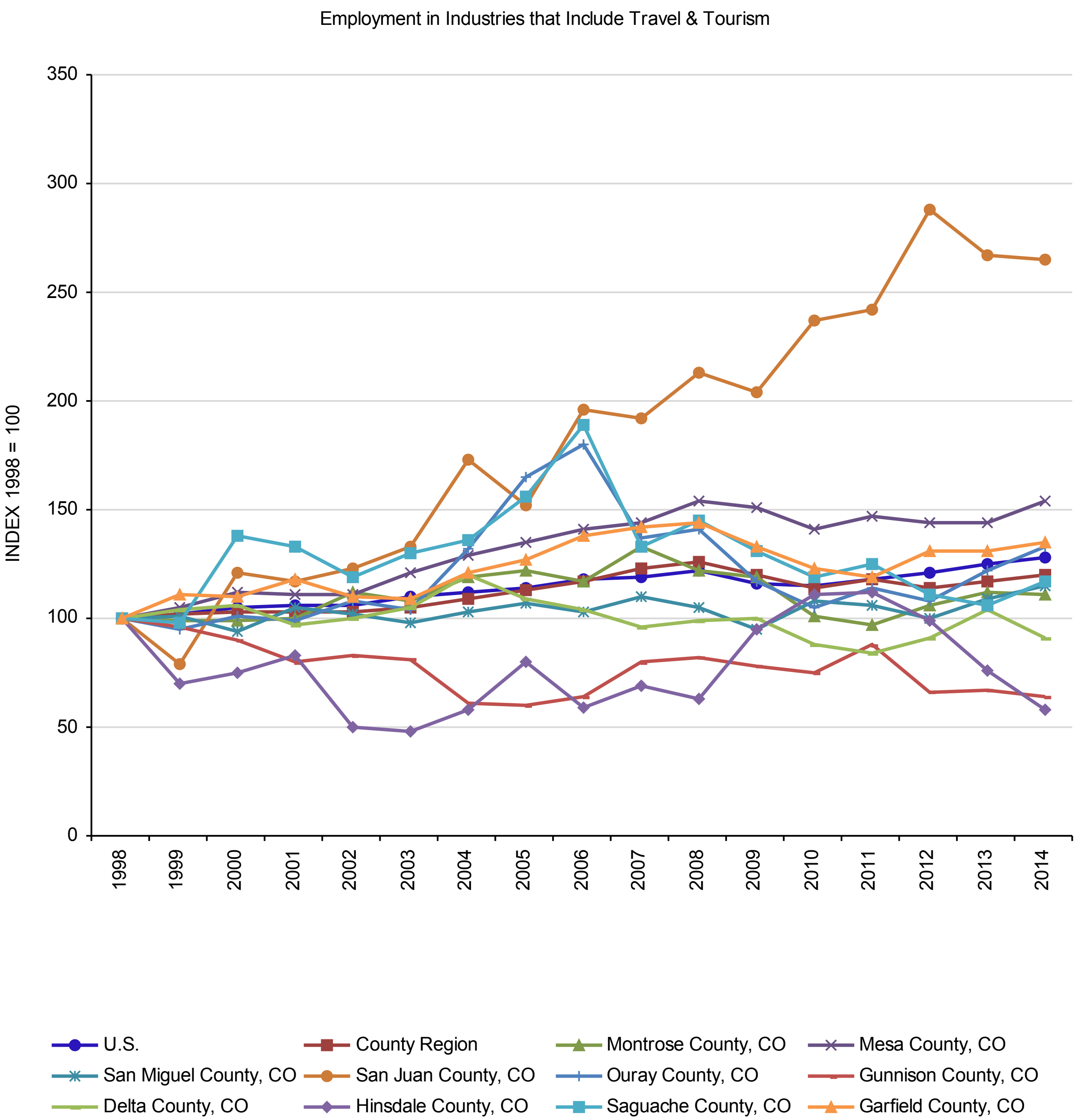
For a review of literature on economic diversity, see Sterling 1998. "On the Economics and Analysis of Diversity." Electronic Working Papers Series, University of Sussex, available at: sussex.ac.uk/Units/spru/publications/imprint/sewps/sewp28/sewp28.pdf *(17)*.
A useful book on the evolving competitive environment for rural areas is: Gaston, William A., and Karen J. Baehler. 1995. Rural Development in the United States: Connecting Theory, Practice, and Possibilities. Washington: Island Press.
A succinct definition of a location quotient is offered by Florida State University's Department of Urban and Regional Planning: mailer.fsu.edu/~tchapin/garnet-tchapin/urp5261/topics/econbase/lq.htm *(18)*.
Documentation explaining methods developed by Headwaters Economics for estimating disclosure gaps is available at headwaterseconomics.org/eps *(3)*.

Data Sources

U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.; U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.

How does employment in industries that include travel and tourism compare across geographies?

This page describes the change in employment in industries that include travel and tourism for all selected geographies and the U.S. The information is indexed (1998=100) so that data from counties with different size economies can be compared to each other, and to larger geographies.



- From 1998 to 2014, County Region had the fastest rate of change in travel & tourism employment, and Montrose County, CO had the slowest.

Data Sources: U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.

Study Guide and Supplemental Information

How does employment in industries that include travel and tourism compare across geographies?

What do we measure on this page?

This page describes the change in employment in industries that include travel and tourism for all selected geographies and the U.S. The information is indexed (1998=100) so that data from counties with different size economies can be compared to each other, and to larger geographies. Indexing makes it easier to understand the relative rate of change in employment over time.

Index: Indexed numbers are compared with a base value. In the line chart, employment in 1998 is the base value, and is set to 100. The employment values for subsequent years are expressed as 100 times the ratio to the base value. The indexing used in the line chart enables easier comparisons between geographies over time.

The term "benchmark" in this report should not be construed as having the same meaning as in the National Forest Management Act (NFMA).
Note: If many geographies are selected, it may be difficult to read the figure on this page.

Why is it important?

Not all geographies have attracted or lost travel and tourism-related employment at the same rate. An index makes it clear where the rate of travel and tourism-related growth or decline has been the fastest. Lines above 100 indicate positive absolute growth while those below 100 show absolute decline. The steeper the curve the faster the rate of change. It may be helpful to look for large year-to-year rises or dips in figure lines to identify rapid employment changes. If the reasons behind these fluctuations are not evident, it may be helpful to talk with regional experts or locals to learn more about what caused abrupt changes.

Geographies with economies that focus on travel and tourism may have a competitive advantage in this area, but can also be sensitive to business cycles and other changes (e.g., a rise in fuel costs) that affect pleasure travel and recreation spending. Public lands represent a tremendous scenic and recreational resource, and travel and tourism activities related to these lands can benefit local communities and in some cases diversify rural economies that have historically been tied to commodity production. The growth of travel and tourism activities is also associated with in-migration that can lead to business relocation and new business development across a range of business sectors.

Methods

This page reports on trends in sectors more likely to include travel and tourism. The information is useful to understand whether sectors likely to be associated with travel and tourism are growing or declining. These data do not measure the absolute size of employment in travel and tourism. Detailed knowledge, obtained through surveys and other means, is required to determine the proportion of a sectors' employment that is due to local expenditures versus expenditures from visitors. The figure on this page begins in 1998 because that is the year the Census Bureau (and County Business Patterns) shifted to using the new North American Industrial Classification System (NAICS). Some data are withheld by the federal government to avoid the disclosure of potentially confidential information. Headwaters Economics uses data from the U.S. Department of Commerce to estimate these data gaps.

Additional Resources

The Economic Research Service of the U.S. Dept. of Agriculture has developed a widely-used classification system for identifying non-metropolitan recreation counties. See Johnson, K.M. and C.L. Beale. 2002. "Non-Metro Recreation Counties: Their Identification and Rapid Growth." Rural America. 17(4): 12-19 ; available at: ers.usda.gov/publications/ruralamerica/ra174/ra174b.pdf *(8)*.
Reeder, R.J. and D.M. Brown. 2005. Recreation, Tourism, and Rural Well-Being. U.S. Department of Agriculture, Economic Research Service. ERR-7. 33 pp. ers.usda.gov/publications/err7/err7.pdf *(9)*. Redder and Brown found that, compared to non-tourism dependent counties, those counties dependent on tourism have double the rate of employment growth; significantly higher levels of income and earnings per job; higher rates of population growth; lower rates of poverty; higher rates of education; better access to health care; but more expensive housing and higher rates of crime.
English, D.B.K., D.W. Marcouiller, and H.K. Cordell. 2000. "Tourism Dependence in Rural America: Estimates and Effects." Society and Natural Resources. 13 (3): 185-202. English et al. found that counties relatively dependent on tourism, when compared to non-tourism dependent counties, have the following characteristics: higher growth in per capita income; less economic diversity, with fewer employed in manufacturing, in particular in wood products sectors; housing that is more expensive; faster population growth; and higher levels of education. They also found that the average household income in tourism dependent counties was about the same as in nondependent counties.
Snepenger D., J. Johnson and R. Rasker. 1994. "Travel Stimulated Entrepreneurial Migration." Journal of Travel Research. Vol. 34(1): 40-44. Snepenger et al. found that tourism can stimulate permanent migration of entrepreneurs.
Documentation explaining methods developed by Headwaters Economics for estimating disclosure gaps is available at headwaterseconomics.org/eps *(3)*.

Data Sources

U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.

Data Sources

The EPS Services report uses published statistics from government sources that are available to the public and cover the entire country. All data used in EPS can be readily verified by going to the original source. The contact information for databases used in this profile is:

- **County Business Patterns**
  Census Bureau, U.S. Department of Commerce
  http://www.census.gov/epcd/cbp/view/cbpview.html
  Tel. 301-763-2580

- **American Community Survey**
  Census Bureau, U.S. Department of Commerce.
  http://www.census.gov
  Tel. 303-969-7750
  The on-line ACS data retrieval tool is available at:
  http://www.census.gov/acs/www/

- **Quarterly Census of Employment and Wages**
  Bureau of Labor Statistics, U.S. Department of Labor
  http://www.bls.gov/cew
  Tel. 202-691-6567

- **Local Area Unemployment Statistics**
  Bureau of Labor Statistics, U.S. Department of Labor
  http://www.bls.gov/lau
  Tel. 202-691-6392

Methods

EPS core approaches: EPS is designed to focus on long-term trends across a range of important measures. Trend analysis provides a more comprehensive view of changes than spot data for select years. We encourage users to focus on major trends rather than absolute numbers. EPS displays detailed industry-level data to show changes in the composition of the economy over time and the mix of industries at points in time. EPS employs cross-sectional benchmarking, comparing smaller geographies such as counties to larger regions, states, and the nation, to give a sense of relative performance. EPS allows users to aggregate data for multiple geographies, such as multi-county regions, to accommodate a flexible range of user-defined areas of interest and to allow for more sophisticated cross-sectional comparisons.

SIC to NAICS: Starting in the 1930s, the Standard Industrial Classification (SIC) system has served as the structure for the collection, aggregation, presentation, and analysis of the U.S. economy. Under SIC, which employed a four-digit coding structure, an industry consists of a group of establishments primarily engaged in producing or handling the same product or group of products or in rendering the same services. As the U.S. economy shifted from a primary emphasis on manufacturing to a more complex services economy, SIC became less useful as a tool for describing the economy's changing industrial composition.

The North American Industry Classification System (NAICS), developed using a production-oriented conceptual framework, groups establishments into industries based on the activity in which they are primarily engaged. NAICS uses a six-digit hierarchical coding system to classify all economic activity into twenty industry sectors. Five sectors are mainly goods-producing sectors and fifteen are entirely services-producing sectors.

County Business Patterns started organizing their data using NAICS in 1998, Census in 2000, and Bureau of Economic Analysis's Regional Economic Information System in 2001. Because the methods underlying SIC and NAICS are fundamentally different (what was sold vs. how it was produced), NAICS is not backward compatible with SIC. There are a few circumstances where it is acceptable to show uninterrupted trends across the SIC-NAICS discontinuity. Total personal income, total labor income, and non-labor income can all be plotted continuously without a problem. In addition, a few industries can also be plotted without a break, though this is not the case for services.

Adjusting dollar figures for inflation: Because a dollar in the past was worth more than a dollar today, data reported in current dollar terms should be adjusted for inflation. The U.S. Department of Commerce reports personal income figures in terms of current dollars. All income data in EPS are adjusted to real (or constant) dollars using the Consumer Price Index. Figures are adjusted to the latest date for which the annual Consumer Price Index is available.

Data gaps and estimation: Some data are withheld by the federal government to avoid the disclosure of potentially confidential information. Headwaters Economics uses supplemental data from the U.S. Department of Commerce to estimate these data gaps. These are indicated in italics in tables. Documentation explaining methods developed by Headwaters Economics for estimating disclosure gaps is available at headwaterseconomics.org/eps.

For more information about EPS see:

headwaterseconomics.org/EPS

Web pages listed under Additional Resources include:

Throughout this report, references to on-line resources are indicated with italicized numbers in parentheses. These resources are provided as hyperlinks here.

1 www.ingentaconnect.com/content
2 www.kansascityfed.com/publicat/econrev/PDF/3q03wilk.pdf
3 headwaterseconomics.org/eps
4 http://mgm2impact.com/
5 www.census.gov/econ/census07
6 www.fs.fed.us/recreation/programs/nvum
7 www.bea.gov/industry/iedguide.htm#ttsa
8 www.ers.usda.gov/publications/ruralamerica/ra174/ra174b.pdf
9 www.ers.usda.gov/publications/err7/err7.pdf
10 www.bls.gov/cps/cps_htgm.htm
11 www.bls.gov/bls/employment.htm
12 www.bls.gov/bls/wages.htm
13 www.bls.gov/oes
14 http://data.bls.gov/pdq/VersionInfo.jsp?version=0.0.0
15 www.bls.gov/oco
16 www.census.gov/econ/cbp/index.html
17 www.sussex.ac.uk/Units/spru/publications/imprint/sewps/sewp28/sewp28.pdf
18 www.mailer.fsu.edu/~tchapin/garnet-tchapin/urp5261/topics/econbase/lq.htm

A Profile of Demographics

County Region

Selected Geographies:

Montrose County, CO; Mesa County, CO; San Miguel County, CO; San Juan County, CO; Ouray County, CO; Gunnison County, CO; Delta County, CO; Hinsdale County, CO; Saguache County, CO; Garfield County, CO

Benchmark Geographies:

U.S.

Produced by
Economic Profile System
EPS
November 28, 2016

About the Economic Profile System (EPS)

EPS is a free, easy-to-use software application that produces detailed socioeconomic reports of counties, states, and regions, including custom aggregations.

EPS uses published statistics from federal data sources, including Bureau of Economic Analysis and Bureau of the Census, U.S. Department of Commerce; and Bureau of Labor Statistics, U.S. Department of Labor.

The Bureau of Land Management and Forest Service have made significant financial and intellectual contributions to the operation and content of EPS.

See headwaterseconomics.org/EPS for more information about the other tools and capabilities of EPS.

For technical questions, contact Patty Gude at eps@headwaterseconomics.org, or 406-599-7425.

HEADWATERS ECONOMICS

headwaterseconomics.org

Headwaters Economics is an independent, nonprofit research group. Our mission is to improve community development and land management decisions in the West.

www.blm.gov

The Bureau of Land Management, an agency within the U.S. Department of the Interior, administers 249.8 million acres of America's public lands, located primarily in 12 Western States. It is the mission of the Bureau of Land Management to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations.

www.fs.fed.us

The Forest Service, an agency of the U.S. Department of Agriculture, administers national forests and grasslands encompassing 193 million acres. The Forest Service's mission is to achieve quality land management under the "sustainable multiple-use management concept" to meet the diverse needs of people while protecting the resource. Significant intellectual, conceptual, and content contributions were provided by the following individuals: Dr. Pat Reed, Dr. Jessica Montag, Doug Smith, M.S., Fred Clark, M.S., Dr. Susan A. Winter, and Dr. Ashley Goldhor-Wilcock.

Table of Contents

Note to Users:

Because ACS is based on a survey, it is subject to error. The Census Bureau reports the accuracy of the data by providing margins of error (MOE) for every data point. In this report, we alert the user to the data accuracy using color-coded text in the tables: BLACK indicates a coefficient of variation (CV) < 12%; ORANGE (preceded with one dot) indicates between 12 and 40%; and **RED BOLD** (preceded with two dots) indicates a CV > 40%.

This is one of fourteen reports that can be created and downloaded from EPS Web. You may want to run another EPS report for either a different geography or topic. Topics include land use, demographics, specific industry sectors, the role of non-labor income, the wildland-urban interface, the role of amenities in economic development, and payments to county governments from federal lands. Throughout the reports, references to online resources are indicated in parentheses. These resources are provided as hyperlinks on each report's final page. The EPS reports are downloadable as Excel, PDF, and Word documents. For further information and to download reports, go to:

headwaterseconomics.org/eps

How has population changed?

This page describes the total population and change in total population.

Note: with the exception of some 2000 Decennial Census data used on pages 1-3, all other data used in this report are from the American Community Survey (ACS) of the Census Bureau. Red, orange, and black text indicate different data quality thresholds – please read the Methods section in the Study Guide text.

Population, 2000-2014*

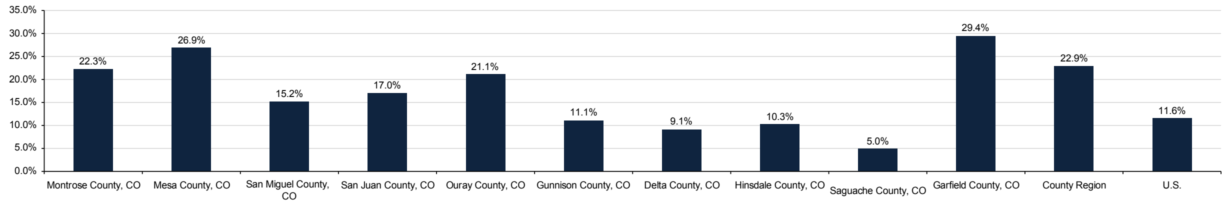
	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Population (2014*)	40,885	147,509	7,597	653	4,532	15,503	30,378	871	6,211	56,684	310,823	314,107,084
Population (2000)	33,432	116,255	6,594	558	3,742	13,956	27,834	790	5,917	43,791	252,869	281,421,906
Population Change (2000-2014*)	7,453	31,254	1,003	¨95	790	1,547	2,544	¨81	294	12,893	57,954	32,685,178
Population Percent Change (2000-2014*)	22.3%	26.9%	15.2%	¨17.0%	21.1%	11.1%	9.1%	¨10.3%	5.0%	29.4%	22.9%	11.6%

* The data in this table are calculated by ACS using annual surveys conducted during 2010-2014 and are representative of average characteristics during this period.

- From 2000 to the 2009-2014 period, Hinsdale County, CO had the smallest estimated absolute change in population (81).

- From 2000 to the 2009-2014 period, Garfield County, CO had the largest estimated relative change in population (29.4%), and Saguache County, CO had the smallest (5.0%).

Percent Change in Population, 2000-2014*



Data Sources: U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.; U.S. Department of Commerce. 2000. Census Bureau, Systems Support Division, Washington, D.C.

Study Guide and Supplemental Information

How has population changed?

What do we measure on this page?

This page describes the total population and change in total population.
Note: with the exception of some 2000 Decennial Census data used on pages 1-3, all other data used in this report are from the American Community Survey (ACS) of the Census Bureau. Red, orange, and black text indicate different data quality thresholds – please read the Methods section below.

Why is this important?

This report covers a range of characteristics including gender, race, age, employment status, income levels, education, and housing. It is the only EPS report that can be run for geographic areas other than the U.S., states, and counties. These include cities, towns, and census designated places, American Indian, Alaska native, and native Hawaii areas, congressional districts, and county subdivisions.

In addition to its usefulness for social research, the information throughout this report is valuable for public land managers and others in identifying whether the selected geographies contain minorities and people who are economically and/or socially disadvantaged. This is important because Executive Order 12898, February 11, 1994 states that "...each federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations..." (see Additional Resources on Page 2 of this report for more references).

While the data in this report does not constitute an analysis of environmental justice per se, it serves to identify whether minorities and/or economically/socially disadvantaged people live in an area. The assessment of whether environmental justice pertains to an area or management action requires consideration of the presence and distribution of minority individuals, minority populations, and low income populations and whether they are or would be disproportionately subject to high and adverse human health effects (such as bodily impairment, infirmity, illness, or any other negative health effects from cumulative or multiple adverse exposures to environmental hazards), and disproportionately high and adverse environmental effects (such as impacts on the natural environment that significantly or adversely affect minority, low income, or native populations).

Methods

The majority of data in this report comes from the Census Bureau's American Community Survey (ACS). The ACS is a nation-wide survey conducted every year by the Census Bureau that provides current demographic, social, economic, and housing information about communities every year—information that until recently was only available once a decade. The ACS is not the same as the decennial census, which is conducted every ten years (the ACS has replaced the detailed, Census 2000 long-form questionnaire).

For populations of 65,000 or more, ACS provides estimates based on 1 year of sampling. For populations of 20,000 or more, ACS provides estimates based on 3 years of sampling. For all other geographies, estimates based on 5 years of sampling are provided. Data used in this report are 5-year ACS estimates. More than the 1 or 3-year estimates, the 5-year estimates are consistently available for small geographies, such as towns. We show 5-year estimates for all geographies since data obtained using the same survey technique is ideal for cross-geography comparisons. The disadvantage is that multiyear estimates cannot be used to describe any particular year in the period, only what the average value is over the full period. For brevity, table and figure titles show the latest year of the 5-year period. Footnotes are provided to clarify that the data represent average characteristics over a 5-year period.

ACS is based on a survey, and is subject to error. The Census Bureau reports the accuracy of the data by providing margins of error. In this report, we alert the user to the data accuracy using color-coded text and symbols in the tables: BLACK indicates a coefficient of variation < 12%; ORANGE (preceded with one dot) indicates between 12 and 40%; and **RED BOLD** (preceded with two dots) indicates a coefficient of variation > 40%. Less populated areas tend to have lower accuracy. If data have consistently low accuracy throughout a report, we suggest running another demographics report at a larger geographic scale. A listing of all coefficients of variation by data point can be found by scrolling down to the tables provided below the border of the page in the Excel workbook.

Additional Resources

An indispensable publication on environmental justice: Council on Environmental Quality. 1997. Environmental Justice: Guidance under the National Environmental Policy Act. Washington, D.C. Available at:
epa.gov/compliance/ej/resources/policy/ej_guidance_nepa_ceq1297.pdf *(1)*.
For a description of the Census Bureau's ACS survey methodology and data accuracy used by the Census Bureau, see:
census.gov/acs/www/methodology/methodology_main/ *(2)*.
census.gov/acs/www/Downloads/data_documentation/Accuracy/MultiyearACSAccuracyofData2009.pdf *(3)*.

Data Sources

U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.; U.S. Department of Commerce. 2000. Census Bureau, Systems Support Division, Washington, D.C.

What is the age and gender distribution of the population?

This page describes population distribution by age and gender, and the change in median age.

Median Age: The age which divides the population into two numerically equal groups; i.e, half the people are younger than this age and half are older.

Age & Gender Distribution, 2014*

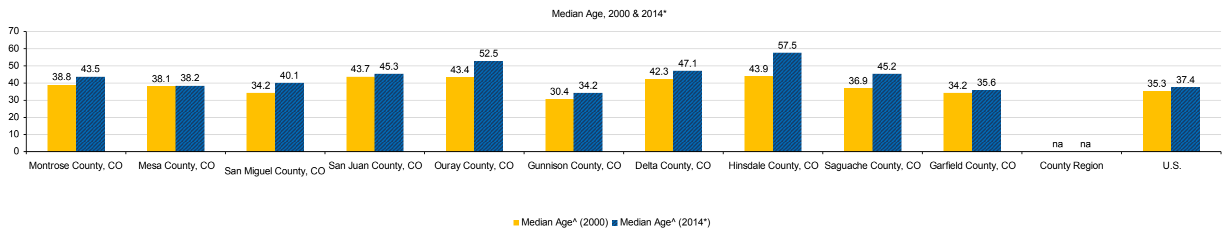
	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Total Population	40,885	147,509	7,597	653	4,532	15,503	30,378	871	6,211	56,684	310,823	314,107,084
Under 5 years	2,351	9,567	403	¨30	˙114	751	1,565	˙65	405	4,274	19,525	19,973,711
5 to 9 years	2,780	9,614	464	¨11	˙188	1,057	1,709	˙18	368	4,192	20,401	20,460,355
10 to 14 years	2,640	9,020	373	¨18	˙192	˙624	1,966	¨9	407	4,216	19,465	20,698,883
15 to 19 years	2,600	10,199	˙300	¨15	˙298	1,441	1,984	¨25	˙359	3,658	20,879	21,510,534
20 to 24 years	1,848	10,382	393	¨62	˙98	1,862	1,306	¨4	˙329	3,216	19,500	22,407,472
25 to 29 years	2,049	9,983	641	˙97	˙182	1,111	1,424	˙33	289	4,051	19,860	21,445,137
30 to 34 years	2,270	9,467	590	˙45	˙158	1,156	1,627	˙53	˙260	4,198	19,824	20,865,045
35 to 39 years	2,266	8,726	627	¨14	˙177	1,146	1,418	¨12	371	4,289	19,046	19,802,434
40 to 44 years	2,346	7,879	646	˙33	˙257	909	1,678	¨14	˙300	4,046	18,108	20,920,606
45 to 49 years	2,658	8,848	640	˙53	˙336	901	1,815	˙39	458	3,918	19,666	21,725,883
50 to 54 years	3,011	10,625	596	˙62	˙491	983	2,379	˙109	479	4,106	22,841	22,522,303
55 to 59 years	2,905	10,637	˙524	˙47	413	1,056	2,362	˙111	559	3,737	22,351	20,623,001
60 to 64 years	3,165	9,143	723	˙72	498	984	2,391	˙96	638	3,298	21,008	17,973,759
65 to 69 years	2,597	7,270	˙343	˙51	˙581	663	2,139	˙111	471	2,086	16,312	13,832,906
70 to 74 years	1,951	5,455	˙177	˙22	˙296	˙376	1,668	˙53	˙214	1,297	11,509	10,161,078
75 to 79 years	1,567	4,458	˙103	¨7	˙122	˙207	1,346	˙74	164	869	8,917	7,559,561
80 to 84 years	944	3,147	¨36	¨8	˙101	˙128	747	˙22	˙77	˙654	5,864	5,805,252
85 years and over	937	3,089	¨18	¨6	¨30	˙148	854	˙23	˙63	˙579	5,747	5,819,164
Total Female	20,861	74,163	3,598	˙283	2,303	7,102	15,083	467	3,044	27,619	154,523	159,591,925
Total Male	20,024	73,346	3,999	370	2,229	8,401	15,295	404	3,167	29,065	156,300	154,515,159

Change in Median Age, 2000-2014*

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Median Age^ (2014*)	43.5	38.2	40.1	45.3	52.5	34.2	47.1	57.5	45.2	35.6	na	37.4
Median Age^ (2000)	38.8	38.1	34.2	43.7	43.4	30.4	42.3	43.9	36.9	34.2	na	35.3
Median Age % Change	12.1%	¨0.3%	˙17.3%	¨3.7%	˙21.0%	12.5%	11.3%	˙31.0%	22.5%	4.1%	na	5.9%

^ Median age is not available for metro/non-metro or regional aggregations.
* The data in this table are calculated by ACS using annual surveys conducted during 2009-2014 and are representative of average characteristics during this period.

- From 2000 to the 2009-2014 period, the median age estimate increased the most in Hinsdale County, CO (43.9 to 57.5, a 31.0% increase) and increased the least in Mesa County, CO (38.1 to 38.2, a 0.3% increase).



Data Sources: U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.; U.S. Department of Commerce. 2000. Census Bureau, Systems Support Division, Washington, D.C.

Study Guide and Supplemental Information

What is the age and gender distribution of the population?

What do we measure on this page?

This page describes population distribution by age and gender, and the change in median age.

Median Age: The age which divides the population into two numerically equal groups; i.e., half the people are younger than this age and half are older.

Why is it important?

Different geographies can have different age distributions. For example, in counties with a large number of retirees, the age distribution may be skewed towards categories 65 years and older. In counties with universities, the age distribution will be skewed toward the age group 18-29. In many counties, the largest segment of the population is in the Baby Boomer generation (people born between 1946 and 1964).

The change in median age is one indicator of whether the population has gotten older or younger.

Methods

Data in this report are based on the American Community Survey (ACS) of the Census Bureau. Data used in this report are 5-year estimates for all geographies. The latest year of the 5-year estimate is indicated in tables and figures (for example, 2009* may be listed as the year, but this is a 5-year estimate based on data collected from 2005 through 2009).

Data accuracy is indicated as follows: BLACK indicates a coefficient of variation < 12%; ORANGE (preceded with one dot) indicates between 12 and 40%; and **RED BOLD** (preceded with two dots) indicates a coefficient of variation > 40%. If data have consistently low accuracy throughout a report, we suggest running another demographics report at a larger geographic scale.

Additional Resources

The U.S. Environmental Protection Agency defines environmental justice as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies." Environmental Protection Agency environmental justice resources are available at: epa.gov/compliance/ej *(4)*.

An indispensable publication on environmental justice: Council on Environmental Quality. 1997. Environmental Justice: Guidance under the National Environmental Policy Act. Washington, D.C. Available at: epa.gov/compliance/ej/resources/policy/ej_guidance_nepa_ceq1297.pdf *(1)*.

The nonprofit organization The State of the USA is developing a national indicator system using consistent measures of well-being. Their resources are available at: stateoftheusa.org *(5)*.

A useful resource on rural population change is the U.S. Department of Agriculture’s Economic Research Service’s Briefing Room on “Rural Population and Migration” available at: ers.usda.gov/topics/rural-economy-population/population-migration.aspx *(6)*.

William H. Frey's website provides links to publications, issues, media stories, data tools and resources on migration, population redistribution, and demography of both rural and urban populations in the U.S.: frey-demographer.org *(7)*.

The U.S. Department of Health and Human Services’ Administration on Aging has a host of resources on older Americans at: aoa.gov/aoaroot/aging_statistics/index.aspx *(8)*.

The U.S. Census Bureau’s Population Estimates Program publishes age data estimates for the U.S., states, counties, and metropolitan areas. This information is available at: http://www.census.gov/popest/ *(9)*.

For information on county-level health ranking, see: countyhealthrankings.org/ *(10)*.

Data Sources

U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.; U.S. Department of Commerce. 2000. Census Bureau, Systems Support Division, Washington, D.C.

What is the age and gender distribution of the population?

This page describes the change in age and gender distribution over time, and the change in age distribution, with age categories separated into five age groups.

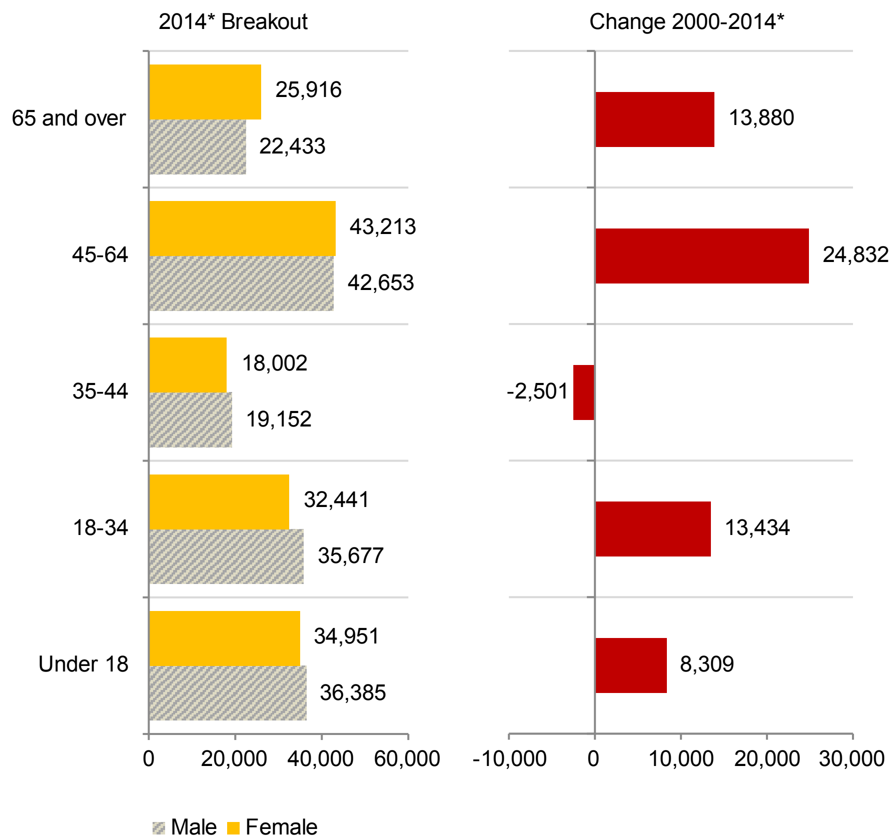
Age & Gender Distribution and Change, 2000-2014*

	2000	2014*
Total Population	252,869	310,823
Under 18	63,027	71,336
18-34	54,684	68,118
35-44	39,655	37,154
45-64	61,034	85,866
65 and over	34,469	48,349
Percent of Total		
Under 18	24.9%	23.0%
18-34	21.6%	21.9%
35-44	15.7%	12.0%
45-64	24.1%	27.6%
65 and over	13.6%	15.6%

* The data in this table are calculated by ACS using annual surveys conducted during 2009-2014 and are representative of average characteristics during this period.

- In the 2009-2014 period, the age category with the highest estimate for number of women was 45-64 (43,213), and the age category with the highest estimate for number of men was 45-64 (42,653).

- From 2000 to the 2009-2014 period, the age category with the largest estimated increase was 45-64 (24,832), and the age category with the largest estimated decrease was 35-44 (-2,501).



Data Sources: U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.; U.S. Department of Commerce. 2000. Census Bureau, Systems Support Division, Washington, D.C.

Study Guide and Supplemental Information

What is the age and gender distribution of the population?

What do we measure on this page?

This page describes the change in age and gender distribution over time, and the change in age distribution, with age categories separated into five age groups.

Why is it important?

For public land managers, understanding the age distribution can help highlight whether management actions might affect some age groups more than others. It also may highlight the need to understand the different needs, values, and attitudes of different age groups. If a geography has a large retired population, or soon-to-be-retired population, for example, the needs and interests of the public may place different demands on public land managers than a geography with a large number of minors or young adults.

For many geographies, a significant development is the aging of the population, and in particular the retirement of the "Baby Boomer" generation (those born between 1946 and 1964). As this generation enters retirement age, their mobility, spending patterns, and consumer demands (for health care and housing, for example) can affect how communities develop economically. An aging population can also affect changing demands on land use (e.g., recreation).

Methods

Data accuracy is indicated as follows: BLACK indicates a coefficient of variation < 12%; ORANGE (preceded with one dot) indicates between 12 and 40%; and **RED BOLD** (preceded with two dots) indicates a coefficient of variation > 40%. If data have consistently low accuracy throughout a report, we suggest running another demographics report at a larger geographic scale.

Additional Resources

The non-profit Population Reference Bureau offers a helpful video on population pyramids at: prb.org/Journalists/Webcasts/2009/distilleddemographics1.aspx *(11)*.

For a discussion on the implications of rising age trends, see: Peterson, Peter, G. 1999. Gray Dawn: How the Coming Age Wave Will Transform America—and the World. Random House. New York, New York. 280 p.

The Census maintains a useful web site with data, articles, and PowerPoint presentations on the characteristics of different age groups: census.gov/population/age/ *(12)*.

The Next Four Decades: Older Population in the United States: 2010 to 2050. May 2010. Census Bureau. census.gov/prod/2010pubs/p25-1138.pdf *(13)*.

Cromartie, J. and P. Nelson. 2009. Baby Boom Migration and Its Impact on Rural America. Economic Research Service, Report Number 29. Washington, DC. ers.usda.gov/publications/err-economic-research-report/err79.aspx *(14)*.

Frey, W.H. 2006. America's Regional Demographics in the '00 Decade: The Role of Seniors, Boomers and New Minorities. The Brookings Institution, Washington, D.C.

Frey, W. H. 2007. Mapping the Growth of Older America: Seniors and Boomers in the Early 21st Century. Brookings Census 2000 Series. Washington, D.C.: Brookings Institution Metropolitan Policy Program.

Jacobsen, L. A., and Mather, M. 2010. "U.S. Social and Economic Trends Since 2000." Population Bulletin 65(1): 1-16. Washington D.C.: Population Reference Bureau.

U.S. Census Bureau. 2005. "State Interim Population Projections by Age and Sex: 2004-2030." census.gov/population/www/projections/projectionsagesex.html *(15)*. Retrieved September 1, 2010.

Data Sources

U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.; U.S. Department of Commerce. 2000. Census Bureau, Systems Support Division, Washington, D.C.

How do people self-identify (race)?

This page describes the number of people who self-identify as belonging to a particular race.

Race: Race is a self-identification data item in which Census respondents choose the race or races with which they most closely identify. The Office of Management and Budget revised the standards in 1997 for how the Federal government collects and presents data on race and ethnicity.

Population by Race, 2014*

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Total Population	40,885	147,509	7,597	653	4,532	15,503	30,378	871	6,211	56,684	310,823	314,107,084
White alone	37,489	135,965	7,334	608	4,421	14,852	28,820	854	5,309	50,191	285,843	231,849,713
Black or African American alone	˙276	1,060	¨17	¨0	¨0	˙77	˙328	¨0	¨24	˙499	2,281	39,564,785
American Indian alone	˙363	˙1,168	¨22	¨6	¨28	¨92	˙203	¨0	˙68	˙447	2,397	2,565,520
Asian alone	˙210	˙904	˙91	¨10	¨5	˙144	˙184	¨0	¨31	˙392	1,971	15,710,659
Native Hawaiian & Other Pacific Is. alone	¨67	˙139	¨0	¨0	¨0	¨0	¨0	¨0	¨0	¨0	˙206	535,761
Some other race alone	˙1,492	˙4,280	¨39	¨26	¨0	¨37	˙473	¨0	˙530	˙3,654	10,531	14,754,895
Two or more races	˙988	3,993	˙94	¨3	˙78	˙301	˙370	¨17	˙249	˙1,501	7,594	9,125,751

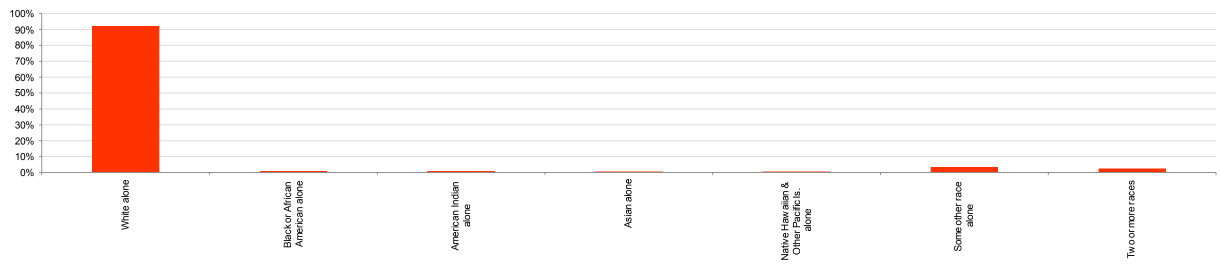
Percent of Total

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
White alone	91.7%	92.2%	96.5%	93.1%	97.6%	95.8%	94.9%	98.0%	85.5%	88.5%	92.0%	73.8%
Black or African American alone	˙0.7%	0.7%	¨0.2%	¨0.0%	¨0.0%	˙0.5%	˙1.1%	¨0.0%	¨0.4%	˙0.9%	0.7%	12.6%
American Indian alone	˙0.9%	˙0.8%	¨0.3%	¨0.9%	¨0.6%	¨0.6%	˙0.7%	¨0.0%	˙1.1%	˙0.8%	0.8%	0.8%
Asian alone	0.5%	0.6%	˙1.2%	¨1.5%	¨0.1%	˙0.9%	˙0.6%	¨0.0%	¨0.5%	˙0.7%	0.6%	5.0%
Native Hawaiian & Other Pacific Is. alone	¨0.2%	¨0.1%	¨0.0%	¨0.0%	¨0.0%	¨0.0%	¨0.0%	¨0.0%	¨0.0%	¨0.0%	0.1%	0.2%
Some other race alone	˙3.6%	˙2.9%	¨0.5%	¨4.0%	¨0.0%	¨0.2%	˙1.6%	¨0.0%	˙8.5%	˙6.4%	3.4%	4.7%
Two or more races	˙2.4%	2.7%	˙1.2%	¨0.5%	˙1.7%	˙1.9%	˙1.2%	¨2.0%	˙4.0%	˙2.6%	2.4%	2.9%

* The data in this table are calculated by ACS using annual surveys conducted during 2009-2014 and are representative of average characteristics during this period.

- In the 2009-2014 period, the racial category with the highest estimated percent of the population in the County Region was white alone (92.0%), and the racial category the lowest estimated percent of the population was native hawaiian & other pacific is. alone (0.1%).

Population by Race, Percent of Total, County Region, 2014*



Data Sources: U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.

Study Guide and Supplemental Information

How do people self-identify (race)?

What do we measure on this page?

This page describes the number of people who self-identify as belonging to a particular race.

Race: Race is a self-identification data item in which Census respondents choose the race or races with which they most closely identify. The Office of Management and Budget (OMB) revised the standards in 1997 for how the Federal government collects and presents data on race and ethnicity.
Race Alone Categories: This includes the minimum five race categories required by the OMB, plus the 'some other race alone' included by the Census Bureau, with the approval of the OMB. The categories are: White alone, Black or African-American alone, American Indian or Alaska Native alone, Asian alone, Native Hawaiian or other Pacific Islander alone, and Some other race alone.

Some Other Race: This includes all other responses not included in the "White," "Black or African American," "American Indian and Alaska Native," "Asian" and "Native Hawaiian or Other Pacific Islander" race categories described above. Respondents providing write-in entries such as multiracial, mixed, interracial, or a Hispanic/Latino group (for example, Mexican, Puerto Rican, or Cuban) in the "Some other race" write-in space are included in this category.
Two or More Races: People may have chosen to provide two or more races either by checking two or more race response check boxes, by providing multiple write-in responses, or by some combination of check boxes and write-in responses.

Why is it important?

Federal agencies make use of information on race and ethnicity for implementing a number of programs, while also using this information to promote and enforce equal opportunities, such as in employment or housing, under the Civil Rights Act.

According to the Census Bureau, “Many federal programs are put into effect based on the race data obtained from the decennial census (i.e., promoting equal employment opportunities; assessing racial disparities in health and environmental risks).” In addition, “Data on ethnic groups are important for putting into effect a number of federal statutes (i.e., enforcing bilingual election rules under the Voting Rights Act; monitoring and enforcing equal employment opportunities under the Civil Rights Act). Data on Ethnic Groups are also needed by local governments to run programs and meet legislative requirements (i.e., identifying segments of the population who may not be receiving medical services under the Public Health Act; evaluating whether financial institutions are meeting the credit needs of minority populations under the Community Reinvestment Act).”

For public land managers, one of the important considerations of proposed management actions is whether the action could have disproportionately high and adverse effects on minority populations. This consideration, broadly referred to as "Environmental Justice", is a requirement of Executive Order 12898. The data on this page show which minority populations are represented, but does not analyze whether there is a potential environmental justice issue.

Methods

Race categories include both racial and national-origin groups. The concept of race is separate from the concept of Hispanic origin, which is discussed elsewhere in this report. Percentages for the various race categories add to 100 percent, and should not be combined with the percent Hispanic.

Data accuracy is indicated as follows: BLACK indicates a coefficient of variation < 12%; ORANGE (preceded with one dot) indicates between 12 and 40%; and **RED BOLD** (preceded with two dots) indicates a coefficient of variation > 40%. If data have consistently low accuracy throughout a report, we suggest running another demographics report at a larger geographic scale.

Additional Resources

For information on revised Federal Office of Management and Budget standards for the classification of Federal data on race and ethnicity (1997), see: whitehouse.gov/omb/fedreg_1997standards *(16)*.

For a primer on how the Census 2000 handles race and Hispanic origin, see the U.S. Census Bureau’s publication “Overview of Race and Hispanic Origin,” available at: census.gov/prod/2001pubs/c2kbr01-1.pdf *(17)*.

Additional race and ethnicity data from the U.S. Census Bureau can be found at: factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml *(18)*.

The American Human Development Project has created a useful resource on the health and welfare of racial and ethnic groups. It is called A Century Apart: New Measures of Well-Being for U.S. Racial and Ethnic Groups and is available at: measureofamerica.org/acenturyapart *(19)*.

Data Sources

U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.

How do people self-identify (ethnicity)?

This page describes the number of people who self-identify as Hispanic. The information also is presented according to race. The term "Hispanic" refers to a cultural identification, and Hispanics can be of any race.

Hispanic or Latino Origin: People who identify with the terms "Hispanic" or "Latino" are those who classify themselves in one of the specific Hispanic or Latino categories listed on the Census questionnaire "Mexican," "Puerto Rican," or "Cuban" as well as those who indicate that they are "other Spanish, Hispanic, or Latino." Origin can be viewed as the heritage, nationality group, lineage, or country of birth of the person or the person's parents or ancestors before their arrival in the United States. People who identify their origin as Spanish, Hispanic, or Latino may be of any race.

Hispanic Population, 2014*

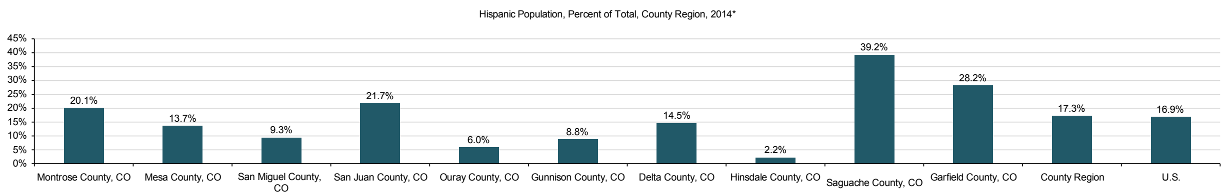
	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Total Population	40,885	147,509	7,597	653	4,532	15,503	30,378	871	6,211	56,684	310,823	314,107,084
Hispanic or Latino (of any race)	8,199	20,161	706	˙142	˙270	1,362	4,390	¨19	2,436	15,964	53,649	53,070,096
Not Hispanic or Latino	32,686	127,348	6,891	˙511	4,262	14,141	25,988	852	3,775	40,720	257,174	261,036,988
White alone	31,407	121,600	6,655	˙482	4,184	13,676	25,008	835	3,533	39,067	246,447	197,159,492
Black or African American alone	˙205	996	¨17	¨0	¨0	˙57	˙328	¨0	¨24	˙275	1,902	38,460,598
American Indian alone	˙168	˙552	¨17	¨6	¨28	¨55	˙171	¨0	¨15	˙297	1,309	2,082,768
Asian alone	˙210	˙893	˙91	¨10	¨5	˙95	˙181	¨0	¨31	˙373	1,889	15,536,209
Native Hawaiian & Oth.Pacific Is. alone	¨67	˙131	¨0	¨0	¨0	¨0	¨0	¨0	¨0	¨0	˙198	493,155
Some other race	¨52	¨287	¨24	¨10	¨0	¨0	¨57	¨0	¨0	¨16	˙446	611,881
Two or more races	˙577	2,889	˙87	¨3	¨45	˙258	˙243	¨17	172	˙692	4,983	6,692,885

Percent of Total

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Hispanic or Latino (of any race)	20.1%	13.7%	9.3%	˙21.7%	˙6.0%	8.8%	14.5%	¨2.2%	39.2%	28.2%	17.3%	16.9%
Not Hispanic or Latino	79.9%	86.3%	90.7%	˙78.3%	94.0%	91.2%	85.5%	97.8%	60.8%	71.8%	82.7%	83.1%
White alone	76.8%	82.4%	87.6%	˙73.8%	92.3%	88.2%	82.3%	95.9%	56.9%	68.9%	79.3%	62.8%
Black or African American alone	˙0.5%	0.7%	¨0.2%	¨0.0%	¨0.0%	˙0.4%	˙1.1%	¨0.0%	¨0.4%	˙0.5%	0.6%	12.2%
American Indian alone	˙0.4%	˙0.4%	¨0.2%	¨0.9%	¨0.6%	¨0.4%	˙0.6%	¨0.0%	¨0.2%	˙0.5%	˙0.4%	0.7%
Asian alone	0.5%	0.6%	˙1.2%	¨1.5%	¨0.1%	˙0.6%	˙0.6%	¨0.0%	¨0.5%	˙0.7%	0.6%	4.9%
Native Hawaiian & Oth.Pacific Is. alone	¨0.2%	¨0.1%	¨0.0%	¨0.0%	¨0.0%	¨0.0%	¨0.0%	¨0.0%	¨0.0%	¨0.0%	0.1%	0.2%
Some other race	¨0.1%	˙0.2%	¨0.3%	¨1.5%	¨0.0%	¨0.0%	¨0.2%	¨0.0%	¨0.0%	0.0%	¨0.1%	0.2%
Two or more races	˙1.4%	2.0%	˙1.1%	¨0.5%	¨1.0%	˙1.7%	˙0.8%	¨2.0%	2.8%	˙1.2%	1.6%	2.1%

* The data in this table are calculated by ACS using annual surveys conducted during 2009-2014 and are representative of average characteristics during this period.

- In the 2009-2014 period, Saguache County, CO had the highest estimated percent of the population that self-identify as Hispanic or Latino of any race (39.2%), and Hinsdale County, CO had the lowest (2.2%).



Data Sources: U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.

How do people self-identify (ethnicity)?

What do we measure on this page?

This page describes the number of people who self-identify as Hispanic. The information also is presented according to race. The term “Hispanic” refers to a cultural identification, and Hispanics can be of any race.

Ethnicity: There are two minimum categories for ethnicity: Hispanic or Latino, and Not Hispanic or Latino. The federal government considers race and Hispanic origin to be two separate and distinct concepts. Hispanics and Latinos may be of any race.

Hispanic or Latino Origin: People who identify with the terms "Hispanic" or "Latino" are those who classify themselves in one of the specific Hispanic or Latino categories listed on the Census questionnaire "Mexican," "Puerto Rican," or "Cuban" as well as those who indicate that they are "other Spanish, Hispanic, or Latino." Origin can be viewed as the heritage, nationality group, lineage, or country of birth of the person or the person's parents or ancestors before their arrival in the United States. People who identify their origin as Spanish, Hispanic, or Latino may be of any race.

Why is it important?

Hispanics are one of the fastest growing segments of the U.S. population. The Census Bureau reported that 15 percent of the population in the U.S. self-identified as being Hispanic in 2010. The Census Bureau predicts that 24.4 percent of the population in the U.S. will be Hispanic by 2050. Between 2000 and 2010, Hispanics accounted for over one-half of the nation’s population growth.

Different groups of people may value and use public lands in different ways. Understanding the various values, beliefs, and attitudes of the Hispanic community in an area can be an important consideration for public land managers working to meet the needs of the public or evaluating potentially adverse impacts on a population.

According to the Census Bureau: “Many federal programs are put into effect based on the race data obtained from the decennial census (i.e., promoting equal employment opportunities; assessing racial disparities in health and environmental risks)” and “Data on ethnic groups are important for putting into effect a number of federal statutes (i.e., enforcing bilingual election rules under the Voting Rights Act; monitoring and enforcing equal employment opportunities under the Civil Rights Act). Data on Ethnic Groups are also needed by local governments to run programs and meet legislative requirements (i.e., identifying segments of the population who may not be receiving medical services under the Public Health Act; evaluating whether financial institutions are meeting the credit needs of minority populations under the Community Reinvestment Act).”

Methods

Data accuracy is indicated as follows: BLACK indicates a coefficient of variation < 12%; ORANGE (preceded with one dot) indicates between 12 and 40%; and **RED BOLD** (preceded with two dots) indicates a coefficient of variation > 40%. If data have consistently low accuracy throughout a report, we suggest running another demographics report at a larger geographic scale.

Additional Resources

For information on revised Federal Office of Management and Budget standards for the classification of Federal data on race and ethnicity (1997), see: whitehouse.gov/omb/fedreg_1997standards *(16)*.

For a primer on how the Census 2000 handles race and Hispanic origin, see the U.S. Census Bureau publication “Overview of Race and Hispanic Origin,” available at: census.gov/prod/2001pubs/c2kbr01-1.pdf *(17)*.

Additional race and ethnicity data from the U.S. Census Bureau can be found at: factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml *(18)*.

Additional information on the U.S. Hispanic population from the U.S. Census Bureau is available at: census.gov/newsroom/cspan/hispanic/2012.06.22_cspan_hispanics.pdf *(20)*.

For an analysis of Latinos and Hispanics and federal land management in the Columbia River Basin, as well as a literature review on the subject, see: icbemp.gov/science/hansisrichard_10pg.pdf *(21)*.

Data Sources

U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.

How do people self-identify (Tribal)?

This page describes, in general terms, the number of people who self-identify as American Indian and Alaska Native alone or in combination with one or more other races.

American Indian: This category shows self-identification among people of American Indian descent. Many American Indians are members of a principal tribe or group empowered to negotiate and make decisions on behalf of the individual members. Census data are available for 34 tribes or Selected American Indian categories: Apache, Blackfeet, Cherokee, Cheyenne, Chickasaw, Chippewa, Choctaw, Colville, Comanche, Cree, Creek, Crow, Delaware, Houma, Iroquois, Kiowa, Lumbee, Menominee, Navajo, Osage, Ottawa, Paiute, Pima, Potawatomi, Pueblo, Puget Sound Salish, Seminole, Shoshone, Sioux, Tohono O'Odham, Ute, Yakama, Yaqui, Yuman, and All other.

Alaska Native: This category shows self-identification among people of Alaska Native descent. Census data are available for five detailed Alaska Native race and ethnic categories: Alaska Athabaskan, Aleut, Eskimo, Tlingit-Haida, and All other tribes.

Non-Specified Tribes: This category shows self-identification among people of American Indian or Alaska Native decent that does not fall within a major tribal affiliation.

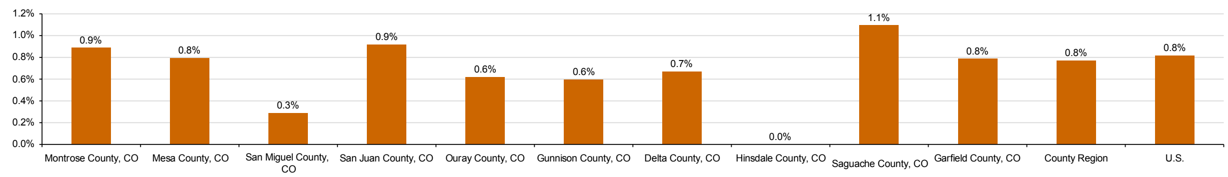
American Indian & Alaska Native Population, 2014*

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Total Population	40,885	147,509	7,597	653	4,532	15,503	30,378	871	6,211	56,684	310,823	314,107,084
Total Native American	˙363	˙1,168	¨22	¨6	¨28	¨92	˙203	¨0	˙68	˙447	2,397	2,565,520
American Indian Tribes	¨127	˙725	¨17	¨6	¨16	¨90	˙171	¨0	˙52	˙280	˙1,484	2,013,814
Alaska Native Tribes	¨40	¨10	¨0	¨0	¨0	¨0	¨0	¨0	¨0	¨28	¨78	110,176
Non-Specified Tribes	˙193	˙285	¨5	¨0	¨0	¨2	¨25	¨0	¨10	¨112	˙632	364,400
Percent of Total												
Total Native American	˙0.9%	˙0.8%	¨0.3%	¨0.9%	¨0.6%	¨0.6%	˙0.7%	¨0.0%	˙1.1%	˙0.8%	0.8%	0.8%
American Indian Tribes	¨0.3%	˙0.5%	¨0.2%	¨0.9%	¨0.4%	¨0.6%	˙0.6%	¨0.0%	˙0.8%	˙0.5%	˙0.5%	0.6%
Alaska Native Tribes	¨0.1%	0.0%	¨0.0%	¨0.0%	¨0.0%	¨0.0%	¨0.0%	¨0.0%	¨0.0%	¨0.0%	0.0%	0.0%
Non-Specified Tribes	˙0.5%	˙0.2%	¨0.1%	¨0.0%	¨0.0%	0.0%	¨0.1%	¨0.0%	¨0.2%	¨0.2%	˙0.2%	0.1%

* The data in this table are calculated by ACS using annual surveys conducted during 2009-2014 and are representative of average characteristics during this period.

- In the 2009-2014 period, Saguache County, CO had the highest estimated percent of the population that self-identified as American Indian and Alaska Native (1.1%) and Hinsdale County, CO had the lowest (0.0%).

Native American Population, Percent of Total, County Region, 2014*



Data Sources: U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.

How do people self-identify (Tribal)?

What do we measure on this page?

This page describes, in general terms, the number of people who self-identify as American Indian and Alaska Native alone or in combination with one or more other races.

American Indian: This category shows self-identification among people of American Indian descent. Many American Indians are members of a principal tribe or group empowered to negotiate and make decisions on behalf of the individual members. Census data are available for 34 tribes or Selected American Indian categories: Apache, Blackfeet, Cherokee, Cheyenne, Chickasaw, Chippewa, Choctaw, Colville, Comanche, Cree, Creek, Crow, Delaware, Houma, Iroquois, Kiowa, Lumbee, Menominee, Navajo, Osage, Ottawa, Paiute, Pima, Potawatomi, Pueblo, Puget Sound Salish, Seminole, Shoshone, Sioux, Tohono O'Odham, Ute, Yakama, Yaqui, Yuman, and All other.

Alaska Native: This category shows self-identification among people of Alaska Native descent. Census data are available for five detailed Alaska Native race and ethnic categories: Alaska Athabaskan, Aleut, Eskimo, Tlingit-Haida, and All other tribes.

Non-Specified Tribes: This category includes respondents who checked the ‘‘American Indian or Alaska Native’’ response category on the Census questionnaire or wrote in the generic term ‘‘American Indian’’ or ‘‘Alaska Native," or tribal entries not elsewhere classified.

Why is it important?

Different groups of people may value and use public lands in different ways. Understanding the various values, beliefs, and attitudes of American Indian and Alaska Native tribes is an important consideration for public land managers where these populations reside and have a historical and/or current tie to the land. Some management actions may have disproportionately high and adverse effects on tribes and it is helpful to know if native peoples live in a particular geography.

Methods

Data accuracy is indicated as follows: BLACK indicates a coefficient of variation < 12%; ORANGE (preceded with one dot) indicates between 12 and 40%; and **RED BOLD** (preceded with two dots) indicates a coefficient of variation > 40%. If data have consistently low accuracy throughout a report, we suggest running another demographics report at a larger geographic scale.

Additional Resources

An indispensable publication on environmental justice: Council on Environmental Quality. 1997. Environmental Justice: Guidance under the National Environmental Policy Act. Washington, D.C. Available at: epa.gov/compliance/ej/resources/policy/ej_guidance_nepa_ceq1297.pdf *(1)*.

The U.S. Department of Interior’s Indian Affairs oversees the Bureau of Indian Affairs and Bureau of Indian Education. Indian Affairs resources and contacts are available at: bia.gov/index.htm *(22)*.

The American Indian Heritage Foundation hosts an American Indian Resource Directory with a list of all American Indian tribes, including Federally recognized tribes, and the Native Wire news service. These and other resources are available at: indians.org/index.html *(23)*.

Data Sources

U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.

How do people self-identify (Tribal)?

This page describes the number of people who self-identify as American Indian and Alaska Native alone or in combination with one or more other races.

American Indian & Alaska Native Population, 2014*

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Total Population	40,885	147,509	7,597	653	4,532	15,503	30,378	871	6,211	56,684	310,823	314,107,084
Total Native American	363	1,168	22	6	28	92	203	0	68	447	2,397	2,565,520
American Indian Tribes; Specified	127	725	17	6	16	90	171	0	52	280	1,484	2,013,814
Apache	35	8	0	6	0	12	3	0	0	0	64	69,082
Blackfeet	0	0	0	0	6	2	0	0	0	0	8	27,465
Cherokee	6	168	4	0	10	14	42	0	2	59	305	279,728
Cheyenne	0	9	0	0	0	0	0	0	0	0	9	12,691
Chickasaw	0	3	0	0	0	0	0	0	0	0	3	22,572
Chippewa	0	10	0	0	0	0	7	0	0	0	17	113,968
Choctaw	0	12	0	0	0	7	0	0	0	0	19	91,809
Colville	0	0	0	0	0	0	0	0	0	0	0	8,464
Comanche	0	0	5	0	0	0	0	0	0	0	5	12,410
Cree	10	0	0	0	0	0	0	0	0	0	10	2,323
Creek	0	0	0	0	0	0	0	0	0	0	0	42,212
Crow	0	0	0	0	0	0	0	0	0	0	0	12,076
Delaware	0	0	0	0	0	0	1	0	0	0	1	7,147
Houma	0	0	0	0	0	0	0	0	0	0	0	9,776
Iroquois	3	17	0	0	0	0	11	0	0	0	31	44,024
Kiowa	0	0	0	0	0	0	0	0	0	0	0	7,885
Lumbee	0	0	0	0	0	0	0	0	0	75	75	68,376
Menominee	0	0	0	0	0	0	0	0	0	0	0	7,981
Navajo	66	130	8	0	0	23	27	0	15	50	319	308,296
Osage	0	0	0	0	0	0	0	0	0	0	0	8,682
Ottawa	0	0	0	0	0	0	0	0	0	0	0	7,153
Paiute	0	0	0	0	0	0	0	0	0	0	0	10,970
Pima	0	0	0	0	0	0	0	0	0	0	0	23,996
Potawatomi	0	52	0	0	0	0	0	0	0	37	89	19,644
Pueblo	0	4	0	0	0	0	20	0	0	0	24	55,622
Puget Sound Salish	0	0	0	0	0	0	0	0	0	0	0	14,056
Seminole	0	0	0	0	0	0	0	0	0	0	0	14,260
Shoshone	0	0	0	0	0	0	0	0	0	0	0	8,981
Sioux	0	33	0	0	0	22	0	0	0	28	83	125,425
Tohono O'Odham	0	0	0	0	0	0	0	0	0	0	0	21,853
Ute	0	145	0	0	0	0	0	0	14	0	159	8,485
Yakama	0	0	0	0	0	0	0	0	0	0	0	8,722
Yaqui	0	0	0	0	0	0	0	0	0	0	0	20,525
Yuman	0	0	0	0	0	0	0	0	0	0	0	8,413
All other tribes	7	134	0	0	0	10	60	0	21	31	263	508,742
American Indian; Not Specified	3	148	0	0	12	0	7	0	6	27	203	66,184
Alaska Native Tribes; Specified	40	10	0	0	0	0	0	0	0	28	78	110,176
Alaska Athabaskan	0	0	0	0	0	0	0	0	0	0	0	16,018
Aleut	0	0	0	0	0	0	0	0	0	0	0	12,107
Eskimo	40	10	0	0	0	0	0	0	0	28	78	62,849
Tlingit-Haida	0	0	0	0	0	0	0	0	0	0	0	15,121
All other tribes	0	0	0	0	0	0	0	0	0	0	0	4,081
Alaska Native; Not Specified	0	0	0	0	0	0	0	0	0	0	0	10,946
American Indian or Alaska Native; Not Specified	193	285	5	0	0	2	25	0	10	112	632	364,400

* The data in this table are calculated by ACS using annual surveys conducted during 2010-2014 and are representative of average characteristics during this period.

Data Sources: U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.

How do people self-identify (Tribal)?

What do we measure on this page?

This page describes, in general terms, the number of people who self-identify as American Indian and Alaska Native alone or in combination with one or more other races.

American Indian: This category shows self-identification among people of American Indian descent. Many American Indians are members of a principal tribe or group empowered to negotiate and make decisions on behalf of the individual members. Census data are available for 34 tribes or Selected American Indian categories: Apache, Blackfeet, Cherokee, Cheyenne, Chickasaw, Chippewa, Chocktaw, Colville, Comanche, Cree, Creek, Crow, Delaware, Houma, Iroquois, Kiowa, Lumbee, Menominee, Navajo, Osage, Ottawa, Paiute, Pima, Potawatomi, Pueblo, Puget Sound Salish, Seminole, Shoshone, Sioux, Tohono O'Odham, Ute, Yakama, Yaqui, Yuman, and All other.

Alaska Native: This category shows self-identification among people of Alaska Native descent. Census data are available for five detailed Alaska Native race and ethnic categories: Alaska Athabaskan, Aleut, Eskimo, Tlingit-Haida, and All other tribes.

Non-Specified Tribes: This category includes respondents who checked the ‘‘American Indian or Alaska Native’’ response category on the Census questionnaire or wrote in the generic term ‘‘American Indian’’ or ‘‘Alaska Native,’ ’ or tribal entries not elsewhere classified.

Why is it important?

Different groups of people may value and use public lands in different ways. Understanding the various values, beliefs, and attitudes of American Indian and Alaska Native tribes is an important consideration for public land managers where these populations reside and have a historical and/or current tie to the land. Some management actions may have disproportionately high and adverse effects on tribes and it is helpful to know if native peoples live in a particular geography.

Methods

Data accuracy is indicated as follows: BLACK indicates a coefficient of variation < 12%; ORANGE (preceded with one dot) indicates between 12 and 40%; and **RED BOLD** (preceded with two dots) indicates a coefficient of variation > 40%. If data have consistently low accuracy throughout a report, we suggest running another demographics report at a larger geographic scale.

Additional Resources

The U.S. Forest Service Office of Tribal Relations, formed in 2004, is a useful source of information and policies related to agency-tribal relations. See: fs.fed.us/spf/tribalrelations/index.shtml *(24)*.

Data Sources

U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.

What occupations and industries are present?

This page describes what people do for work in terms of the type of work (occupation) and where they work (by industry).

Employment by Occupation, 2014*

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Civilian employed population > 16 years	17,539	67,168	4,571	366	2,172	8,867	11,737	413	2,592	28,904	144,329	143,435,233
Management, professional, & related	5,331	21,265	1,765	`122	1,007	2,956	3,853	`170	790	8,260	45,519	52,234,574
Service	3,389	12,239	999	`75	`460	1,924	2,407	`75	`405	5,661	27,634	26,053,338
Sales and office	3,703	17,222	984	`71	`350	1,768	2,301	`85	`432	6,665	33,581	34,935,133
Farming, fishing, and forestry	`411	`302	¨16	¨0	¨27	`78	`339	¨3	`325	`216	1,717	1,050,726
Construction, extraction, maint., & repair	1,928	5,443	`332	`54	`177	1,110	1,301	`37	`194	4,352	14,928	7,169,365
Production, transportation, & material moving	2,011	8,009	`368	¨19	`109	`604	980	¨16	`324	2,791	15,231	17,336,254

Percent of Total

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Management, professional, & related	30.4%	31.7%	38.6%	`33.3%	46.4%	33.3%	32.8%	`41.2%	30.5%	28.6%	31.5%	36.4%
Service	19.3%	18.2%	21.9%	`20.5%	`21.2%	21.7%	20.5%	`18.2%	`15.6%	19.6%	19.1%	18.2%
Sales and office	21.1%	25.6%	21.5%	`19.4%	`16.1%	19.9%	19.6%	`20.6%	`16.7%	23.1%	23.3%	24.4%
Farming, fishing, and forestry	`2.3%	`0.4%	¨0.4%	¨0.0%	¨1.2%	¨0.9%	`2.9%	¨0.7%	`12.5%	`0.7%	1.2%	0.7%
Construction, extraction, maint., & repair	11.0%	8.1%	`7.3%	`14.8%	`8.1%	12.5%	11.1%	`9.0%	`7.5%	15.1%	10.3%	5.0%
Production, transportation, & material moving	11.5%	11.9%	`8.1%	¨5.2%	`5.0%	`6.8%	8.3%	¨3.9%	`12.5%	9.7%	10.6%	12.1%

* The data in this table are calculated by ACS using annual surveys conducted during 2009-2014 and are representative of average characteristics during this period.

Employment by Industry, 2014*

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Civilian employed population > 16 years	17,539	67,168	4,571	366	2,172	8,867	11,737	413	2,592	28,904	144,329	143,435,233
Ag, forestry, fishing & hunting, mining	`1,148	4,882	`171	¨21	`121	`238	1,942	¨26	`452	`1,530	10,531	2,807,292
Construction	2,025	4,804	503	`70	`212	1,231	`1,079	`43	`216	4,668	14,851	8,843,718
Manufacturing	1,349	3,515	`102	¨18	`93	`153	`660	¨3	`191	`902	6,986	14,955,235
Wholesale trade	`369	1,729	¨70	¨0	¨6	¨29	`187	¨0	`43	`765	3,198	3,937,598
Retail trade	1,908	8,859	`333	`61	`245	`865	1,228	`31	`288	3,473	17,291	16,598,718
Transportation, warehousing, and utilities	1,025	3,639	`158	¨13	`103	`453	`527	¨15	`240	`1,249	7,422	7,066,666
Information	`278	`1,308	¨110	¨0	¨18	`221	`251	¨15	¨19	`519	2,739	3,064,078
Finance and insurance, and real estate	`763	4,012	`450	¨21	`84	`431	`347	¨27	¨14	1,698	7,847	9,467,555
Prof, scientific, mgmt, admin, & waste mgmt	1,428	5,845	`629	`30	`226	`784	`745	`39	`76	3,221	13,023	15,618,627
Education, health care, & social assistance	3,621	15,657	`478	`25	`425	1,735	2,545	`51	`469	4,647	29,653	33,297,237
Arts, entertain., rec., accomodation, & food	1,627	6,706	1,216	`95	`366	1,885	`1,052	`90	`246	3,325	16,608	13,610,162
Other services, except public administration	`1,056	3,409	`148	¨2	`96	`498	`620	`40	`142	`1,532	7,543	7,112,579
Public administration	`942	2,803	`203	¨10	`177	`344	`554	`33	`196	1,375	6,637	7,055,768

Percent of Total

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Ag, forestry, fishing & hunting, mining	`6.5%	7.3%	`3.7%	¨5.7%	`5.6%	`2.7%	16.5%	¨6.3%	`17.4%	`5.3%	7.3%	2.0%
Construction	11.5%	7.2%	`11.0%	`19.1%	`9.8%	13.9%	9.2%	`10.4%	`8.3%	16.2%	10.3%	6.2%
Manufacturing	7.7%	5.2%	`2.2%	¨4.9%	`4.3%	`1.7%	`5.6%	¨0.7%	`7.4%	`3.1%	4.8%	10.4%
Wholesale trade	`2.1%	2.6%	¨1.5%	¨0.0%	¨0.3%	¨0.3%	`1.6%	¨0.0%	`1.7%	`2.6%	2.2%	2.7%
Retail trade	10.9%	13.2%	`7.3%	`16.7%	`11.3%	`9.8%	10.5%	`7.5%	`11.1%	12.0%	12.0%	11.6%
Transportation, warehousing, and utilities	5.8%	5.4%	`3.5%	¨3.6%	`4.7%	`5.1%	`4.5%	¨3.6%	`9.3%	`4.3%	5.1%	4.9%
Information	`1.6%	`1.9%	¨2.4%	¨0.0%	¨0.8%	`2.5%	`2.1%	¨3.6%	¨0.7%	`1.8%	1.9%	2.1%
Finance and insurance, and real estate	`4.4%	6.0%	`9.8%	¨5.7%	`3.9%	`4.9%	`3.0%	¨6.5%	¨0.5%	5.9%	5.4%	6.6%
Prof, scientific, mgmt, admin, & waste mgmt	8.1%	8.7%	`13.8%	`8.2%	`10.4%	`8.8%	`6.3%	`9.4%	`2.9%	11.1%	9.0%	10.9%
Education, health care, & social assistance	20.6%	23.3%	`10.5%	`6.8%	`19.6%	19.6%	21.7%	`12.3%	`18.1%	16.1%	20.5%	23.2%
Arts, entertain., rec., accomodation, & food	9.3%	10.0%	26.6%	`26.0%	`16.9%	21.3%	`9.0%	`21.8%	`9.5%	11.5%	11.5%	9.5%
Other services, except public administration	`6.0%	5.1%	`3.2%	¨0.5%	`4.4%	`5.6%	`5.3%	`9.7%	`5.5%	`5.3%	5.2%	5.0%
Public administration	`5.4%	4.2%	`4.4%	¨2.7%	`8.1%	`3.9%	`4.7%	`8.0%	`7.6%	4.8%	4.6%	4.9%

Data Sources: U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.

What occupations and industries are present?

What do we measure on this page?

This page describes what people do for work in terms of the type of work (occupation) and where they work (by industry).

Employment by Occupation: Refers to the Standard Occupational Classification (SOC) system, where workers are classified into occupations with similar job duties, skills, education, and/or training, regardless of industry.

Employment by Industry: Refers to the employment by industry, listed according to the North American Industry Classification System (NAICS).

Why is it Important?

Employment statistics are usually reported by industry (as with other reports in EPS). This is a useful way to show the relative diversity of the economy and the degree of dependence on certain sectors. Employment by occupation offers additional information that describes what people do for a living and the type of work they do, regardless of the industry. For example, management and professional occupations are generally of higher wage and require formal education, and these occupations could exist in any number of industries (for example, managers could be working for a software firm, a mine, or a construction company). Occupation information describes what people do, while employment by industry describes where people work.

Methods

Data accuracy is indicated as follows: BLACK indicates a coefficient of variation < 12%; ORANGE (preceded with one dot) indicates between 12 and 40%; and **RED BOLD** (preceded with two dots) indicates a coefficient of variation > 40%. If data have consistently low accuracy throughout a report, we suggest running another demographics report at a larger geographic scale.

Additional Resources

The Census Bureau provides a definition of SOCS: census.gov/hhes/www/ioindex/overview.html *(25)*.

Occupations are also defined by U.S. Bureau of Labor Statistics: bls.gov/soc/ *(26)*.

The Bureau of Labor Statistics provides an analysis of the prospects for different types of jobs, including training and education needed, earnings, working conditions, and what workers do on the job: bls.gov/oco/ *(27)*.

Data Sources

U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.

What are the characteristics of labor participation?

This page describes workers by weeks worked per year and usual hours works per week.

Labor Participation Characteristics, 2014*

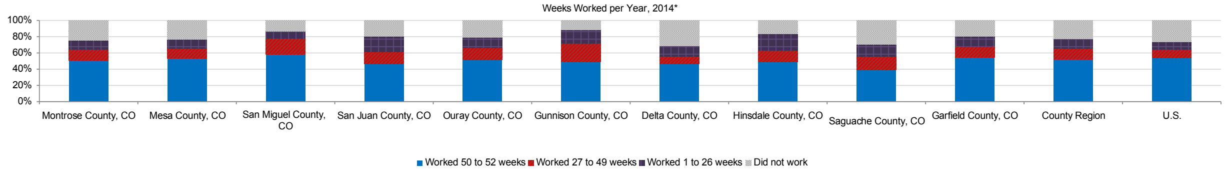
	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Population 16 to 64	24,604	93,659	5,564	`500	2,856	11,453	17,936	496	3,976	37,830	198,874	205,597,667
WEEKS WORKED PER YEAR:												
Worked 50 to 52 weeks	12,847	51,135	3,312	`238	1,509	5,751	8,574	248	1,609	21,107	106,330	113,319,555
Worked 27 to 49 weeks	3,232	11,337	1,095	``75	`418	2,580	1,656	``70	`648	5,102	26,213	21,167,398
Worked 1 to 26 weeks	2,743	10,722	`463	`94	`372	1,915	2,336	`103	`585	4,646	23,979	19,004,078
Did not work	5,782	20,465	694	`93	557	1,207	5,370	`75	1,134	6,975	42,352	52,106,636
HOURS WORKED PER WEEK:												
Worked 35 or more hours per week	13,526	52,322	3,718	`336	1,656	6,610	9,026	272	2,138	22,686	112,290	116,630,261
Worked 15 to 34 hours per week	3,997	16,511	986	`58	459	2,773	2,434	`128	522	6,456	34,324	29,529,528
Worked 1 to 14 hours per week	1,299	4,361	`166	``13	`184	`863	1,106	``21	`182	1,713	9,908	7,331,242
Did not work	5,782	20,465	694	`93	557	1,207	5,370	`75	1,134	6,975	42,352	52,106,636
Mean usual hours worked for workers	37.5	38.7	40.5	41.0	38.5	36.2	38.1	38.5	38.2	38.8	38.4	38.4

Percent of Total

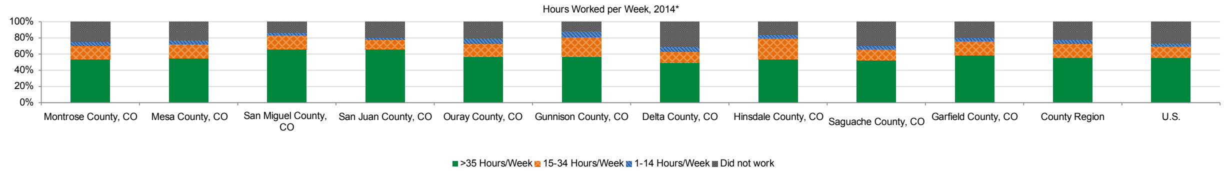
	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
WEEKS WORKED PER YEAR:												
Worked 50 to 52 weeks	52.2%	54.6%	59.5%	47.6%	52.8%	50.2%	47.8%	50.0%	40.5%	55.8%	53.5%	55.1%
Worked 27 to 49 weeks	13.1%	12.1%	19.7%	`15.0%	14.6%	22.5%	9.2%	14.1%	16.3%	13.5%	13.2%	10.3%
Worked 1 to 26 weeks	11.1%	11.4%	8.3%	``18.8%	`13.0%	16.7%	13.0%	``20.8%	`14.7%	12.3%	12.1%	9.2%
Did not work	23.5%	21.9%	`12.5%	`18.6%	`19.5%	10.5%	29.9%	`15.1%	`28.5%	18.4%	21.3%	25.3%
HOURS WORKED PER WEEK:												
Worked 35 or more hours per week	55.0%	55.9%	66.8%	67.2%	58.0%	57.7%	50.3%	54.8%	53.8%	60.0%	56.5%	56.7%
Worked 15 to 34 hours per week	16.2%	17.6%	17.7%	`11.6%	16.1%	24.2%	13.6%	25.8%	13.1%	17.1%	17.3%	14.4%
Worked 1 to 14 hours per week	5.3%	4.7%	3.0%	`2.6%	6.4%	7.5%	6.2%	`4.2%	4.6%	4.5%	5.0%	3.6%
Did not work	23.5%	21.9%	`12.5%	``18.6%	`19.5%	`10.5%	29.9%	``15.1%	`28.5%	`18.4%	21.3%	25.3%

* The data in this table are calculated by ACS using annual surveys conducted during 2010-2014 and are representative of average characteristics during this period.

- In the 2009-2014 period, San Miguel County, CO had the highest estimated percent of people that worked 50 to 52 weeks per year (59.5%), and Saguache County, CO had the lowest (40.5%).



- In the 2009-2014 period, San Juan County, CO had the highest estimated percent of people that worked 35 or more hours per week (67.2%), and Delta County, CO had the lowest (50.3%).



Data Sources: U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.

What are the characteristics of labor participation?

What do we measure on this page?

This page describes workers by hours worked per week and by weeks worked per year.

Note: Weeks worked per year and hours worked per week are irrespective of each other. For example, regardless of whether an individual worked 10 or 40 hours per week, if they worked 50 weeks per year, they will be recorded as having "worked 50 to 52 weeks per year".

Why is it important?

Often, if too few hours are worked per week or weeks worked per year, the local economy may suffer from underemployment of labor and human capital, translating to lower real incomes and a lower standard of living. For example, labor incomes in agriculture and other seasonal sources of employment have consistently been among the lowest of the industrial classes as reported by the U.S. Census.

However, shorter work weeks and fewer weeks worked per year can be indicative of worker preference. Part-time jobs (those that average less than 35 hours/week) are often ideal for students, people who are responsible for taking care of their dependents, and the elderly who wish to remain active in the workplace but do not want to work a full schedule. Advances in computer technologies have also enabled workers to telecommute and work shorter and more flexible hours. And, in some cases, young adults seek out seasonal, tourism, or recreation related employment by choice. Since the 1960s, during periods of economic stability, the vast majority of part-time workers have been voluntary. For example, in 2006, only about one in seven part-time workers were involuntary (individuals wanting full-time jobs but working less than 35 hours/week).

To understand the degree to which the data on this page are related to underemployment and economic hardship versus worker preference, data on age and income distribution should be examined.

Most employment statistics count full time, part time, and seasonal employment as the same, a single job. In places where a relatively large percent of the employment base is either part time or seasonally employed this may explain falling wages or rates of employment that outpace population change (see the Socioeconomic Measures report for changes in wages, employment, and population over time).

Methods

Data accuracy is indicated as follows: BLACK indicates a coefficient of variation < 12%; ORANGE (preceded with one dot) indicates between 12 and 40%; and **RED BOLD** (preceded with two dots) indicates a coefficient of variation > 40%. If data have consistently low accuracy throughout a report, we suggest running another demographics report at a larger geographic scale.

Additional Resources

Maynard, D. C. & Feldman, D. C. (Eds.) 2011. Underemployment: Psychological, economic and social challenges. New York: Springer.

A. Levenson. 2006. Trends in Jobs and Wages in the U.S. Economy. CEO Publication G 06-12 (501). Available at: ceo.usc.edu/pdf/G0612501.pdf *(28)*.

For historical fluctuations of involuntary part-time employment, see: bls.gov/opub/ils/pdf/opbils71.pdf *(29)*.

For information on unemployment, run the EPS-HDT Measures, Summary, or Tourism reports.

Data Sources

U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.

What are commuting patterns?

This page describes workers who do not work from home by place of work and by travel time to work.

Commuting Characteristics, 2014*

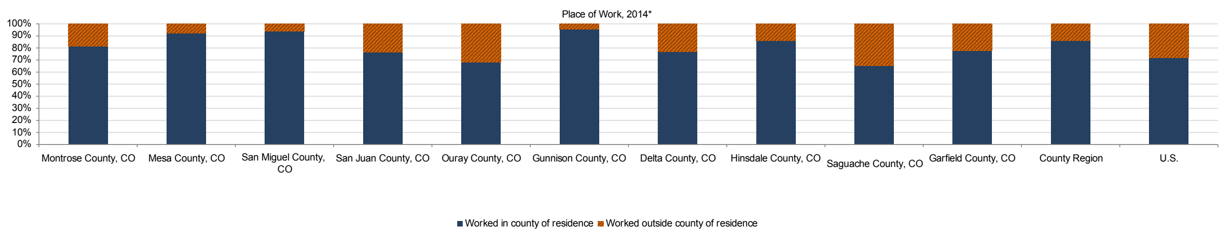
	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Workers 16 years and over	17,155	66,035	4,370	366	2,084	8,725	11,505	401	2,563	28,483	141,687	141,337,148
PLACE OF WORK:												
Worked in county of residence	14,107	61,284	4,140	`282	1,435	8,405	8,937	347	1,694	22,307	122,938	102,383,695
Worked outside county of residence	3,048	4,751	`230	`84	`649	`320	2,568	`54	869	6,176	18,749	38,953,453
TRAVEL TIME TO WORK:												
Less than 10 minutes	4,315	11,217	923	`205	543	4,159	3,136	`267	1,033	5,404	31,202	17,926,611
10 to 14 minutes	4,212	13,975	`663	`40	`267	1,451	1,713	``14	`328	3,478	26,141	19,118,214
15 to 19 minutes	2,516	14,792	`625	``24	`228	`859	1,407	``0	`187	3,094	23,732	20,908,743
20 to 24 minutes	1,595	8,991	`519	``20	`124	`451	1,091	``20	`117	3,368	16,296	19,975,565
25 to 29 minutes	`373	2,595	`165	``0	``158	``53	`284	``5	`71	`1,126	4,830	8,356,337
30 to 34 minutes	1,069	3,875	`449	``0	`196	`549	`947	``11	`201	2,753	10,050	18,463,798
35 to 39 minutes	``116	`641	``14	``12	``25	``81	`190	``0	``90	`547	`1,716	3,769,500
40 to 44 minutes	`137	`452	``70	``3	``25	`165	`304	``0	``29	`835	2,020	5,037,201
45 to 59 minutes	`722	`1,862	`261	``0	`97	`290	`559	``19	`101	2,288	6,199	10,409,233
60 or more minutes	`1,205	4,296	`102	``41	`169	`181	`1,031	``19	`217	3,754	11,015	11,200,355
Mean travel time to work (minutes)	19.3	20.1	16.5	`13	18.9	12.7	21.4	`11	17.8	25.8	20.6	24.6

Percent of Total

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
PLACE OF WORK:												
Worked in county of residence	82.2%	92.8%	94.7%	`77.0%	68.9%	96.3%	77.7%	86.5%	66.1%	78.3%	86.8%	72.4%
Worked outside county of residence	17.8%	7.2%	`5.3%	`23.0%	`31.1%	`3.7%	22.3%	`13.5%	33.9%	21.7%	13.2%	27.6%
TRAVEL TIME TO WORK:												
Less than 10 minutes	25.2%	17.0%	21.1%	`56.0%	26.1%	47.7%	27.3%	`66.6%	40.3%	19.0%	22.0%	12.7%
10 to 14 minutes	24.6%	21.2%	`15.2%	`10.9%	`12.8%	16.6%	14.9%	``3.5%	`12.8%	12.2%	18.4%	13.5%
15 to 19 minutes	14.7%	22.4%	`14.3%	``6.6%	`10.9%	`9.8%	12.2%	``0.0%	`7.3%	10.9%	16.7%	14.8%
20 to 24 minutes	9.3%	13.6%	`11.9%	``5.5%	`6.0%	`5.2%	9.5%	``5.0%	`4.6%	11.8%	11.5%	14.1%
25 to 29 minutes	`2.2%	3.9%	`3.8%	``0.0%	``7.6%	``0.6%	`2.5%	``1.2%	`2.8%	`4.0%	3.4%	5.9%
30 to 34 minutes	6.2%	5.9%	`10.3%	``0.0%	`9.4%	`6.3%	`8.2%	``2.7%	`7.8%	9.7%	7.1%	13.1%
35 to 39 minutes	`0.7%	`1.0%	``0.3%	``3.3%	``1.2%	``0.9%	`1.7%	``0.0%	``3.5%	`1.9%	`1.2%	2.7%
40 to 44 minutes	`0.8%	`0.7%	``1.6%	``0.8%	``1.2%	`1.9%	`2.6%	``0.0%	``1.1%	`2.9%	1.4%	3.6%
45 to 59 minutes	`4.2%	`2.8%	`6.0%	``0.0%	`4.7%	`3.3%	`4.9%	``4.7%	`3.9%	8.0%	4.4%	7.4%
60 or more minutes	`7.0%	6.5%	`2.3%	``11.2%	`8.1%	`2.1%	`9.0%	``4.7%	`8.5%	13.2%	7.8%	7.9%

* The data in this table are calculated by ACS using annual surveys conducted during 2010-2014 and are representative of average characteristics during this period.

- In the 2010-2014 period, Saguache County, CO had the highest estimated percent of people that worked outside the county of residence (33.9%), and Gunnison County, CO had the lowest (3.7%).



Data Sources: U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.

What are commuting patterns?

What do we measure on this page?

This page describes workers who do not work from home by place of work and by travel time to work.

Place of Work: The values reported under "place of work" describe the number of workers that live in the selected geographic area who worked either in or outside the county they live in. If the selected geography is not a county, the workers may or may not work within the selected geography. For example, for the city of Phoenix, the data reported for "Worked in county of residence" describes the number of city of Phoenix residents that worked in Maricopa County (but not necessarily within the city of Phoenix).

Why is it important?

High rates of out-commuting are more common in non-metro areas, and in parts of the U.S. where communities are closer together.

Economic development is sometimes affected by commuting in unanticipated ways: strategies aimed at increasing jobs in a community will not necessarily mean jobs for residents. Conversely, creating job opportunities for residents does not always require bringing jobs into that community.

High out-commuting rates can also separate tax revenues from demands for services, complicating fiscal planning for local governments. "Bedroom communities," those with high levels of out-commuting, may struggle to provide social services, housing, and water and sewer facilities without an adequate source of revenue. Higher levels and longer distance of commuting likely indicate a housing-job imbalance. This can result from unaffordable housing prices or other residential constraints.

Methods

Data accuracy is indicated as follows: BLACK indicates a coefficient of variation < 12%; ORANGE (preceded with one dot) indicates between 12 and 40%; and **RED BOLD** (preceded with two dots) indicates a coefficient of variation > 40%. If data have consistently low accuracy throughout a report, we suggest running another demographics report at a larger geographic scale.

Additional Resources

Aldrich, L., Beale, B. and K. Kasse. 1997. Commuting and the Economic Functions of Small Towns and Places. Rural Development Perspectives 12(3). ers.usda.gov/Publications/RDP/RDP697/RDP697e.pdf *(30)*.

Data Sources

U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.

How is income distributed?

This page describes the distribution of household income.

Household Income Distribution, 2014*

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Per Capita Income (2014 $s)	$23,408	$26,518	$40,993	$25,926	$32,562	$27,070	$24,590	$36,046	$20,569	$27,022	na	$28,555
Median Household Income^ (2014 $s)	$44,885	$48,610	$59,490	$37,679	$60,701	$51,371	$42,389	$55,682	$33,398	$57,214	na	$53,482
Total Households	16,815	58,966	3,330	338	1,969	6,336	12,527	418	2,598	20,330	123,627	116,211,092
Less than $10,000	1,057	4,681	`145	¨21	`112	`494	1,102	¨13	`330	`954	8,909	8,395,338
$10,000 to $14,999	1,135	3,239	`158	¨15	`99	`283	`1,019	¨20	`201	`619	6,788	6,189,386
$15,000 to $24,999	2,387	6,336	`259	`56	`139	`644	1,670	`64	`457	2,163	14,175	12,402,928
$25,000 to $34,999	2,221	6,983	`424	`42	`193	`563	1,515	`32	`352	1,796	14,121	11,870,709
$35,000 to $49,999	2,468	8,926	`421	`82	`217	1,133	1,954	`47	`374	3,006	18,628	15,681,133
$50,000 to $74,999	3,511	10,727	659	`65	`509	1,298	2,117	`79	`481	4,133	23,579	20,719,319
$75,000 to $99,999	1,855	7,101	`417	`30	`284	945	1,512	`67	`198	3,023	15,432	14,125,429
$100,000 to $149,999	1,582	6,994	`435	`21	`245	`604	991	`62	`141	2,966	14,041	15,123,755
$150,000 to $199,999	`342	2,471	`167	¨6	`92	`200	`330	¨19	¨23	`981	4,631	5,857,717
$200,000 or more	`257	1,508	`245	¨0	`79	`172	`317	¨15	`41	`689	3,323	5,845,378
Gini Coefficient^	0.42	0.46	0.51	0.37	0.41	0.43	0.48	0.44	0.49	0.41	na	0.48

Percent of Total

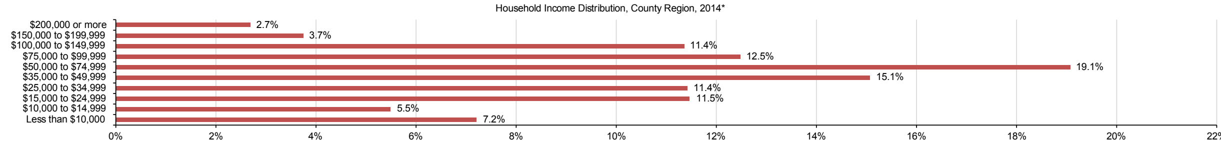
	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Less than $10,000	6.3%	7.9%	`4.4%	¨6.2%	`5.7%	`7.8%	8.8%	¨3.1%	`12.7%	`4.7%	7.2%	7.2%
$10,000 to $14,999	6.7%	5.5%	`4.7%	¨4.4%	`5.0%	`4.5%	`8.1%	¨4.8%	`7.7%	`3.0%	5.5%	5.3%
$15,000 to $24,999	14.2%	10.7%	`7.8%	`16.6%	`7.1%	`10.2%	13.3%	`15.3%	`17.6%	10.6%	11.5%	10.7%
$25,000 to $34,999	13.2%	11.8%	`12.7%	`12.4%	`9.8%	`8.9%	12.1%	`7.7%	`13.5%	8.8%	11.4%	10.2%
$35,000 to $49,999	14.7%	15.1%	`12.6%	`24.3%	`11.0%	17.9%	15.6%	`11.2%	`14.4%	14.8%	15.1%	13.5%
$50,000 to $74,999	20.9%	18.2%	19.8%	`19.2%	`25.9%	20.5%	16.9%	`18.9%	`18.5%	20.3%	19.1%	17.8%
$75,000 to $99,999	11.0%	12.0%	`12.5%	`8.9%	`14.4%	14.9%	12.1%	`16.0%	`7.6%	14.9%	12.5%	12.2%
$100,000 to $149,999	9.4%	11.9%	`13.1%	`6.2%	`12.4%	`9.5%	7.9%	`14.8%	`5.4%	14.6%	11.4%	13.0%
$150,000 to $199,999	`2.0%	4.2%	`5.0%	¨1.8%	`4.7%	`3.2%	`2.6%	¨4.5%	¨0.9%	`4.8%	3.7%	5.0%
$200,000 or more	`1.5%	2.6%	`7.4%	¨0.0%	`4.0%	`2.7%	`2.5%	¨3.6%	`1.6%	`3.4%	2.7%	5.0%

^ Median Household Income and Gini Coefficient are not available for metro/non-metro or regional aggregations.

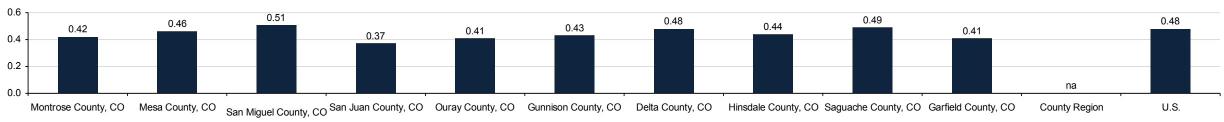
* The data in this table are calculated by ACS using annual surveys conducted during 2010-2014 and are representative of average characteristics during this period.

- In the 2009-2014 period, the income category in the County Region with the most households was $50,000 to $74,999 (19.1% of households). The income category with the fewest households was $200,000 or more (2.7% of households).
- In the 2009-2014 period, the bottom 40% of households in the County Region accumulated approximately 10.5% of total income, and the top 20% of households accumulated approximately 53.5% of total income.
- In the 2009-2014 period, San Juan County, CO had the most equal income distribution between high and low income households (Gini coef. of 0.37) and San Miguel County, CO had the least equal income distribution (Gini coef. of 0.51).

Household Income Distribution, County Region, 2014*



Gini Coefficient (where 1 represents complete inequality), County Region, 2014*



Data Sources: U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.

Study Guide and Supplemental Information

How is income distributed?

What do we measure on this page?

This page describes the distribution of household income.

Per Capita Income: Total personal income divided by total population of an area.

household: A household includes all the people who occupy a housing unit as their usual place of residence.

Gini Coefficient: A summary value of the inequality of income distribution. A value of 0 represents perfect equality and a value of 1 represents perfect inequality. The lower the Gini coefficient, the more equal the income distribution.

Why is it important?

For public land managers, one of the important considerations of proposed management actions is whether low income populations could experience disproportionately high and adverse effects as a result of those actions. Understanding income differences within and between geographies helps to highlight areas where the population or a sub-population may be experiencing economic hardship.

The distribution of income is related to important aspects of economic well-being. Large numbers of households in the lower end of income distribution indicates economic hardship. A bulge in the middle can be interpreted as the size of the middle class. A figure that shows a proportionally large number of households at both extremes indicates a geography characterized by “haves” and "have-nots.”

Income distribution has always been a central concern of economic theory and economic policy. Classical economists were mainly concerned with the distribution of income between the main factors of production, land, labor, and capital. Modern economists have also addressed this issue, but have been more concerned with the distribution of income across individuals and households.

According to the Census Bureau, “Researchers believe that changes in the labor market and... household composition affected the long-run increase in income inequality. The wage distribution has become considerably more unequal with workers at the top experiencing real wage gains and those at the bottom real wage losses... At the same time, long-run changes in society's living arrangements have taken place also tending to exacerbate household income differences. For example, divorces, marital separations, births out of wedlock, and the increasing age at first marriage have led to a shift away from married-couple households to single-parent families and nonfamily households. Since non-married-couple households tend to have lower income and less equally distributed income than other types of households... changes in household composition have been associated with growing income inequality.”

Methods

While the Census Bureau does not have an official definition of the "middle class," it does derive several measures related to the distribution of income and income inequality. Two standard measures of income equality are the Lorenz Curve and the Gini Coefficient. Mean values for each cohort were used to calculate total income, in the case of the top income cohort, income was assumed to be $250,000, a value which tends to yield lower than actual values for income disparity. For details on how to calculate, see Additional Resources below.

Data accuracy is indicated as follows: BLACK indicates a coefficient of variation < 12%; ORANGE (preceded with one dot) indicates between 12 and 40%; and **RED BOLD** (preceded with two dots) indicates a coefficient of variation > 40%. If data have consistently low accuracy throughout a report, we suggest running another demographics report at a larger geographic scale.

Additional Resources

The U.S. Department of Agriculture’s Economic Research Service published a useful article on metro and non-metro income levels and inequality. McLaughlin, Diane K. “Income Inequality in America.” 2002. Rural America. Vol. 17(2). It is available at: ers.usda.gov/publications/ruralamerica/ra172/ra172c.pdf *(31)*.

For useful remarks and scholarly references on the level and distribution of economic well-being, see Federal Reserve System Chairman Ben S. Bernanke’s speech on February 6, 2007, available at: federalreserve.gov/newsevents/speech/Bernanke20070206a.htm *(32)*.

For a helpful definition and description of the Lorenz Curve and Gini Coefficient see: econedlink.org/lessons/index.php?lid=885&type=educator *(33)*.

For source material on how the Gini Coefficient and Lorenz Curve were computed see: https://docs.google.com/Doc?docid=0AXe2E1Mm09WlZGhzazhxaDRfMjUzZ25nMjdkZzY&hl=en *(34)*.

Data Sources

U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.

What are poverty levels?

This page describes the number of individuals and families living below the poverty line.

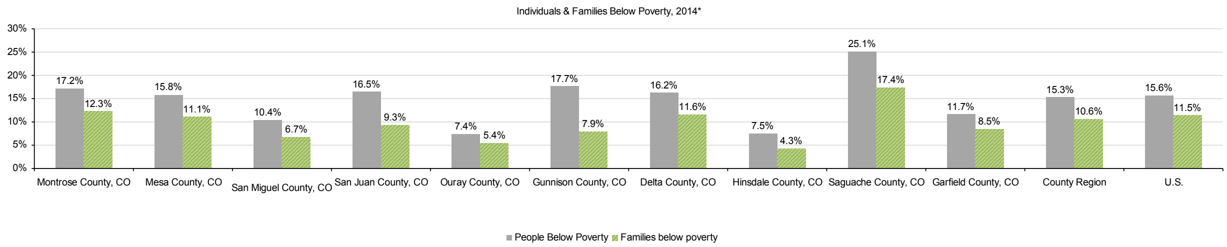
Poverty: Following the Office of Management and Budget's Directive 14, the Census Bureau uses a set of income thresholds that vary by family size and composition to detect who is poor. If the total income for a family or an unrelated individual falls below the relevant poverty threshold, then the family or an unrelated individual is classified as being "below the poverty level."

Poverty, 2014*

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
People	40,300	144,055	7,568	653	4,521	14,551	29,171	871	6,172	55,605	303,467	306,226,394
Families	11,470	38,386	1,770	`151	1,272	3,604	8,386	281	1,473	14,539	81,332	76,958,064
People Below Poverty	6,915	22,726	`787	``$108	`334	2,570	4,738	`65	`1,547	6,503	46,293	47,755,606
Families below poverty	1,409	4,263	`119	``$14	`69	`286	`971	``$12	`256	`1,232	8,631	8,824,660
Percent of Total												
People Below Poverty	17.2%	15.8%	`10.4%	``16.5%	`7.4%	17.7%	16.2%	`7.5%	`25.1%	11.7%	15.3%	15.6%
Families below poverty	12.3%	11.1%	`6.7%	``9.3%	`5.4%	`7.9%	`11.6%	``4.3%	`17.4%	`8.5%	10.6%	11.5%

* The data in this table are calculated by ACS using annual surveys conducted during 2010-2014 and are representative of average characteristics during this period.

- In the 2010-2014 period, Saguache County, CO had the highest estimated percent of individuals living below poverty (25.1%), and Ouray County, CO had the lowest (7.4%).
- In the 2010-2014 period, Saguache County, CO had the highest estimated percent of families living below poverty (17.4%), and Hinsdale County, CO had the lowest (4.3%).



Poverty Rate by Age & Family Type~, 2014*

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
People	17.2%	15.8%	`10.4%	``16.5%	`7.4%	17.7%	16.2%	`7.5%	`25.1%	11.7%	15.3%	15.6%
Under 18 years	25.9%	20.5%	`9.6%	``16.9%	``9.4%	`20.7%	24.0%	``9.8%	`37.3%	13.6%	20.1%	21.9%
65 years and older	`8.9%	8.9%	``6.8%	``7.4%	`4.8%	`9.4%	`11.5%	`9.9%	`12.9%	`11.6%	9.6%	9.4%
Families	12.3%	11.1%	`6.7%	``9.3%	`5.4%	`7.9%	`11.6%	``4.3%	`17.4%	`8.5%	10.6%	11.5%
Families with related children < 18 years	`21.0%	18.8%	`8.0%	``7.3%	``10.2%	`12.9%	`21.6%	``5.3%	`30.9%	`12.8%	17.6%	18.1%
Married couple families	`8.0%	`4.9%	`5.3%	``2.9%	``3.7%	`3.6%	`5.7%	``4.4%	`7.4%	`6.3%	5.7%	5.7%
with children < 18 years	`13.9%	`6.6%	`6.3%	``11.5%	``2.0%	``4.6%	`8.1%	``6.1%	``13.5%	`9.9%	8.5%	8.4%
Female householder, no husband present	`36.7%	35.3%	``13.3%	``10.3%	``14.0%	`31.7%	`43.2%	``0.0%	`47.6%	`18.4%	33.0%	30.9%
with children < 18 years	`44.0%	47.0%	``18.8%	``0.0%	``34.2%	`38.5%	`66.1%	``0.0%	`61.1%	`22.7%	43.4%	40.5%

~Poverty rate by age and family type is calculated by dividing the number of people by demographic in poverty by the total population of that demographic.

Data Sources: U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.

What are poverty levels?

What do we measure on this page?

This page describes the number of individuals and families living below the poverty line.

Family: A group of two or more people who reside together and who are related by birth, marriage, or adoption.

Poverty: Following the Office of Management and Budget's Directive 14, the Census Bureau uses a set of income thresholds that vary by family size and composition to detect who is poor. If the total income for a family or an unrelated individual falls below the relevant poverty threshold, then the family or an unrelated individual is classified as being "below the poverty level."

Why is it important?

Poverty is an important indicator of economic well-being. For public land managers, understanding the extent of poverty is important for several reasons. First, people with limited income may have different needs, values, and attitudes as they relate to public lands. Second, proposed activities on public lands may need to be analyzed in the context of whether people who are economically disadvantaged could experience disproportionately high and adverse effects.

Poverty rates are often reported in aggregate, which can hide important differences. The bottom table shows poverty for various types of individuals and families. This is important because aggregate poverty rates (for example, families below poverty) may hide some important information (for example, the poverty rate for single mothers with children).

Methods

Data accuracy is indicated as follows: BLACK indicates a coefficient of variation < 12%; ORANGE (preceded with one dot) indicates between 12 and 40%; and **RED BOLD** (preceded with two dots) indicates a coefficient of variation > 40%. If data have consistently low accuracy throughout a report, we suggest running another demographics report at a larger geographic scale.

Additional Resources

For more information on rural poverty, see U.S. Department of Agriculture, Economic Research Service, Briefing Room, "Rural Income, Poverty, and Welfare: High Poverty Counties" available at: ers.usda.gov/topics/rural-economy-population/rural-poverty-well-being.aspx *(35)*.

The University of Michigan's National Poverty Center has a range of resources on poverty in the United States. See: www.npc.umich.edu/poverty *(36)*.

The U.S. Environmental Protection Agency defines environmental justice as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies." Environmental Protection Agency environmental justice resources are available at: epa.gov/compliance/ej *(4)*.

Data Sources

U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.

What are poverty levels?

This page describes the number of people living in poverty by race and ethnicity. It also shows the share of all people living in poverty by race and ethnicity, and the share of each race and ethnicity living in poverty.

Race: Race is a self-identification data item in which Census respondents choose the race or races with which they most closely identify.

Ethnicity: There are two minimum categories for ethnicity: Hispanic or Latino and Not Hispanic or Latino. The federal government considers race and Hispanic origin to be two separate and distinct concepts. Hispanics and Latinos may be of any race.

Poverty by Race and Ethnicity^, 2014*

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Total Population (all races) in Poverty	6,915	22,726	`787	¨108	`334	2,570	4,738	`65	`1,547	6,503	46,293	47,755,606
White alone	5,996	19,961	`772	¨108	`289	2,486	4,406	`61	`1,169	5,346	40,594	28,912,690
Black or African American alone	¨41	`297	¨0	¨0	¨0	¨0	¨11	¨0	¨3	¨142	`494	10,351,976
American Indian alone	¨88	`274	¨0	¨0	¨12	¨0	¨47	¨0	¨9	¨68	`498	714,053
Asian alone	¨30	`140	¨15	¨0	¨0	¨10	¨75	¨0	¨29	¨8	`307	1,957,794
Native Hawaiian & Oth.Pacific Is. alone	¨0	¨69	¨0	¨0	¨0	¨0	¨0	¨0	¨0	¨0	¨69	107,874
Some other race	¨363	`1,150	¨0	¨0	¨0	¨0	¨119	¨0	`266	¨777	`2,675	3,914,622
Two or more races	`397	`835	¨0	¨0	¨33	¨74	¨80	¨4	¨71	¨162	`1,656	1,796,597
All Ethnicities in Poverty												
Hispanic or Latino (of any race)	`2,196	5,087	¨92	¨30	¨41	`519	`1,097	¨0	`837	`3,033	12,932	12,880,559
Not Hispanic or Latino (of any race)	4,347	16,341	`680	¨78	`281	1,971	3,475	`61	`657	`3,296	31,187	20,834,824
Percent of Total**												
White alone	86.7%	87.8%	`98.1%	¨100.0%	`86.5%	96.7%	93.0%	`93.8%	`75.6%	82.2%	87.7%	60.5%
Black or African American alone	¨0.6%	`1.3%	¨0.0%	¨0.0%	¨0.0%	¨0.0%	¨0.2%	¨0.0%	¨0.2%	¨2.2%	`1.1%	21.7%
American Indian alone	¨1.3%	`1.2%	¨0.0%	¨0.0%	¨3.6%	¨0.0%	¨1.0%	¨0.0%	¨0.6%	¨1.0%	`1.1%	1.5%
Asian alone	¨0.4%	`0.6%	¨1.9%	¨0.0%	¨0.0%	¨0.4%	¨1.6%	¨0.0%	¨1.9%	¨0.1%	`0.7%	4.1%
Native Hawaiian & Oth.Pacific Is. alone	¨0.0%	¨0.3%	¨0.0%	¨0.0%	¨0.0%	¨0.0%	¨0.0%	¨0.0%	¨0.0%	¨0.0%	¨0.1%	0.2%
Some other race	¨5.2%	`5.1%	¨0.0%	¨0.0%	¨0.0%	¨0.0%	¨2.5%	¨0.0%	`17.2%	¨11.9%	`5.8%	8.2%
Two or more races	`5.7%	`3.7%	¨0.0%	¨0.0%	¨9.9%	¨2.9%	¨1.7%	¨6.2%	¨4.6%	¨2.5%	`3.6%	3.8%
Hispanic or Latino (of any race)	`31.8%	22.4%	¨11.7%	¨27.8%	¨12.3%	`20.2%	`23.2%	¨0.0%	`54.1%	`46.6%	27.9%	27.0%
Not Hispanic or Latino (of any race)	62.9%	71.9%	`86.4%	¨72.2%	`84.1%	76.7%	73.3%	`93.8%	`42.5%	`50.7%	67.4%	43.6%

^ Percent of total population in poverty by race and ethnicity is calculated by dividing the number of people in poverty in each racial or ethnic category by the total population.
* The data in this table are calculated by ACS using annual surveys conducted during 2010-2014 and are representative of average characteristics during this period.
** Total equals all individuals in poverty.

Percent of People by Race and Ethnicity Who Are Below Poverty~, 2014*

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
White alone	16.2%	15.0%	`10.6%	¨17.8%	`6.6%	17.7%	15.8%	`7.1%	`22.1%	10.8%	14.5%	12.8%
Black or African American alone	¨19.8%	`34.2%	¨0.0%	na	na	¨0.0%	¨25.0%	na	¨37.5%	¨44.9%	`33.3%	27.3%
American Indian alone	¨24.2%	`23.7%	¨0.0%	¨0.0%	¨42.9%	¨0.0%	¨24.2%	na	¨13.2%	¨15.3%	`21.0%	28.8%
Asian alone	¨14.3%	`16.5%	¨16.5%	¨0.0%	¨0.0%	¨10.5%	¨47.5%	na	¨93.5%	¨2.1%	`16.9%	12.7%
Native Hawaiian & Oceanic alone	¨0.0%	¨65.7%	na	na	na	na	na	na	na	na	¨40.1%	20.7%
Some other race alone	¨25.0%	`27.3%	¨0.0%	¨0.0%	na	¨0.0%	¨25.2%	na	`50.2%	¨21.5%	`25.7%	27.1%
Two or more races alone	`41.1%	`21.8%	¨0.0%	¨0.0%	¨42.3%	¨28.0%	¨22.1%	¨23.5%	¨29.0%	¨10.8%	`22.5%	20.3%
Hispanic or Latino alone	`27.4%	25.9%	¨13.0%	¨21.1%	¨15.2%	`42.8%	`26.6%	¨0.0%	`34.7%	`19.5%	24.8%	24.8%
Non-Hispanic/Latino alone	14.0%	13.7%	`10.3%	¨16.2%	`6.7%	15.2%	14.2%	`7.3%	`18.6%	`8.5%	12.9%	10.8%

~Poverty prevalence by race and ethnicity is calculated by dividing the number of people by race in poverty by the total population of that race.

Data Sources: U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.

Study Guide and Supplemental Information

What are poverty levels?

What do we measure on this page?

This page describes the number of people living in poverty by race and ethnicity. It also shows the share of all people living in poverty by race and ethnicity, and the share of each race and ethnicity living in poverty.

Race: Race is a self-identification data item in which Census respondents choose the race or races with which they most closely identify.

Ethnicity: There are two minimum categories for ethnicity: Hispanic or Latino, and Not Hispanic or Latino. The federal government considers race and Hispanic origin to be two separate and distinct concepts. Hispanics and Latinos may be of any race.

Poverty: Following the Office of Management and Budget's Directive 14, the Census Bureau uses a set of income thresholds that vary by family size and composition to detect who is poor. If the total income for a family or an unrelated individual falls below the relevant poverty threshold, then the family or an unrelated individual is classified as being "below the poverty level."

Why is it important?

For public land managers, understanding whether different races and ethnicities are affected by poverty can be important. People with limited income and from different races and ethnicities may have different needs, values, and attitudes as they relate to public lands. In addition, proposed activities on public lands may need to be analyzed in the context of whether minorities and people who are economically disadvantaged could experience disproportionately high and adverse effects.

Methods

The Census Bureau uses the federal government's official poverty definition. According to the Census: “Families and persons are classified as below poverty if their total family income or unrelated individual income was less than the poverty threshold specified for the applicable family size, age of householder, and number of related children under 18 present" (see below for poverty level thresholds).

The poverty thresholds are updated every year by the Census Bureau to reflect changes in the Consumer Price Index. The poverty thresholds are the same for all parts of the country. They are not adjusted for regional, state or local variations in the cost of living. The specific thresholds used for tabulation of income for particular years are shown at: census.gov/hhes/www/poverty/data/threshld/index.html (37).

Race categories include both racial and national-origin groups. The concept of race is separate from the concept of Hispanic origin. Percentages for the various race categories add to 100 percent, and should not be combined with the percent Hispanic.

Data accuracy is indicated as follows: BLACK indicates a coefficient of variation < 12%; ORANGE (preceded with one dot) indicates between 12 and 40%; and **RED BOLD** (preceded with two dots) indicates a coefficient of variation > 40%. If data have consistently low accuracy throughout a report, we suggest running another demographics report at a larger geographic scale.

Additional Resources

The University of Michigan’s National Poverty Center hosts a body of research on race and ethnicity as they relate to poverty. See: npc.umich.edu/research/ethnicity *(38)*.

The U.S. Census Bureau briefing on “Poverty Areas” shows that Blacks and Hispanics are disproportionately affected by poverty. “Four times as many Blacks and three times as many Hispanics lived in poverty areas than lived outside them.” For more information, see: census.gov/population/socdemo/statbriefs/povarea.html *(39)*.

Data Sources

U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.

What are the components of household earnings?

This page describes household earnings by income source and mean household earnings by source.

Number of Households Receiving Earnings, by Source, 2014*

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Total households:	16,815	58,966	3,330	338	1,969	6,336	12,527	418	2,598	20,330	123,627	116,211,092
Labor earnings	12,311	44,755	2,845	301	1,441	5,555	8,566	315	1,899	17,880	95,868	90,513,367
Social Security (SS)	6,247	18,682	577	`75	715	1,152	5,418	`181	880	4,086	38,013	34,082,501
Retirement income	3,322	10,476	`253	`54	525	746	2,527	`108	431	2,196	20,638	20,738,512
Supplemental Security Income (SSI)	`673	2,460	``37	``5	`93	`89	`604	``3	`195	`501	4,660	6,160,788
Cash public assistance income	`661	1,518	`15	``31	``17	`172	`375	``9	`81	`228	3,107	3,274,407
Food Stamp/SNAP	2,186	6,555	`133	``26	`122	`389	1,411	``9	`404	1,392	12,627	15,089,358

Percent of Total^

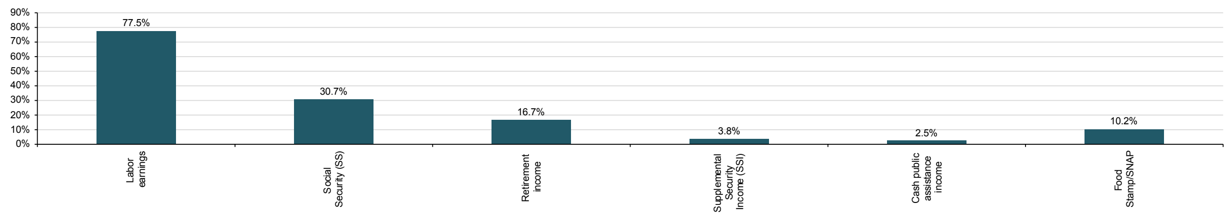
	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Labor earnings	73.2%	75.9%	85.4%	89.1%	73.2%	87.7%	68.4%	75.4%	73.1%	87.9%	77.5%	77.9%
Social Security (SS)	37.2%	31.7%	17.3%	`22.2%	36.3%	18.2%	43.3%	`43.3%	33.9%	20.1%	30.7%	29.3%
Retirement income	19.8%	17.8%	`7.6%	`16.0%	26.7%	11.8%	20.2%	`25.8%	16.6%	10.8%	16.7%	17.8%
Supplemental Security Income (SSI)	`4.0%	4.2%	``1.1%	``1.5%	`4.7%	`1.4%	`4.8%	``0.7%	`7.5%	`2.5%	3.8%	5.3%
Cash public assistance income	`3.9%	2.6%	``0.5%	``9.2%	``0.9%	`2.7%	`3.0%	``2.2%	`3.1%	`1.1%	2.5%	2.8%
Food Stamp/SNAP	13.0%	11.1%	`4.0%	``7.7%	`6.2%	`6.1%	11.3%	``2.2%	`15.6%	6.8%	10.2%	13.0%

^ Total may add to more than 100% due to households receiving more than 1 source of income.

* The data in this table are calculated by ACS using annual surveys conducted during 2009-2014 and are representative of average characteristics during this period.

- In the 2010-2014 period, the highest estimated percent of public assistance in the County Region was in the form of Social Security (SS) (30.7%), and the lowest was in the form of Cash public assistance income (2.5%).

Percent of Households Receiving Earnings, by Source, 2014*



Mean Annual Household Earnings by Source, 2014 (2014 $s)

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Mean earnings	$52,414	$65,345	$70,825	`$42,310	$65,360	$57,147	$61,969	`$60,175	$46,615	$68,806	$63,256	$76,303
Mean Social Security income	$17,302	$17,301	$18,021	`$13,915	$21,457	$14,328	$16,268	`$17,056	$13,730	$15,988	$16,921	$17,636
Mean retirement income	$25,436	$24,650	`$30,013	`$19,265	`$31,329	$33,749	$20,525	``$52,528	`$16,720	$28,879	$25,252	$24,095
Mean Supplemental Security Income	`$8,436	$9,596	``$8,003	``$8,620	`$10,456	`$8,011	`$8,856	``$11,667	`$10,377	`$12,635	$9,666	$9,400
Mean cash public assistance income	`$3,833	`$3,609	``$1,633	``$781	``$1,494	`$2,748	`$3,136	``$2,167	``$4,017	`$3,899	`$3,530	$3,720

Data Sources: U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.

Study Guide and Supplemental Information

What are the components of household earnings?

What do we measure on this page?

This page describes household earnings by source.

Labor Earnings: Refers to households that receive wage or salary income and net income from self-employment.

Social Security: Refers to households that receive income that includes Social Security pensions and survivor benefits, permanent disability insurance payments made by the Social Security Administration before deductions for medical insurance, and railroad retirement insurance. It does not include Medicare reimbursement.

Retirement income: Consists of families that receive income from: 1) retirement pensions and survivor benefits from a former employer; labor union; or federal, state, or local government; and the U.S. military; 2) disability income from companies or unions; federal, state, or local government; and the U.S. military; 3) periodic receipts from annuities and insurance; and 4) regular income from IRA and Keogh plans. It does not include Social Security income.

Supplemental Security Income (SSI): Refers to households that receive assistance by the Social Security Administration that guarantees a minimum level of income for needy aged, blind, or disabled individuals.

Cash Public Assistance Income: Are households that receive public assistance that includes general assistance and Temporary Assistance to Needy Families (TANF). It does not include separate payments received for hospital or other medical care (vendor payments) or Supplemental Security Income (SSI) or noncash benefits such as Food Stamps.

Food Stamps/SNAP: Refers to households that receive coupons or cards that can be used to purchase food. This program was recently renamed the Supplemental Nutrition Assistance Program (SNAP). ACS does not report mean dollar amounts for this item.

Methods

Data accuracy is indicated as follows: BLACK indicates a coefficient of variation < 12%; ORANGE (preceded with one dot) indicates between 12 and 40%; and **RED BOLD** (preceded with two dots) indicates a coefficient of variation > 40%. If data have consistently low accuracy throughout a report, we suggest running another demographics report at a larger geographic scale.

Why is this important?

Earnings are not the only source of income, and for many families and communities a significant portion of income can be in the form of additional sources, such as retirement and Social Security. While some payments may be an indication of an aging population or an influx of retirees (retirement payments), other measures (for example, SSI or Food Stamps) are an indication of economic hardship.

Additional Resources

For a glossary of terms used in ACS, see:
census.gov/acs/www/Downloads/data_documentation/SubjectDefinitions/2009_ACSSubjectDefinitions.pdf *(40)*.

Data Sources

U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.

What are education and enrollment levels?

This page describes educational attainment and school enrollment.

Educational Attainment, 2014*

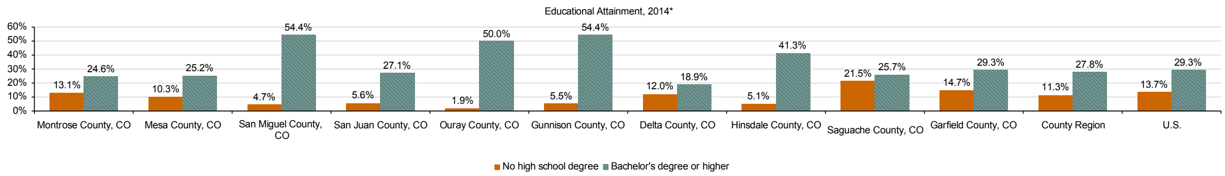
	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Total Population 25 yrs or older	28,666	98,727	5,664	517	3,642	9,768	21,848	750	4,343	37,128	211,053	209,056,129
No high school degree	3,755	10,185	˙269	¨29	¨68	˙535	2,615	¨38	932	5,465	23,891	28,587,748
High school graduate	24,911	88,542	5,395	488	3,574	9,233	19,233	712	3,411	31,663	187,162	180,468,381
Associates degree	2,221	9,114	˙251	˙54	˙195	˙614	1,702	˙34	˙214	2,844	17,243	16,580,076
Bachelor's degree or higher	7,061	24,901	3,082	˙140	1,821	5,310	4,135	310	1,118	10,867	58,745	61,206,147
Bachelor's degree	4,181	16,525	2,301	˙110	1,084	3,986	2,793	˙196	718	7,468	39,362	38,184,668
Graduate or professional	2,880	8,376	781	¨30	˙737	1,324	1,342	˙114	˙400	3,399	19,383	23,021,479

Percent of Total

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
No high school degree	13.1%	10.3%	˙4.7%	¨5.6%	˙1.9%	˙5.5%	12.0%	¨5.1%	21.5%	14.7%	11.3%	13.7%
High school graduate	86.9%	89.7%	95.3%	94.4%	98.1%	94.5%	88.0%	94.9%	78.5%	85.3%	88.7%	86.3%
Associates degree	7.7%	9.2%	˙4.4%	˙10.4%	˙5.4%	˙6.3%	7.8%	˙4.5%	˙4.9%	7.7%	8.2%	7.9%
Bachelor's degree or higher	24.6%	25.2%	54.4%	˙27.1%	50.0%	54.4%	18.9%	41.3%	25.7%	29.3%	27.8%	29.3%
Bachelor's degree	14.6%	16.7%	40.6%	˙21.3%	29.8%	40.8%	12.8%	˙26.1%	16.5%	20.1%	18.7%	18.3%
Graduate or professional	10.0%	8.5%	13.8%	¨5.8%	˙20.2%	13.6%	6.1%	˙15.2%	˙9.2%	9.2%	9.2%	11.0%

* The data in this table are calculated by ACS using annual surveys conducted during 2009-2014 and are representative of average characteristics during this period.

- In the 2010-2014 period, San Miguel County, CO had the highest estimated percent of people over the age of 25 with a bachelor's degree or higher (54.4%), and Delta County, CO had the lowest (18.9%).
- In the 2010-2014 period, Saguache County, CO had the highest estimated percent of people over the age of 25 with no high school degree (21.5%), and Ouray County, CO had the lowest (1.9%).



School Enrollment, 2014*

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Total Population over 3 years old:	39,583	142,095	7,434	628	4,458	15,091	29,505	834	5,979	54,340	299,947	302,459,217
Enrolled in school:	8,869	37,108	1,290	˙51	760	4,880	6,117	˙85	1,393	14,960	75,513	82,735,509
Enrolled in nursery school, preschool	˙625	2,381	˙166	¨3	¨53	˙247	˙497	¨28	˙118	1,087	5,205	4,996,054
Enrolled in kindergarten	˙637	˙1,778	˙82	¨0	¨33	˙286	˙243	¨8	˙90	˙716	3,873	4,214,718
Enrolled in grade 1 to grade 4	2,067	7,512	366	¨11	˙148	710	1,416	˙10	˙292	3,207	15,739	16,313,067
Enrolled in grade 5 to grade 8	2,177	7,415	˙324	¨18	˙155	˙485	1,613	¨9	290	3,673	16,159	16,529,309
Enrolled in grade 9 to grade 12	2,331	7,575	223	¨11	˙273	˙599	1,653	¨20	358	3,450	16,493	17,053,876
Enrolled in college, undergraduate years	˙806	9,414	˙79	¨8	˙76	2,364	˙537	¨10	˙168	2,335	15,797	19,482,655
Graduate or professional school	˙226	˙1,033	¨50	¨0	¨22	˙189	˙158	¨0	˙77	˙492	2,247	4,145,830
Not enrolled in school	30,714	104,987	6,144	577	3,698	10,211	23,388	749	4,586	39,380	224,434	219,723,708

Percent of Total

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Enrolled in school:	22.4%	26.1%	17.4%	˙8.1%	17.0%	32.3%	20.7%	˙10.2%	23.3%	27.5%	25.2%	27.4%
Enrolled in nursery school, preschool	˙1.6%	1.7%	˙2.2%	¨0.5%	¨1.2%	˙1.6%	˙1.7%	¨3.4%	˙2.0%	˙2.0%	1.7%	1.7%
Enrolled in kindergarten	1.6%	1.3%	˙1.1%	¨0.0%	¨0.7%	˙1.9%	˙0.8%	¨1.0%	˙1.5%	˙1.3%	1.3%	1.4%
Enrolled in grade 1 to grade 4	5.2%	5.3%	4.9%	¨1.8%	˙3.3%	4.7%	4.8%	˙1.2%	˙4.9%	5.9%	5.2%	5.4%
Enrolled in grade 5 to grade 8	5.5%	5.2%	˙4.4%	¨2.9%	˙3.5%	˙3.2%	5.5%	¨1.1%	4.9%	6.8%	5.4%	5.5%
Enrolled in grade 9 to grade 12	5.9%	5.3%	˙3.0%	¨1.8%	˙6.1%	˙4.0%	5.6%	¨2.4%	˙6.0%	6.3%	5.5%	5.6%
Enrolled in college, undergraduate years	2.0%	6.6%	˙1.1%	¨1.3%	˙1.7%	15.7%	˙1.8%	¨1.2%	˙2.8%	4.3%	5.3%	6.4%
Graduate or professional school	˙0.6%	˙0.7%	¨0.7%	¨0.0%	˙0.5%	˙1.3%	˙0.5%	¨0.0%	˙1.3%	˙0.9%	0.7%	1.4%
Not enrolled in school	77.6%	73.9%	82.6%	91.9%	83.0%	67.7%	79.3%	89.8%	76.7%	72.5%	74.8%	72.6%

Data Sources: U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.

What are education and enrollment levels?

What do we measure on this page?

This page describes levels of educational attainment.

Educational Attainment: This refers to the level of education completed by people 25 years and over in terms of the highest degree or the highest level of schooling completed.

School Enrollment: The ACS defines people as enrolled in school if when the survey was conducted they were attending a public or private school or college at any time during the three months prior to the time of interview. People enrolled in vocational, technical, or business school such as post-secondary vocational, trade, hospital school, and on job training were not reported as enrolled in school.

Why is it important?

Education is one of the most important indicators of the potential for economic success, and lack of education is closely linked to poverty. Studies show that geographies with a higher than average educated workforce grow faster, have higher incomes, and suffer less during economic downturns than other geographies. See "Additional Resources" below for more information.

For public land managers, understanding the differences in education levels can highlight whether certain people in geographic areas might experience disproportionately high and adverse effects of particular management actions. It also can help to identify how communication and outreach efforts could be tailored to different audiences.

School enrollment is an important indicator of the number of dependents in a community that are not of working age, access to education, and potential for future growth. Some government agencies also use this information for funding allocations.

Methods

Data accuracy is indicated as follows: BLACK indicates a coefficient of variation < 12%; ORANGE (preceded with one dot) indicates between 12 and 40%; and **RED BOLD** (preceded with two dots) indicates a coefficient of variation > 40%. If data have consistently low accuracy throughout a report, we suggest running another demographics report at a larger geographic scale.

Additional Resources

For information on the relationship between level of education, earnings, year-round employment, and unemployment rates, see:

The Bureau of Labor Statistics' web resource: bls.gov/emp/ep_chart_001.htm *(41)*.

U.S. Census Bureau's 2002 publication "The Big Payoff: Educational Attainment and Synthetic Estimates of Work-Life Earnings," available at: census.gov/prod/2002pubs/p23-210.pdf *(42)*.

Card, David (1999). "The Causal Effect of Education on Earnings" in Orley Ashenfelter and David Card, eds., Handbook of Labor Economics, vol. 3A. New York: Elsevier, pp. 1801-63.

Data Sources

U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.

What languages are spoken?

This page measures the primary language people speak at home.

Language Spoken at Home: The language currently used by respondents five years and over at home, either "English only" or a non-English language which is used in addition to English or in place of English.

Language Spoken at Home, 2014*

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Population 5 yrs or older	38,534	137,942	7,194	623	4,418	14,752	28,813	806	5,806	52,410	291,298	294,133,373
Speak only English	33,161	128,353	6,485	593	4,087	13,514	25,917	733	3,847	39,581	256,271	232,724,203
Speak a language other than English	5,373	9,589	˙709	¨30	˙331	˙1,238	2,896	¨73	1,959	12,829	35,027	61,409,170
Spanish or Spanish Creole	5,001	7,851	602	¨30	˙203	˙777	2,453	¨42	1,804	12,096	30,859	38,098,698
Other Indo-European languages	¨206	˙1,016	¨85	¨0	˙122	˙327	˙293	¨31	¨82	˙506	2,668	10,806,493
Asian and Pacific Island languages	¨159	˙539	¨10	¨0	¨3	¨94	¨135	¨0	¨60	¨190	˙1,190	9,776,631
Other languages	¨7	˙183	¨12	¨0	¨3	¨40	¨15	¨0	¨13	¨37	˙310	2,727,348
Speak English less than "very well"	1,988	2,852	˙259	¨12	¨54	˙317	˙1,087	¨0	˙655	5,094	12,318	25,305,202

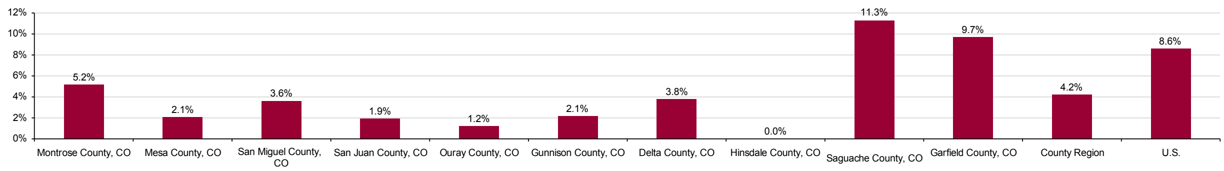
Percent of Total

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Speak only English	86.1%	93.0%	90.1%	95.2%	92.5%	91.6%	89.9%	90.9%	66.3%	75.5%	88.0%	79.1%
Speak a language other than English	13.9%	7.0%	˙9.9%	¨4.8%	˙7.5%	˙8.4%	10.1%	¨9.1%	33.7%	24.5%	12.0%	20.9%
Spanish or Spanish Creole	13.0%	5.7%	8.4%	¨4.8%	˙4.6%	˙5.3%	8.5%	¨5.2%	31.1%	23.1%	10.6%	13.0%
Other Indo-European languages	¨0.5%	˙0.7%	¨1.2%	¨0.0%	˙2.8%	˙2.2%	˙1.0%	¨3.8%	¨1.4%	˙1.0%	˙0.9%	3.7%
Asian and Pacific Island languages	¨0.4%	˙0.4%	¨0.1%	¨0.0%	¨0.1%	¨0.6%	¨0.5%	¨0.0%	¨1.0%	¨0.4%	˙0.4%	3.3%
Other languages	¨0.0%	¨0.1%	¨0.2%	¨0.0%	¨0.1%	¨0.3%	¨0.1%	¨0.0%	¨0.2%	¨0.1%	¨0.1%	0.9%
Speak English less than "very well"	5.2%	2.1%	˙3.6%	¨1.9%	¨1.2%	˙2.1%	˙3.8%	¨0.0%	˙11.3%	9.7%	4.2%	8.6%

* The data in this table are calculated by ACS using annual surveys conducted during 2009-2014 and are representative of average characteristics during this period.

- In the 2010-2014 period, Saguache County, CO had the highest estimated percent of people that spoke English less than 'very well' (11.3%), and Hinsdale County, CO had the lowest (0.0%).

Percent of Population that 'Speaks English Less Than Very Well', 2014*



Data Sources: U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.

Study Guide and Supplemental Information

What languages are spoken?

What do we measure on this page?

This page measures the primary language people speak at home.

Language Spoken at Home: The language currently used by respondents five years and over at home, either "English only" or a non-English language which is used in addition to English or in place of English.

Why is it important?

If a significant portion of the population is classified as speaking English "less than very well", public outreach, meetings, plans, and implementation may need to be conducted in multiple languages. Public land managers should be prepared to use interpreters of languages other than English to communicate effectively with diverse publics.

Methods

Data accuracy is indicated as follows: BLACK indicates a coefficient of variation < 12%; ORANGE (preceded with one dot) indicates between 12 and 40%; and **RED BOLD** (preceded with two dots) indicates a coefficient of variation > 40%. If data have consistently low accuracy throughout a report, we suggest running another demographics report at a larger geographic scale.

Additional Resources

The Modern Language Association has developed an online mapping tool that shows languages spoken for most geographies in the United States. This tool is available at: mla.org/map_single *(43)*.

Data Sources

U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.

What are the main housing characteristics?

This page describes whether housing is occupied or vacant, for rent or seasonally occupied, and the year built.

Housing Characteristics, 2014*

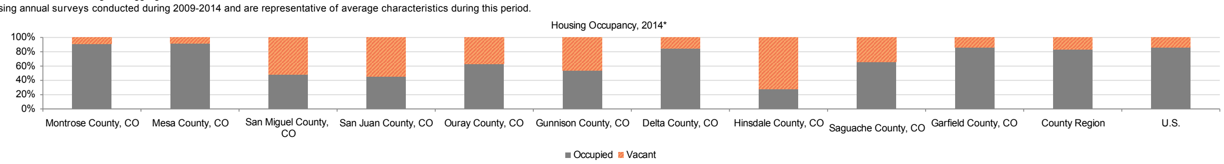
	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Total Housing Units	18,280	63,230	6,697	728	3,068	11,500	14,520	1,447	3,889	23,333	146,692	132,741,033
Occupied	16,815	58,966	3,330	338	1,969	6,336	12,527	418	2,598	20,330	123,627	116,211,092
Vacant	`1,465	4,264	3,367	390	1,099	5,164	1,993	1,029	1,291	3,003	23,065	16,529,941
For rent	`299	`597	`488	`65	`133	`549	`236	¨22	¨34	`851	3,274	3,105,361
Rented, not occupied	¨11	¨63	¨13	¨0	¨0	¨76	¨67	¨4	¨0	¨124	`358	609,396
For sale only	`400	`591	`120	¨20	`72	`273	`280	`26	`110	¨116	2,008	1,591,421
Sold, not occupied	¨4	¨124	¨0	¨7	¨8	¨45	¨38	¨7	¨0	¨68	`301	616,027
Seasonal, recreational, occasional use	`254	`1,696	2,536	278	752	3,808	`1,052	917	643	`1,039	12,975	5,267,667
For migrant workers	¨22	¨0	¨0	¨0	¨15	¨34	¨73	¨7	¨33	¨40	`224	34,475
Other vacant	`475	`1,193	`210	¨20	`119	`379	`247	`46	`471	`765	3,925	5,305,594
Year Built												
Built 2005 or later	¨84	`651	¨26	¨5	¨54	¨57	¨47	¨0	¨24	`282	`1,230	1,315,426
Built 2000 to 2004	4,840	14,406	1,799	`144	929	2,214	2,183	`186	713	6,274	33,688	19,803,260
Built 1990 to 1999	3,649	10,876	2,143	`38	675	2,452	2,701	305	775	4,934	28,548	18,512,067
Built 1980 to 1989	2,243	8,826	1,307	`142	`440	1,538	1,607	310	542	4,163	21,118	18,346,272
Built 1970 to 1979	3,351	13,880	`527	`72	`338	2,478	2,755	`276	`474	3,081	27,232	20,978,482
Built 1960 to 1969	1,238	3,308	`117	¨8	`95	`923	1,103	`94	`240	`1,107	8,233	14,626,326
Built 1959 or earlier	2,875	11,283	778	319	537	1,838	4,124	276	1,121	3,492	26,643	39,159,200
Median year structure built^	1987	1984	1993	1975	1992	1983	1977	1983	1982	1990	na	1976

Percent of Total

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Occupancy												
Occupied	92.0%	93.3%	49.7%	46.4%	64.2%	55.1%	86.3%	28.9%	66.8%	87.1%	84.3%	87.5%
Vacant	`8.0%	6.7%	50.3%	53.6%	35.8%	44.9%	13.7%	71.1%	33.2%	12.9%	15.7%	12.5%
For rent	`1.6%	`0.9%	7.3%	`8.9%	`4.3%	`4.8%	`1.6%	`1.5%	¨0.9%	`3.6%	2.2%	2.3%
Rented, not occupied	¨0.1%	¨0.1%	¨0.2%	¨0.0%	¨0.0%	¨0.7%	¨0.5%	¨0.3%	¨0.0%	¨0.5%	`0.2%	0.5%
For sale only	`2.2%	`0.9%	`1.8%	¨2.7%	`2.3%	`2.4%	`1.9%	¨1.8%	`2.8%	¨0.5%	1.4%	1.2%
Sold, not occupied	0.0%	`0.2%	¨0.0%	¨1.0%	¨0.3%	¨0.4%	¨0.3%	¨0.5%	¨0.0%	¨0.3%	`0.2%	0.5%
Seasonal, recreational, occasional use	`1.4%	2.7%	37.9%	38.2%	24.5%	33.1%	`7.2%	63.4%	16.5%	`4.5%	8.8%	4.0%
For migrant workers	¨0.1%	¨0.0%	¨0.0%	¨0.0%	¨0.5%	¨0.3%	¨0.5%	¨0.5%	¨0.8%	¨0.2%	`0.2%	0.0%
Other vacant	`2.6%	`1.9%	`3.1%	¨2.7%	`3.9%	`3.3%	`1.7%	`3.2%	`12.1%	`3.3%	2.7%	4.0%
Year Built												
Built 2005 or later	`0.5%	`1.0%	¨0.4%	¨0.7%	¨1.8%	¨0.5%	`0.3%	¨0.0%	¨0.6%	¨1.2%	`0.8%	1.0%
Built 2000 to 2004	26.5%	22.8%	26.9%	`19.8%	30.3%	19.3%	15.0%	`12.9%	18.3%	26.9%	23.0%	14.9%
Built 1990 to 1999	20.0%	17.2%	32.0%	`5.2%	22.0%	21.3%	18.6%	21.1%	19.9%	21.1%	19.5%	13.9%
Built 1980 to 1989	12.3%	14.0%	19.5%	`19.5%	`14.3%	13.4%	11.1%	21.4%	13.9%	17.8%	14.4%	13.8%
Built 1970 to 1979	18.3%	22.0%	`7.9%	`9.9%	`11.0%	21.5%	19.0%	`19.1%	`12.2%	13.2%	18.6%	15.8%
Built 1960 to 1969	6.8%	5.2%	`1.7%	¨1.1%	`3.1%	`8.0%	7.6%	`6.5%	`6.2%	`4.7%	5.6%	11.0%
Built 1959 or earlier	15.7%	17.8%	11.6%	43.8%	17.5%	16.0%	28.4%	19.1%	28.8%	15.0%	18.2%	29.5%

^ Median year structure built is not available for metro/non-metro or regional aggregations.
* The data in this table are calculated by ACS using annual surveys conducted during 2009-2014 and are representative of average characteristics during this period.

- In the 2010-2014 period, Hinsdale County, CO had the highest estimated percent of the vacant housing (71.1%), and Mesa County, CO had the lowest (6.7%).



Data Sources: U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.

What are the main housing characteristics?

What do we measure on this page?

This page describes whether housing is occupied or vacant, for rent or seasonally occupied, and the year built.

Rent: The number of homes for rent was defined as occupied housing units that were for rent, vacant housing units that were for rent, and vacant units rented but not occupied at the time of interview.

For Seasonal, Recreational, or Occasional Use: Refers to vacant units used or intended for use only in certain seasons or for weekends or other occasional use throughout the year.

For Migrant Workers: refers to housing units intended for occupancy by migratory workers employed in farm work during the crop season.

Why is it important?

Vacancy status is an indicator of the housing market and provides information on the stability and quality of housing for certain areas. The data is used to assess the demand for housing, to identify housing turnover within areas, and to better understand the population within the housing market over time. These data also serve to aid in the development of housing programs to meet the needs of persons at different economic levels.

Seasonal or recreational homes (i.e., “second homes”) are often an indicator of the desirability of a place for recreation and tourism. This could also be used as an indicator of recreational and scenic amenities, which can be one of the economic contributions of public lands.

While the late 1990s and early 2000s were a period of rapid home development throughout the country, there have been other periods when housing grew at a fast rate (the late 1970s, for example, in some parts of the country). Understanding the relative growth rates of housing is relevant for public lands managers in the context of the wildland-urban interface, and as an indicator of overall economic growth. The year the home was built also provides information on the age of the housing stock, which can be used to forecast future demand of services, such as energy consumption and fire protection.

Housing that is classified as available for migrant workers can be used an indicator of a certain type of economic activity, in particular crop agriculture.

Methods

Data accuracy is indicated as follows: BLACK indicates a coefficient of variation < 12%; ORANGE (preceded with one dot) indicates between 12 and 40%; and **RED BOLD** (preceded with two dots) indicates a coefficient of variation > 40%. If data have consistently low accuracy throughout a report, we suggest running another demographics report at a larger geographic scale.

Additional Resources

For a glossary of terms used in ACS, see:
census.gov/acs/www/Downloads/data_documentation/SubjectDefinitions/2009_ACSSubjectDefinitions.pdf *(40)*.

Data Sources

U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.

How affordable is housing?

This page describes whether housing is affordable for homeowners and renters.

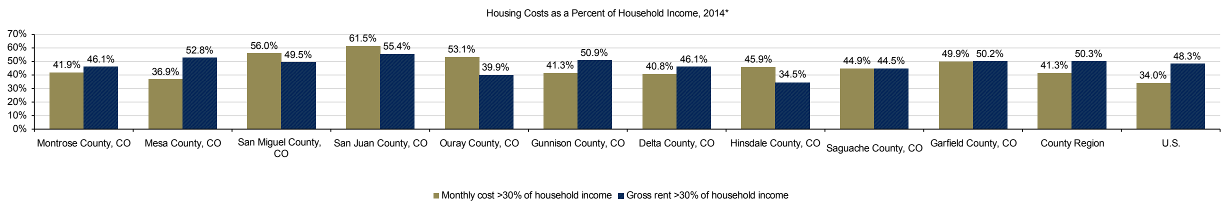
Housing Costs as a Percent of Household Income, 2014*

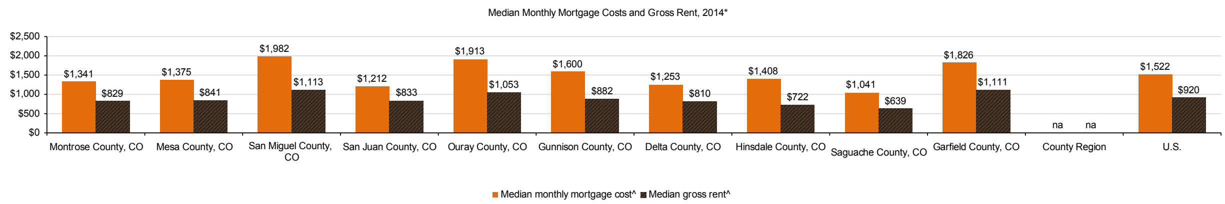
	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Owner-occupied housing w/ a mortgage	7,046	28,191	1,440	`104	868	2,487	4,850	`157	900	9,982	56,025	49,043,774
Monthly cost <15% of household income	`1,019	5,529	`210	``5	`81	`491	968	``12	`119	1,385	9,819	9,630,439
Monthly cost >30% of household income	2,953	10,405	`807	`64	461	1,027	1,977	`72	`404	4,979	23,149	16,687,628
Specified renter-occupied units	5,022	17,868	1,270	`130	`536	2,604	3,531	`87	816	7,036	38,900	41,423,632
Gross rent <15% of household income	`635	`1,452	`91	``16	`67	`261	`603	``18	``58	`340	3,541	4,472,954
Gross rent >30% of household income	2,317	9,441	629	`72	`214	`1,325	1,627	``30	`363	3,534	19,552	20,011,827
Median monthly mortgage cost^	$1,341	$1,375	$1,982	$1,212	$1,913	$1,600	$1,253	$1,408	$1,041	$1,826	na	$1,522
Median gross rent^	$829	$841	$1,113	`$833	$1,053	$882	$810	$722	$639	$1,111	na	$920
Percent of Total												
Monthly cost <15% of household income	`14.5%	19.6%	`14.6%	``4.8%	`9.3%	`19.7%	20.0%	``7.6%	`13.2%	13.9%	17.5%	19.6%
Monthly cost >30% of household income	41.9%	36.9%	`56.0%	`61.5%	53.1%	41.3%	40.8%	`45.9%	`44.9%	49.9%	41.3%	34.0%
Gross rent <15% of household income	`12.6%	`8.1%	`7.2%	``12.3%	`12.5%	`10.0%	`17.1%	``20.7%	``7.1%	`4.8%	9.1%	10.8%
Gross rent >30% of household income	46.1%	52.8%	49.5%	`55.4%	`39.9%	`50.9%	46.1%	``34.5%	`44.5%	50.2%	50.3%	48.3%

^ Median monthly mortgage cost and median gross rent are not available for metro/non-metro or regional aggregations.

* The data in this table are calculated by ACS using annual surveys conducted during 2009-2014 and are representative of average characteristics during this period.

- In the 2010-2014 period, San Juan County, CO had the highest estimated percent of owner-occupied households where greater than 30% of household income was spent on mortgage costs (61.5%), and the U.S. had the lowest (34.0%).
- In the 2010-2014 period, San Juan County, CO had the highest estimated percent of renter-occupied households where greater than 30% of household income was spent on gross rent (55.4%), and Hinsdale County, CO had the lowest (34.5%).
- In the 2010-2014 period, San Miguel County, CO had the highest estimated monthly mortgage costs for owner-occupied homes ($1,982), and Saguache County, CO had the lowest ($1,041).
- In the 2010-2014 period, San Miguel County, CO had the highest estimated monthly gross rent for renter-occupied homes ($1,113), and Saguache County, CO had the lowest ($639).





Data Sources: U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.

How affordable is housing?

What do we measure on this page?

This page describes whether housing is affordable for homeowners and renters.

Owner-Occupied Housing Unit: A housing unit is owner-occupied if the owner or co-owner lives in the unit even if it is mortgaged or not fully paid for.

Renter-Occupied Housing Unit: All occupied units which are not owner-occupied, whether they are rented for cash rent or occupied without payment of cash rent, are classified as renter-occupied.

Household: A household includes all the people who occupy a housing unit as their usual place of residence.

Monthly Costs (owner-occupied): The sum of payment for mortgages, real estate taxes, various insurances, utilities, fuels, mobile home costs, and condominium fees.

Gross Rent: The amount of the contract rent plus the estimated average monthly cost of utilities (electricity, gas, and water and sewer) and fuels (oil, coal, kerosene, wood, etc.) if these are paid for by the renter (or paid for the renter by someone else).

Why is it important?

An important indicator of economic hardship is whether housing is affordable. This page measures housing affordability in terms of the share of household income that is devoted to mortgage and related costs (for homeowners) and rent and related costs (for renters). The income share devoted to housing that is below 15 percent is a good proxy for highly affordable, while the income share devoted to housing that is above 30 percent is a good proxy for unaffordable.

Methods

The lowest ownership costs and gross rent share of household income reported in ACS is 15 percent. Many government agencies define as excessive (or unaffordable) housing costs that exceed 30 percent of monthly household income.

Data accuracy is indicated as follows: BLACK indicates a coefficient of variation < 12%; ORANGE (preceded with one dot) indicates between 12 and 40%; and **RED BOLD** (preceded with two dots) indicates a coefficient of variation > 40%. If data have consistently low accuracy throughout a report, we suggest running another demographics report at a larger geographic scale.

Additional Resources

The U.S. Census Bureau's American Housing Survey has additional information on housing and housing affordability. See: census.gov/hhes/www/housing/ahs/ahs.html *(44)*.

For housing prices, for-profit online real-estate services may have more recent price information. See, for example, zillow.com *(45)*.

For current calculations on housing affordability, see the National Association of Realtors' Housing Affordability Index, available at: realtor.org/research/research/housinginx *(46)*.

Data Sources

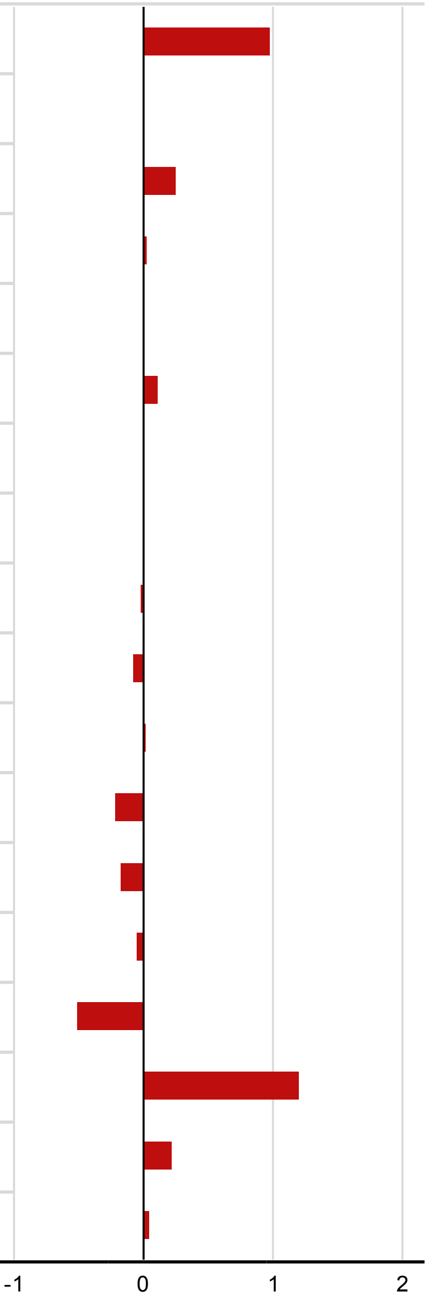
U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.

How do demographic, income, and social characteristics in the region compare to the U.S.?

This page compares key demographic, income, and social indicators from the region to the United States.

	Indicators	County Region	U.S.
Demographics	Population Growth (% change, 2000-2014*)	22.9%	11.6%
Demographics	Median Age (2014*)	na	37.4
Demographics	Percent Population White Alone (2014*)	92.0%	73.8%
Demographics	Percent Population Hispanic or Latino (2014*)	17.3%	16.9%
Demographics	Percent Population American Indian or Alaska Native (2014*)	0.8%	0.8%
Demographics	Percent of Population 'Baby Boomers' (2014*)	26.5%	23.9%
Income	Median Household Income (2014*)	na	$53,482
Income	Per Capita Income (2014*)	na	$28,555
Income	Percent Individuals Below Poverty (2014*)	15.3%	15.6%
Income	Percent Families Below Poverty (2014*)	10.6%	11.5%
Income	Percent of Households with Retirement and Social Security Income (2014*)	47.4%	47.2%
Income	Percent of Households with Public Assistance Income (2014*)	16.5%	21.1%
Structure	Percent Population 25 Years or Older without High School Degree (2014*)	11.3%	13.7%
Structure	Percent Population 25 Years or Older with Bachelor's Degree or Higher (2014*)	27.8%	29.3%
Structure	Percent Population That Speak English Less Than 'Very Well' (2014*)	4.2%	8.6%
Structure	Percent of Houses that are Seasonal Homes (2014*)	8.8%	4.0%
Structure	Owner-Occupied Homes where Greater than 30% of Household Income Spent on Mortgage (2014*)	41.3%	34.0%
Structure	Renter-Occupied Homes where Greater than 30% of Household Income Spent on Gross Rent (2014*)	50.3%	48.3%

County Region vs. U.S.



* The data in this table are calculated by ACS using annual surveys conducted during 2010-2014 and are representative of average characteristics during this period.

Data Sources: U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.

How do demographic, income, and social characteristics in the region compare to the U.S.?

What do we measure on this page?

This page compares key demographic, income, and social indicators from the region to the United States.

The term "benchmark" in this report should not be construed as having the same meaning as in the National Forest Management Act.

Race: Race is a self-identification data item in which Census respondents choose the race or races with which they most closely identify. The Office of Management and Budget revised the standards in 1997 for how the Federal government collects and presents data on race and ethnicity.

Poverty: Following the Office of Management and Budget's Directive 14, the Census Bureau uses a set of income thresholds that vary by family size and composition to detect who is poor. If the total income for a family or an unrelated individual falls below the relevant poverty threshold, then the family or an unrelated individual is classified as being "below the poverty level."

Baby Boomers: Baby boomers are defined as having been born between 1946-1964. The reported percent of population that are "baby boomers" has some associated error since ACS generally reports age classes in 5-year increments (55 to 59 years, 60 to 64 years, etc.).

Social Security: Refers to households who receive income that includes Social Security pensions and survivor benefits, permanent disability insurance payments made by the Social Security Administration before deductions for medical insurance, and railroad retirement insurance. It does not include Medicare reimbursement.

Retirement Income: Consists of families that receive income from: (1) retirement pensions and survivor benefits from a former employer; labor union; or federal, state, or local government; and the U.S. military; (2) disability income from companies or unions; federal, state, or local government; and the U.S. military; (3) periodic receipts from annuities and insurance; and (4) regular income from IRA and Keogh plans. It does not include Social Security income.

Why is it important?

This page shows a quick comparison of a number of indicators covered in this report to highlight where the region is different from the U.S.

It also offers an at-a-glance view of whether groups of indicators are atypical compared to the U.S. For example, this page may show that a geography has an older population, relatively unaffordable housing, and difficulties communicating in English. In combination, these indicators can help public land managers identify groups of people and aspects of hardship that can aid with outreach and consideration of whether the impacts of land management actions could have disproportionately high and adverse impacts on disadvantaged people or places.

Methods

The ratio of the selected region to the U.S. is a percentage calculated by dividing the figure from the region by the figure from the U.S.

Data accuracy is indicated as follows: BLACK indicates a coefficient of variation < 12%; ORANGE (preceded with one dot) indicates between 12 and 40%; and **RED BOLD** (preceded with two dots) indicates a coefficient of variation > 40%. If data have consistently low accuracy throughout a report, we suggest running another demographics report at a larger geographic scale.

Median Age, Median Household Income and Per Capita Income are not calculated for multi-geography regions due to data availability.

Data Sources

U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.

Data Sources

EPS uses published statistics from government sources that are available to the public and cover the entire country. All data used in EPS can be readily verified by going to the original source. The contact information for databases used in this profile is:

- **2000 Decennial U.S. Census**
  Census Bureau, U.S. Department of Commerce.
  http://www.census.gov
  Tel. 303-969-7750

- **American Community Survey**
  Census Bureau, U.S. Department of Commerce.
  http://www.census.gov
  Tel. 303-969-7750
  The on-line ACS data retrieval tool is available at:
  http://www.census.gov/acs/www/

Methods

EPS core approaches

EPS is designed to focus on long-term trends across a range of important measures. Trend analysis provides a more comprehensive view of changes than spot data for select years. We encourage users to focus on major trends rather than absolute numbers.

EPS displays detailed industry-level data to show changes in the composition of the economy over time and the mix of industries at points in time.

EPS employs cross-sectional benchmarking, comparing smaller geographies such as counties to larger regions, states, and the nation, to give a sense of relative performance.

EPS allows users to aggregate data for multiple geographies, such as multi-Regions, to accommodate a flexible range of user-defined areas of interest and to allow for more sophisticated cross-sectional comparisons.

About the American Community Survey (ACS)

With the exception of some 2000 Decennial Census data used on pages 1-3, all other data used in this report is based on the American Community Survey (ACS) of the Census Bureau.

The ACS is a nation-wide survey conducted every year by the Census Bureau that provides current demographic, social, economic, and housing information about communities every year—information that until recently was only available once a decade. The ACS is not the same as the decennial census, which is conducted every ten years (the ACS has replaced the detailed, Census 2000 long-form questionnaire).

Data used in this report are 5-year ACS estimates. More than the 1 or 3-year estimates, the 5-year estimates are consistently available for small geographies, such as towns. We show 5-year estimates for all geographies since data obtained using the same survey technique is ideal for cross-geography comparisons. The disadvantage is that multiyear estimates cannot be used to describe any particular year in the period, only what the average value is over the full period.

Because ACS is based on a survey, it is subject to error. The Census Bureau reports the accuracy of the data by providing margins of error for every data point. In this report, we alert the user to the data accuracy using color-coded text in the tables: BLACK indicates a coefficient of variation < 12%; ORANGE (preceded with one dot) indicates between 12 and 40%; and **RED BOLD** (preceded with two dots) indicates a coefficient of variation > 40%.

The coefficient of variation is a measure of relative error in the estimate, and is calculated directly from the margin of error as the ratio of the standard error to the estimate itself. To get the standard error, the margin of error is divided by 1.645 (for a 90 percent confidence interval). The coefficient of variation is expressed as a percentage. For example, if you have an estimate of 60 +/- 20, the coefficient of variation for the estimate is 20.3 percent. This estimate should be used with caution, since the sampling error represents more than 20 percent of the estimate.

For more information about EPS see:

headwaterseconomics.org/eps

Web pages listed under Additional Resources include:

Throughout this report, references to on-line resources are indicated with italicized numbers in parentheses. These resources are provided as hyperlinks here.

1 www.epa.gov/compliance/ej/resources/policy/ej_guidance_nepa_ceq1297.pdf
2 www.census.gov/acs/www/methodology/methodology_main/
3 www.census.gov/acs/www/Downloads/data_documentation/Accuracy/MultiyearACSAccuracyofData2009.pdf
4 www.epa.gov/compliance/ej
5 www.stateoftheusa.org
6 www.ers.usda.gov/topics/rural-economy-population/population-migration.aspx
7 www.frey-demographer.org
8 www.aoa.gov/aoaroot/aging_statistics/index.aspx
9 www.census.gov/popest/
10 www.countyhealthrankings.org/
11 www.prb.org/Journalists/Webcasts/2009/distilleddemographics1.aspx
12 www.census.gov/population/age/
13 www.census.gov/prod/2010pubs/p25-1138.pdf
14 www.ers.usda.gov/publications/err-economic-research-report/err79.aspx
15 www.census.gov/population/www/projections/projectionsagesex.html
16 www.whitehouse.gov/omb/fedreg_1997standards
17 www.census.gov/prod/2001pubs/c2kbr01-1.pdf
18 http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml
19 www.measureofamerica.org/acenturyapart
20 www.census.gov/newsroom/cspan/hispanic/2012.06.22_cspan_hispanics.pdf
21 www.icbemp.gov/science/hansisrichard_10pg.pdf
22 www.bia.gov/index.htm
23 www.indians.org/index.html
24 www.fs.fed.us/spf/tribalrelations/index.shtml
25 www.census.gov/hhes/www/ioindex/overview.html
26 www.bls.gov/soc/
27 www.bls.gov/oco/
28 www.ceo.usc.edu/pdf/G0612501.pdf
29 www.bls.gov/opub/ils/pdf/opbils71.pdf
30 www.ers.usda.gov/Publications/RDP/RDP697/RDP697e.pdf
31 www.ers.usda.gov/publications/ruralamerica/ra172/ra172c.pdf
32 www.federalreserve.gov/newsevents/speech/Bernanke20070206a.htm
33 www.econedlink.org/lessons/index.php?lid=885&type=educator
34 https://docs.google.com/Doc?docid=0AXe2E1Mm09WIZGhzazhxaDRfMjUzZ25nMjdkZzY&hl=en
35 www.ers.usda.gov/topics/rural-economy-population/rural-poverty-well-being.aspx
36 www.npc.umich.edu/poverty
37 www.census.gov/hhes/www/poverty/data/threshld/index.html
38 www.npc.umich.edu/research/ethnicity
39 www.census.gov/population/socdemo/statbriefs/povarea.html
40 www.census.gov/acs/www/Downloads/data_documentation/SubjectDefinitions/2009_ACSSubjectDefinitions.pdf
41 www.bls.gov/emp/ep_chart_001.htm
42 www.census.gov/prod/2002pubs/p23-210.pdf
43 www.mla.org/map_single
44 www.census.gov/hhes/www/housing/ahs/ahs.html
45 www.zillow.com
46 www.realtor.org/research/research/housinginx

A Profile of Federal Land Payments

County Region

Selected Geographies:

Montrose County, CO; Mesa County, CO; San Miguel County, CO; San Juan County, CO; Ouray County, CO; Gunnison County, CO; Delta County, CO; Hinsdale County, CO; Saguache County, CO; Garfield County, CO

Benchmark Geographies:

U.S.

Produced by
Economic Profile System
EPS
November 28, 2016

About the Economic Profile System (EPS)

EPS is a free, easy-to-use software application that produces detailed socioeconomic reports of counties, states, and regions, including custom aggregations.

EPS uses published statistics from federal data sources, including Bureau of Economic Analysis and Bureau of the Census, U.S. Department of Commerce; and Bureau of Labor Statistics, U.S. Department of Labor.

The Bureau of Land Management and Forest Service have made significant financial and intellectual contributions to the operation and content of EPS.

See headwaterseconomics.org/EPS for more information about the other tools and capabilities of EPS.

For technical questions, contact Patty Gude at eps@headwaterseconomics.org, or 406-599-7425.

headwaterseconomics.org

Headwaters Economics is an independent, nonprofit research group. Our mission is to improve community development and land management decisions in the West.

www.blm.gov

The Bureau of Land Management, an agency within the U.S. Department of the Interior, administers 249.8 million acres of America's public lands, located primarily in 12 Western States. It is the mission of the Bureau of Land Management to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations.

www.fs.fed.us

The Forest Service, an agency of the U.S. Department of Agriculture, administers national forests and grasslands encompassing 193 million acres. The Forest Service’s mission is to achieve quality land management under the "sustainable multiple-use management concept" to meet the diverse needs of people while protecting the resource. Significant intellectual, conceptual, and content contributions were provided by the following individuals: Dr. Pat Reed, Dr. Jessica Montag, Doug Smith, M.S., Fred Clark, M.S., Dr. Susan A. Winter, and Dr. Ashley Goldhor-Wilcock.

Table of Contents

Note to Users:

This is one of fourteen reports that can be created and downloaded from EPS Web. You may want to run another EPS report for either a different geography or topic. Topics include land use, demographics, specific industry sectors, the role of non-labor income, the wildland-urban interface, the role of amenities in economic development, and payments to county governments from federal lands. Throughout the reports, references to online resources are indicated in parentheses. These resources are provided as hyperlinks on each report's final page. The EPS reports are downloadable as Excel, PDF, and Word documents. For further information and to download reports, go to:

headwaterseconomics.org/eps

What are federal land payments?

This page describes all federal land payments distributed to state and local governments by the geography of origin.

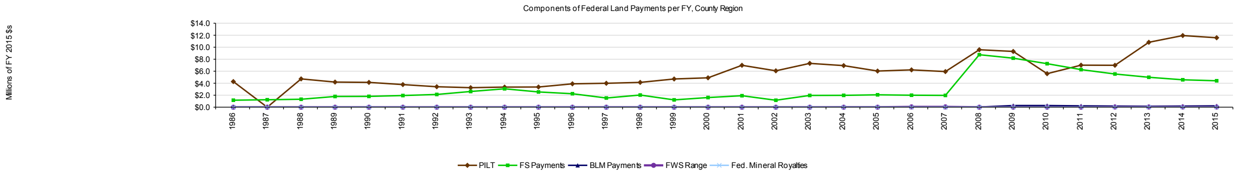
Components of Federal Land Payments to State and Local Governments by Geography of Origin, FY 2015 (FY 2015 $s)

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Total Federal Land Payments	2,575,331	3,849,880	1,036,619	289,001	450,211	1,635,702	414,507	546,619	2,062,941	3,391,763	16,252,574	2,619,597,406
PILT	2,206,802	3,312,746	962,724	78,625	375,507	587,195	201,302	139,675	720,764	2,991,713	11,577,053	439,017,406
Forest Service Payments	341,008	479,708	56,299	208,820	73,727	1,017,121	201,125	404,884	1,295,447	331,245	4,409,384	278,262,072
BLM Payments	27,521	57,364	17,596	1,556	977	25,126	11,599	2,061	15,440	68,805	228,045	50,042,624
USFWS Refuge Payments	0	62	0	0	0	0	481	0	31,290	0	31,833	17,381,146
Federal Mineral Royalties	0	0	0	0	0	6,259	0	0	0	0	6,259	1,834,894,159

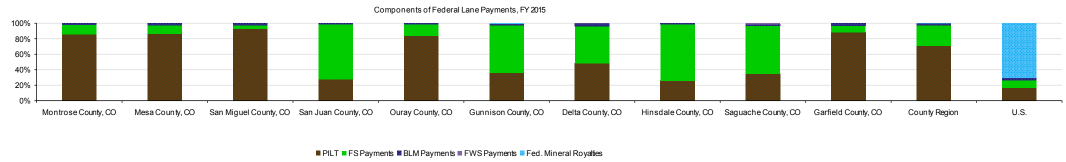
Percent of Total

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
PILT	85.7%	86.0%	92.9%	27.2%	83.4%	35.9%	48.6%	25.6%	34.9%	88.2%	71.2%	16.8%
Forest Service Payments	13.2%	12.5%	5.4%	72.3%	16.4%	62.2%	48.5%	74.1%	62.8%	9.8%	27.1%	10.6%
BLM Payments	1.1%	1.5%	1.7%	0.5%	0.2%	1.5%	2.8%	0.4%	0.7%	2.0%	1.4%	1.9%
USFWS Refuge Payments	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	1.5%	0.0%	0.2%	0.7%
Federal Mineral Royalties	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	70.0%

- From FY 1986 to FY 2015, Forest Service revenue sharing payments grew from $1,173,073 to $4,409,384, an increase of 276 percent.
- From FY 1986 to FY 2015, BLM revenue sharing payments grew from $0 to $228,045.



- In FY 2015, PILT made up the largest percent of federal land payments in County Region (71.2%), and Federal Mineral Royalties made up the smallest (0%).



Data Sources: U.S. Department of Interior. 2016. Payments in Lieu of Taxes (PILT), , Washington, D.C.; U.S. Department of Agriculture. 2016. Forest Service, , Washington, D.C.; U.S. Department of Interior. 2016. Bureau of Land Management, , Washington, D.C.; U.S. Department of Interior. 2016. U.S. Fish and Wildlife Service, , Washington, D.C.; U.S. Department of Interior. 2016. Office of Natural Resources Revenue, , Washington, D.C.

Study Guide and Supplemental Information

What are federal land payments?

What do we measure on this page?

This page describes all federal land payments distributed to state and local governments by the geography of origin.

Federal land payments: These are federal payments that compensate state and local governments for non-taxable federal lands within their borders. Payments are funded by federal appropriations (e.g., PILT) and from receipts received by federal agencies from activities on federal public lands (e.g., timber, grazing, and minerals).

Payments in Lieu of Taxes (PILT): These payments compensate county governments for non-taxable federal lands within their borders. PILT is based on a maximum per-acre payment reduced by the sum of all revenue sharing payments and subject to a population cap.

Forest Service Revenue Sharing: These are payments based on USFS receipts and must be used for county roads and local schools. Payments include the 25% Fund, Secure Rural Schools & Community Self-Determination Act, and Bankhead-Jones Forest Grasslands.

BLM Revenue Sharing: The BLM shares a portion of receipts generated on public lands with state and local governments, including grazing fees through the Taylor Grazing Act and timber receipts generated on Oregon and California (O & C) grant lands.

USFWS Refuge: These payments share a portion of receipts from National Wildlife Refuges and other areas managed by the USFWS directly with the counties in which they are located.

Federal Mineral Royalties: These payments are distributed to state governments by the U.S. Office of Natural Resources Revenue. States may share, at their discretion, a portion of revenues with the local governments where royalties were generated.

Federal Fiscal Year: FY refers to the federal fiscal year that begins on October 1 and ends September 30.

Why is it important?

State and local government cannot tax federally owned lands the way they would if the land were privately owned. A number of federal programs exist to compensate county governments for the presence of federal lands. These programs can represent a significant portion of local government revenue in rural counties with large federal land holdings.

Before 1976, all federal payments were linked directly to receipts generated on public lands. Congress funded PILT with appropriations beginning in 1977 in recognition of the volatility and inadequacy of federal revenue sharing programs. PILT was intended to stabilize and increase federal land payments to county governments. More recently, the Secure Rural Schools and Community Self-Determination Act of 2000 (SRS) decoupled USFS payments from commercial receipts. SRS received broad support because it addressed several major concerns around receipt-based programs--volatility, the payment level, and the incentives provided to counties by linking federal land payments directly to extractive uses of public lands.

PILT and SRS each received a significant increase in federal appropriations in FY 2008 through the Emergency Economic Stabilization Act of 2008. Despite the increased appropriations, SRS is authorized only through FY 2011, PILT only through FY 2012, and federal budget concerns are creating uncertainty for the future of both.

Methods

Data Limitations: Local government distributions of federal land payments may be underreported due to data limitations from USFWS, ONRR, and some states that make discretionary distributions of mineral royalties and some BLM payments.

Significance of Data Limitations: USFWS data limitations are relatively insignificant at the federal level (data gaps on local distributions of USFWS Refuge revenue sharing is less than one percent of total federal land payments in FFY 2009) but may be important to specific local governments with significant USFWS acreage. Federal mineral royalties represent a more significant omission in states that share a portion of royalties with local governments. Federal mineral royalties made up 68% of federal land payments in the U.S. in FFY 2008.

Additional Resources

An Inquiry into Selected Aspects of Revenue Sharing on Federal Lands. 2002. A report to The Forest County Payments Committee, Washington, D.C. by Research Unit 4802 - Economic Aspects of Forest Management on Public Lands, Rocky Mountain Research Station, USDA Forest Service, Missoula, MT.

Gorte, Ross W., M. Lynne Corn, and Carol Hardy Vincent. 1999. Federal Land Management Agencies' Permanently Appropriated Accounts. Congressional Research Service Report RL30335.

Trends in federal land payments are closely tied to commodity extraction on public lands. For more on the economic importance (in terms of jobs and income) of these activities, see the EPS-HDT Socioeconomic Measures report and other industry specific reports at headwaterseconomics.org/eps *(1)*.

For data on federal land ownership, see the EPS-HDT Land Use report at headwaterseconomics.org/eps *(1)*.

Data Sources

U.S. Department of Interior. 2016. Payments in Lieu of Taxes (PILT), , Washington, D.C.; U.S. Department of Agriculture. 2016. Forest Service, , Washington, D.C.; U.S. Department of Interior. 2016. Bureau of Land Management, , Washington, D.C.; U.S. Department of Interior. 2016. U.S. Fish and Wildlife Service, , Washington, D.C.; U.S. Department of Interior. 2016. Office of Natural Resources Revenue, , Washington, D.C.; Additional sources and methods available at www.headwaterseconomics.org/eps-hdt

How are federal land payments distributed to state and local governments?

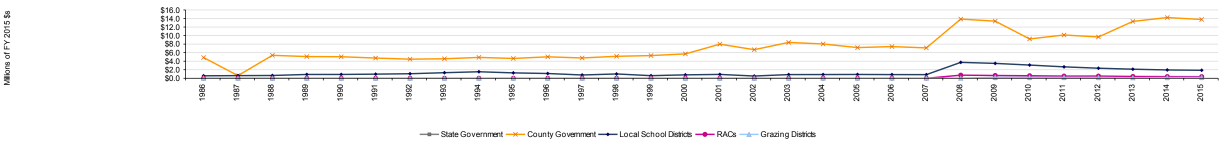
This page describes how federal land payments are distributed to state and local governments by geography of origin.

Distribution of Federal Land Payments to State and Local Governments by Geography of Origin, FY 2015 (FY 2015 $s)

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Total Federal Land Payments	2,575,331	3,849,880	1,036,619	289,001	450,211	1,635,702	414,507	546,619	2,062,941	3,391,763	16,252,574	2,619,597,406
State Government	0	0	0	0	0	6,259	0	0	0	0	6,259	1,835,168,554
County Government	2,377,353	3,560,915	995,106	167,457	412,378	1,100,567	317,515	332,035	1,356,241	3,156,081	13,775,648	631,126,857
Local School Districts	144,929	203,876	23,927	88,749	36,863	432,277	85,478	172,076	550,565	140,779	1,879,519	103,125,810
RACs	27,281	38,377	0	31,323	0	81,370	0	40,488	142,499	26,500	387,838	29,795,982
Grazing Districts	25,769	46,713	17,586	1,473	969	21,488	11,514	2,021	13,636	68,403	209,572	14,223,376
Percent of Total												
State Government	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	70.1%
County Government	92.3%	92.5%	96.0%	57.9%	91.6%	67.3%	76.6%	60.7%	65.7%	93.1%	84.8%	24.1%
Local School Districts	5.6%	5.3%	2.3%	30.7%	8.2%	26.4%	20.6%	31.5%	26.7%	4.2%	11.6%	3.9%
RACs	1.1%	1.0%	0.0%	10.8%	0.0%	5.0%	0.0%	7.4%	6.9%	0.8%	2.4%	1.1%
Grazing Districts	1.0%	1.2%	1.7%	0.5%	0.2%	1.3%	2.8%	0.4%	0.7%	2.0%	1.3%	0.5%

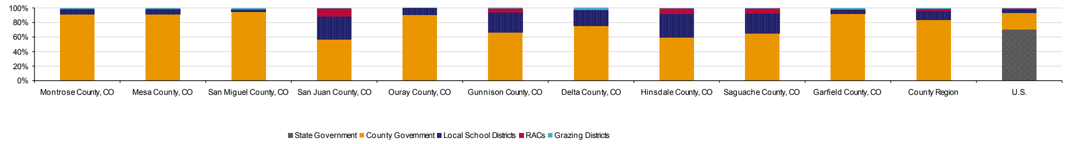
Distribution of Federal Land Payments to State and Local Governments per FY, County Region

- From FY 1986 to FY 2015, the amount county governments received in federal land payments grew from $4,857,289 to $13,775,648, an increase of 184 percent.



Distribution of Federal Land Payments to State and Local Governments by Type, FY 2015

- In FY 2015, County Government made up the largest percent of federal land payments in County Region (84.8%), and State Government made up the smallest (0%).



Data Sources: U.S. Department of Interior. 2016. Payments in Lieu of Taxes (PILT), , Washington, D.C.; U.S. Department of Agriculture. 2016. Forest Service, , Washington, D.C.; U.S. Department of Interior. 2016. Bureau of Land Management, , Washington, D.C.; U.S. Department of Interior. 2016. U.S. Fish and Wildlife Service, , Washington, D.C.; U.S. Department of Interior. 2016. Office of Natural Resources Revenue, , Washington, D.C.

How are federal land payments distributed to state and local governments?

What do we measure on this page?

This page describes how federal land payments are distributed to state and local governments by geography of origin.

Why is it important?

A variety of state and local governments receive federal land payments, and the way these payments are distributed explains who benefits. For example, PILT is directed to county government only, while USFS payments are shared between county government and schools. If USFS payments decline, the PILT formula ensures that county government payments will increase, but school districts will not share in the increased PILT payments. While PILT and SRS have decoupled local government payments from commercial activities on public lands, all the federal land payments delivered to state government (mineral royalties, BLM revenue sharing payments) are still linked directly to how public lands are managed. This means state legislators and governors have a different set of expectations and incentives to lobby for particular outcomes on public lands than do county commissioners or school officials.

Methods

State Government Distributions: Consist of: (1) federal mineral royalties and (2) portions BLM revenue sharing. States make subsequent distributions to local government according to state and federal statute (see note about data limitations).
County Government Distributions: Consist of: (1) PILT; (2) portions of Forest Service payments including Secure Rural Schools and Community Self-Determination Act (SRS) Title I and Title III, 25% Fund, and Forest Grasslands ; (4) BLM Bankhead-Jones; (4) USFWS Refuge revenue sharing; and (5) discretionary state government distributions of federal mineral royalties where these data are available.
Local School District Distributions: Consist of portions of SRS Title I, 25% Fund, and Forest Grasslands.
Resource Advisory Council (RAC) Distributions: Consist of SRS Title II. These funds are retained by the Federal Treasury to be used on public land projects on the national forest or BLM land where the payment originated. Resource Advisory Committee (RAC) provides advice and recommendations to the Forest Service on the development and implementation of special projects on federal lands as authorized under the Secure Rural Schools Act and Community Self-Determination Act, Public Law 110-343. Each RAC consists of 15 people representing varied interests and areas of expertise, who work collaboratively to improve working relationships among community members and national forest personnel.
Grazing District Distributions: Consist of BLM Taylor Grazing Act payments.
Data Limitations: Local government distributions of federal land payments may be underreported due to data limitations from USFWS, ONRR, and from states (some states make discretionary distributions of mineral royalties and some BLM payments, and these data may not be available).

Additional Resources

An Inquiry into Selected Aspects of Revenue Sharing on Federal Lands. 2002. A report to The Forest County Payments Committee, Washington, D.C. by Research Unit 4802 - Economic Aspects of Forest Management on Public Lands, Rocky Mountain Research Station, USDA Forest Service, Missoula, MT.

Gorte, Ross W., M. Lynne Corn, and Carol Hardy Vincent. 1999. Federal Land Management Agencies' Permanently Appropriated Accounts. Congressional Research Service Report RL30335.

Trends in federal land payments are closely tied to commodity extraction on public lands. For more on the economic importance (in terms of jobs and income) of these activities, see the EPS Socioeconomic Measures report and other industry specific reports at headwaterseconomics.org/eps *(1)*.

Data Sources

U.S. Department of Interior. 2016. Payments in Lieu of Taxes (PILT), , Washington, D.C.; U.S. Department of Agriculture. 2016. Forest Service, , Washington, D.C.; U.S. Department of Interior. 2016. Bureau of Land Management, , Washington, D.C.; U.S. Department of Interior. 2016. U.S. Fish and Wildlife Service, , Washington, D.C.; U.S. Department of Interior. 2016. Office of Natural Resources Revenue, , Washington, D.C.; Additional sources and methods available at www.headwaterseconomics.org/eps-hdt

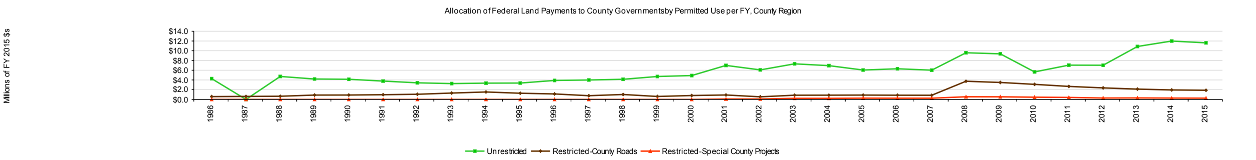
How are federal land payments distributed to county governments allocated to unrestricted and restricted uses?

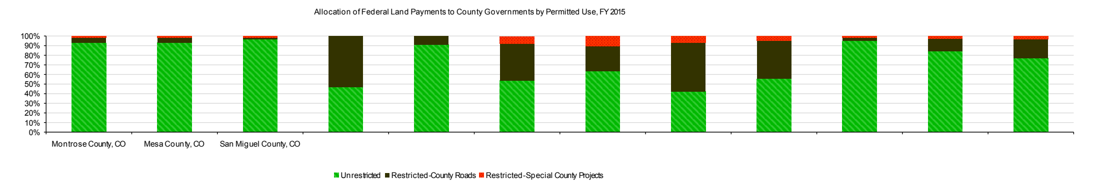
This page describes the amount of money distributed to county governments (federal land payments distributed to the state, school districts, grazing districts, and RACs are excluded) based on the permitted uses of federal land payments.

Allocation of Federal Land Payments to County Government by Permitted Use, FY 2015 (FY 2015 $s)

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Total Federal Land Payments	2,377,353	3,560,915	995,106	167,457	412,378	1,100,567	317,515	332,035	1,356,241	3,156,081	13,775,648	631,126,857
Unrestricted	2,207,094	3,317,246	962,726	78,639	375,508	588,405	201,797	139,682	752,355	2,991,828	11,615,280	486,377,597
Restricted-County Roads	144,929	203,876	23,927	88,749	36,863	432,277	85,478	172,076	550,565	140,779	1,879,519	130,089,946
Restricted-Special County Projects	23,871	33,580	8,445	0	0	71,198	30,169	20,244	51,818	23,187	262,512	14,383,926
Percent of Total												
Unrestricted	92.8%	93.2%	96.7%	47.0%	91.1%	53.5%	63.6%	42.1%	55.5%	94.8%	84.3%	77.1%
Restricted-County Roads	6.1%	5.7%	2.4%	53.0%	8.9%	39.3%	26.9%	51.8%	40.6%	4.5%	13.6%	20.6%
Restricted-Special County Projects	1.0%	0.9%	0.8%	0.0%	0.0%	6.5%	9.5%	6.1%	3.8%	0.7%	1.9%	2.3%

- From 1986 to 2015, unrestricted federal land payments grew from $4,270,752 to $11,615,280, an increase of 172 percent.
- From FY 1986 to FY 2015, federal land payments restricted to county roads grew from $586,538 to $1,879,519, an increase of 220 percent.
- From FY 1986 to FY 2015, federal land payments restricted to special county projects grew from $0 to $262,512.
- In FY 2015, unrestricted federal land payments were the largest type of payment to the county government in County Region (84.3%), and restricted-special county projects were the smallest (1.9%).





Data Sources: U.S. Department of Interior. 2016. Payments in Lieu of Taxes (PILT), , Washington, D.C.; U.S. Department of Agriculture. 2016. Forest Service, , Washington, D.C.; U.S. Department of Interior. 2016. Bureau of Land Management, , Washington, D.C.; U.S. Department of Interior. 2016. U.S. Fish and Wildlife Service, , Washington, D.C.; U.S. Department of Interior. 2016. Office of Natural Resources Revenue, , Washington, D.C.

Study Guide and Supplemental Information

How are federal land payments distributed to county governments allocated to unrestricted and restricted uses?

What do we measure on this page?

This page describes the amount of money distributed to county governments (federal land payments distributed to the state, school districts, grazing districts, and RACs are excluded) based on the permitted uses of federal land payments.

Why is it important?

County governments can incur a number of costs associated with activities that take place on federal public lands within their boundaries. For example, counties must maintain county roads used by logging trucks and recreational traffic traveling to and from federal lands, and they must pay for law enforcement and emergency services associated with public lands. Several federal land payment programs, particularly those from the Forest Service, are specifically targeted to help pay for these costs.

Methods

Unrestricted: Consist of (1) PILT, (2) U.S. Fish and Wildlife Service Refuge Revenue Sharing, and (3) any distributions of federal mineral royalties from the state government.

Restricted--County Roads: Consist of (1) Secure Rural Schools and Community Self-Determination Act (SRS) Title I, (2) Forest Service 25% Fund, (3) Forest Service Owl payments (between 1993 and 2000 only), and (4) Forest Grasslands. Federal law mandates payments be used for county roads and public schools. Each state determines how to split funds between the two services.

Restricted--Special County Projects: Consist of (1) SRS Title III funds that are distributed to county government for use on specific projects, such as Firewise Communities projects, reimbursement for emergency services provided on federal land, and developing community wildfire protection plans.

Data Limitations: Local government distributions of federal land payments may be underreported due to data limitations from USFWS, ONRR, and from states (some states make discretionary distributions of mineral royalties and some BLM payments, and these data may not be available).

Additional Resources

An Inquiry into Selected Aspects of Revenue Sharing on Federal Lands. 2002. A report to The Forest County Payments Committee, Washington, D.C. by Research Unit 4802 - Economic Aspects of Forest Management on Public Lands, Rocky Mountain Research Station, USDA Forest Service, Missoula, MT.

Gorte, Ross W. 2008. The Secure Rural Schools and Community Self-Determination Act of 2000: Forest Service Payments to Counties. Congressional Research Service Report RL33822.

Data Sources

U.S. Department of Interior. 2016. Payments in Lieu of Taxes (PILT), , Washington, D.C.; U.S. Department of Agriculture. 2016. Forest Service, , Washington, D.C.; U.S. Department of Interior. 2016. Bureau of Land Management, , Washington, D.C.; U.S. Department of Interior. 2016. U.S. Fish and Wildlife Service, , Washington, D.C.; U.S. Department of Interior. 2016. Office of Natural Resources Revenue, , Washington, D.C.; Additional sources and methods available at www.headwaterseconomics.org/eps-hdt

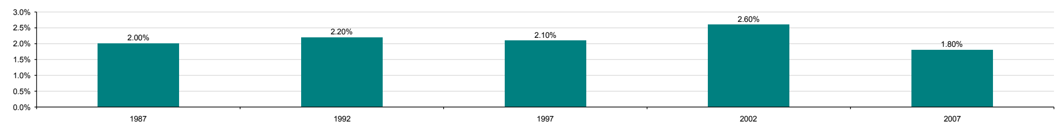
How important are federal land payments to state and local governments?

This page describes federal land payments as a proportion of total county and state government general revenue.

Federal Land Payments as a Share of Total General Government Revenue, Thousands of FY 2012 (FY 2015 $s)

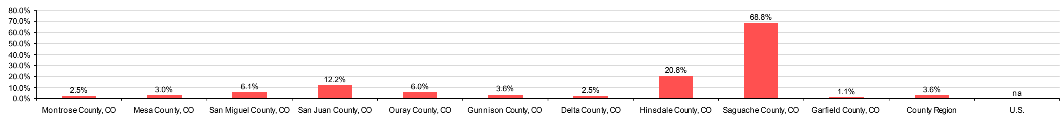
	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Total General Revenue	103,918	78,098	16,351	1,749	7,821	52,259	16,492	2,963	4,311	94,530	378,491	0
Taxes	23,104	64,511	13,970	1,395	4,797	13,405	9,866	1,588	1,922	64,227	198,785	0
Intergovernmental Revenue	11,680	0	1,180	160	1,455	4,530	626	1,067	672	20,604	41,974	0
Total Charges	68,497	11,820	1,103	184	1,561	32,120	2,776	202	1,350	2,508	122,123	0
All Other (Miscellaneous)	637	1,767	97	9	8	2,204	3,224	106	367	7,191	15,610	0
Federal Land Payments (FY 2011)	2,620	2,344	1,004	214	472	1,876	416	615	2,966	996	13,523	4,853,194
Percent of Total												
Taxes	22.2%	82.6%	85.4%	79.8%	61.3%	25.7%	59.8%	53.6%	44.6%	67.9%	52.5%	na
Intergovernmental Revenue	11.2%	0.0%	7.2%	9.1%	18.6%	8.7%	3.8%	36.0%	15.6%	21.8%	11.1%	na
Total Charges	65.9%	15.1%	6.7%	10.5%	20.0%	61.5%	16.8%	6.8%	31.3%	2.7%	32.3%	na
All Other (Miscellaneous)	0.6%	2.3%	0.6%	0.5%	0.1%	4.2%	19.5%	3.6%	8.5%	7.6%	4.1%	na
Federal Land Payments (FY 2011)	2.5%	3.0%	6.1%	12.2%	6.0%	3.6%	2.5%	20.8%	68.8%	1.1%	3.6%	na

Federal Land Payments per FY, Percent of Total General Government Revenue, County Region



- In FY 2012, federal land payments as a percent of total general government revenue in County Region was 3.6%.

Federal Land Payments, Percent of Total General Government Revenue, FY 2012



Data Sources: U.S. Department of Interior. 2016. Payments in Lieu of Taxes (PILT), , Washington, D.C.; U.S. Department of Agriculture. 2016. Forest Service, , Washington, D.C.; U.S. Department of Interior. 2016. Bureau of Land Management, , Washington, D.C.; U.S. Department of Interior. 2016. U.S. Fish and Wildlife Service, , Washington, D.C.; U.S. Department of Interior. 2016. Office of Natural Resources Revenue, , Washington, D.C.

Study Guide and Supplemental Information

How important are federal land payments to state and local governments?

What do we measure on this page?

This page describes federal land payments as a proportion of total county and state government general revenue.

Reporting Period: State and local financial data is from the U.S. Census of Governments, conducted every five years. The latest was for Fiscal Year (FY) 2007. Federal land payments reported for FY 2006 are received by state and local government during FY 2007.
Interactive Table: Census of Government county financial statistics are based on a national survey and may not match local government financial reports. The interactive table on the next page allows the user to input data gathered from primary sources to avoid these data limitations and update data for the latest year.
Taxes: All taxes collected by state and local governments, including property, sales, and income tax.
Intergovernmental Revenue: Payments, grants, and distributions from other governments, including federal education, health care, and transportation assistance to state governments, and state assistance to local governments.
Total Charges: Charges imposed for providing current services, including social services, library, and clerk and recorder charges.
All Other (Miscellaneous): All other general government revenue from their own sources.

Why is it important?

County payments are an important component of local government fiscal health for a handful of rural counties with a large share of land in federal ownership. For counties with fewer public lands and larger economies, federal land payments are a small piece of a much broader revenue stream. Counties most dependent on federal land payments are affected most by changes in distribution and funding levels. For these counties, volatility and uncertainty makes budgeting and planning difficult.

Methods

Reporting Period: The Census of Government FY covers the period July1 to June 30 for most states and counties and does not match the federal FY beginning October 1 and ending September 31. Federal land payments reported for the current FY are often distributed to counties during the following FY. For example, Forest Service payments authorized and appropriated for FY 2007 are delivered to counties in January of 2008, during the Census of Government FY 2008. To correct for the different reporting periods, federal land payments allocated in FY 2006 are compared to local government revenue received in FY 2007.
Federal Land Payments Data Limitations: Local government distributions of federal land payments may be underreported due to data limitations from USFWS, ONRR, and from states (some states make discretionary distributions of mineral royalties and some BLM payments, and these data may not be available).
Census of Governments Data Limitations: (1) county financial statistics may not match local government financial reports for three main reasons: (a) The Census of Government defines the general county government as the aggregation of the parent (county) government and all agencies, institutions, and authorities connected to it (including government and quasi-governmental entities). This may differ from the way local governments define themselves for budgeting purposes; (b) different reporting periods between the Census of Governments fiscal year and the reporting period used by local governments (for example, some counties use a calendar year for reporting purposes); and (c) survey methods introduce error; (2) the last published edition of the Census of Governments was FY 2007, before the recent increase in payments from SRS and PILT; and (3) federal land payments data limitations may under-represent the importance of federal land payments relative to other sources of county revenue.

Additional Resources

U.S. Census Bureau State and Local Government Finance statistics can be downloaded at: census.gov/govs/estimate/ *(2)*.
For a detailed description of Census of Governments survey methods, survey year (fiscal year), and definitions, see: 2006 Government Finance and Employment Classification Manual at census.gov/govs/ *(3)*.
Schuster, Ervin G. and Krista M. Gebert. 2001. Property Tax Equivalency on Federal Resource Management Lands. Journal of Forestry. May 2001 pp 30-35.
Ingles, Brett. 2004. Changing the Funding Structure: An Analysis of the Secure Rural School and Community Self-Determination Act of 2000 on National Forest Lands. Environmental Science and Public Policy Research Institute, Boise State University.

Data Sources

U.S. Department of Interior. 2016. Payments in Lieu of Taxes (PILT), , Washington, D.C.; U.S. Department of Agriculture. 2016. Forest Service, , Washington, D.C.; U.S. Department of Interior. 2016. Bureau of Land Management, , Washington, D.C.; U.S. Department of Interior. 2016. U.S. Fish and Wildlife Service, , Washington, D.C.; U.S. Department of Interior. 2016. Office of Natural Resources Revenue, , Washington, D.C.; Additional sources and methods available at www.headwaterseconomics.org/eps-hdt

What are Payments in Lieu of Taxes (PILT)?

This page describes Payments in Lieu of Taxes (PILT).

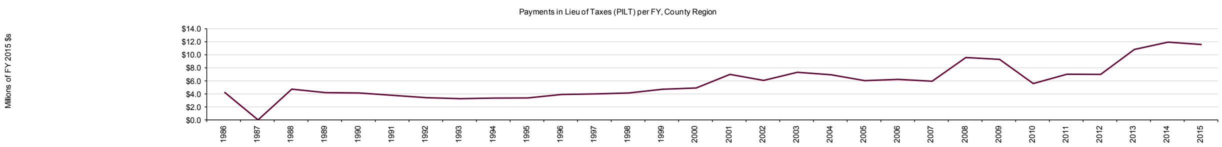
PILT Eligible Acres by Agency, FY 2015

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Total Eligible Acres	978,022	1,556,926	487,620	218,522	159,363	1,631,800	404,022	677,723	1,396,761	1,187,178	8,697,937	606,990,299
BLM	597,484	960,770	315,008	40,530	24,019	333,627	198,807	117,804	343,098	669,597	3,600,744	241,766,732
Forest Service	328,164	551,552	172,569	175,552	131,969	1,262,169	188,927	559,919	949,912	516,264	4,836,997	190,752,167
Bureau of Reclamation	32,513	24,627	43	2,440	3,375	34,907	16,278	0	3,075	1,317	118,575	3,945,389
National Park Service	19,861	19,977	0	0	0	1,097	0	0	99,497	0	140,432	76,885,869
Military	0	0	0	0	0	0	0	0	0	0	0	333,565
Army Corps of Engineers	0	0	0	0	0	0	0	0	0	0	0	8,047,787
U.S. Fish and Wildlife Service	0	0	0	0	0	0	10	0	1,179	0	1,189	85,235,272
Other Eligible Acres	0	0	0	0	0	0	0	0	0	0	0	23,518
PILT Payment (FY 2015 $s)	2,206,802	3,312,746	962,724	78,625	375,507	587,195	201,302	139,675	720,764	2,991,713	11,577,053	439,017,406
Avg. Per-Acre Payment (FY 2015 $s)	2.26	2.13	1.97	0.36	2.36	0.36	0.50	0.21	0.52	2.52	1.33	0.72

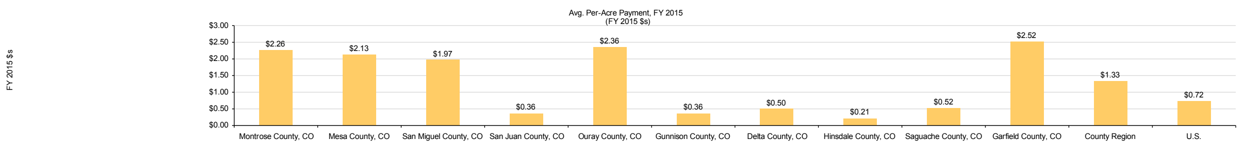
Percent of Total

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
BLM	61.1%	61.7%	64.6%	18.5%	15.1%	20.4%	49.2%	17.4%	24.6%	56.4%	41.4%	39.8%
Forest Service	33.6%	35.4%	35.4%	80.3%	82.8%	77.3%	46.8%	82.6%	68.0%	43.5%	55.6%	31.4%
Bureau of Reclamation	3.3%	1.6%	0.0%	1.1%	2.1%	2.1%	4.0%	0.0%	0.2%	0.1%	1.4%	0.6%
National Park Service	2.0%	1.3%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	7.1%	0.0%	1.6%	12.7%
Military	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
Army Corps of Engineers	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.3%
U.S. Fish and Wildlife Service	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	14.0%
Other Eligible Acres	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

- From FY 1986 to FY 2015, PILT payments grew from $4,270,752 to $11,577,053, increased of 171 percent.



- In FY 2015, Garfield County, CO had the highest average per-acre PILT payment ($2.52), and Hinsdale County, CO had the lowest ($0.21).



Data Sources: U.S. Department of Interior. 2016. Payments in Lieu of Taxes (PILT), , Washington, D.C.

What are Payments in Lieu of Taxes (PILT)?

What do we measure on this page?

This page describes Payments in Lieu of Taxes (PILT).

Congress authorized PILT in 1976 in recognition of the volatility and inadequacy of federal revenue sharing payment programs to compensate counties for non-taxable federal lands within their borders (Public Law 94-565). PILT increases and stabilizes county government revenue sharing payments by paying counties based on a per-acre average "base payment" that is reduced by the amount of revenue sharing payments and is subject to a population cap.

A low average per-acre PILT payment may indicate significant revenue sharing payments from the previous year or that the county's population is below the population cap that limits the base per acre payment.

PILT is permanently authorized, but congress must appropriate funding on an annual basis. PILT was typically not fully funded until FY 2008 when counties received a guarantee of five years at full payment amounts (FY 2008 to FY 2012 payments).

Why is it important?

As county payments became more important to local government after WWII (largely due to high timber extraction levels to fuel the post-war housing and economic growth), volatility became an issue. PILT increased and stabilized payments by funding counties from congressional appropriations rather than directly from commodity receipts. PILT payments are also important because they are not restricted to particular local government services, but can be used at the discretion of county commissioners to fund any local government needs.

Additional Resources

The U.S. Department of the Interior maintains an online searchable database of PILT payments and eligible PILT acres by county and state total. Data are available back to FY 1999 at: doi.gov/nbc/index.cfm *(4)*.

Schuster, Ervin G. 1995. PILT - Its Purpose and Performance. Journal of Forestry. 93(8):31-35.

Corn, M. Lynne. 2008. PILT (Payments in Lieu of Taxes): Somewhat Simplified. Congressional Research Service Report RL31392.

Data Sources

U.S. Department of Interior. 2016. Payments in Lieu of Taxes (PILT), , Washington, D.C.

What is Forest Service Revenue Sharing?

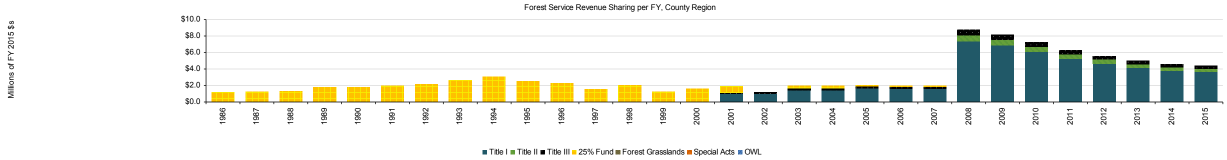
This page describes Forest Service revenue sharing programs, including the Secure Rural Schools and Community Self-Determination Act (SRS), 25% Fund, and Forest Grasslands.

Forest Service Revenue Sharing Payments, FY 2015 (FY 2015 $s)

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Forest Service Total	341,008	479,708	56,299	208,820	73,727	1,017,121	201,125	404,884	1,295,447	331,245	4,409,384	278,262,072
Secure Rural Schools Total	341,008	479,708	56,299	208,820	73,727	1,017,121	201,125	404,884	1,295,447	331,245	4,409,384	260,853,803
Title I	289,857	407,752	47,854	177,497	73,727	864,553	170,956	344,151	1,101,130	281,558	3,759,035	221,964,315
Title II	27,281	38,377	0	31,323	0	81,370	0	40,488	142,499	26,500	387,838	26,812,271
Title III	23,871	33,580	8,445	0	0	71,198	30,169	20,244	51,818	23,187	262,512	12,077,217
25% Fund	0	0	0	0	0	0	0	0	0	0	0	11,251,442
Forest Grasslands	0	0	0	0	0	0	0	0	0	0	0	0
Special Acts	0	0	0	0	0	0	0	0	0	0	0	6,156,827
Percent of Total												
Secure Rural Schools Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	93.7%
Title I	85.0%	85.0%	85.0%	85.0%	100.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.3%	79.8%
Title II	8.0%	8.0%	0.0%	15.0%	0.0%	8.0%	0.0%	10.0%	11.0%	8.0%	8.8%	9.6%
Title III	7.0%	7.0%	15.0%	0.0%	0.0%	7.0%	15.0%	5.0%	4.0%	7.0%	6.0%	4.3%
25% Fund	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.0%
Forest Grasslands	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Special Acts	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.2%

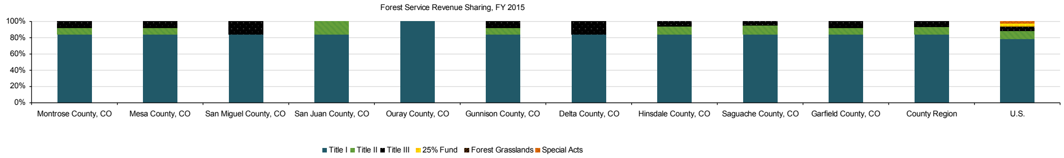
- From FY 1986 to FY 2015, Forest Service revenue sharing payments grew from $1,173,073 to $4,409,384, an increase of 276 percent.

Forest Service Revenue Sharing per FY, County Region



- In FY 2015, Title I payments were the greatest portion of Forest Service revenue sharing in County Region (85.3%), and 25% Fund were the smallest (0%).

Forest Service Revenue Sharing, FY 2015



Data Sources: U.S. Department of Agriculture. 2016. Forest Service, , Washington, D.C.

What is Forest Service Revenue Sharing?

What do we measure on this page?

This page describes Forest Service revenue sharing programs, including the Secure Rural Schools and Community Self-Determination Act (SRS), 25% Fund, and Forest Grasslands.

U.S. Forest Service 25 Percent Fund: The 25% Fund, established in 1908, shares revenue generated from the sale of commodities produced on public land with the county where the activities take place. Twenty-five percent of the value of public land receipts are distributed directly to counties and must be used to fund roads and schools. States determine how to allocate receipts between these two local services.

The Secure Rural Schools and Community Self-Determination Act of 2000 (SRS), or Public Law 106-393: SRS was enacted in FY 2001 to provide 5 years of transitional assistance to rural counties affected by the decline in revenue from timber harvests on federal lands. SRS was reauthorized for a single year in 2007, and again in 2008 for a period of four years. The SRS Act has three titles that allocate payments for specific purposes.

- Title I - these payments to counties make up 80 to 85 percent of the total SRS payments and must be dedicated to funding roads and schools. States determine the split between these two services, and some states let the counties decide.
- Title II - these funds are retained by the federal treasury to be used on special projects on federal land. Resource advisory committees (RACs) at the community level help make spending determinations and monitor project progress.
- Title III - these payments may be used to carry out activities under the Firewise Communities program, to reimburse the county for search and rescue and other emergency services, and to develop community wildfire protection plans.

What is the Relationship Between the 25% Fund and SRS? Counties elect to receive Secure Rural Schools Payments, or to continue with 25% Fund payments. Most counties have elected to receive Secure Rural Schools payments. Some counties, particularly in the East, continue to prefer 25% Fund payments to Secure Rural Schools.

Forest Grasslands: Forest Grasslands are lands acquired by the Forest Service through the Bankhead-Jones Farm Tenant Act of 1937 (P.L. 75-210). The Act authorized acquisition of damaged lands to rehabilitate and use them for various purposes. Receipts from activities on Forest Grasslands are shared directly with county governments.

Special Acts: These include Payments to Minnesota (Act of June 22, 1948, 16 U.S.C. 577g), payments associated with the Quinault Special Management Area in Washington (P.L. 100-638, 102 Stat. 3327), and receipts from the sale of quartz from the Ouachita National Forest in Arkansas (§423, Interior Appropriations Act for FY1989; P.L. 100-446, 102 Stat. 1774). Payments to Minnesota provides a special payment (75% of the appraised value) for lands in the Boundary Waters Canoe Area in St. Louis, Cook, and Lake counties. The Forest Service shares 45 percent of timber receipts from the Quinault Special Management Area with both the Quinault Indian Tribe and with the State of Washington. Congress directed the Forest Service to sell quartz from the Ouachita National Forest as common variety mineral materials (rather than being available under the 1872 General Mining Law), with 50 percent of the receipts to Arkansas counties with Ouachita National Forest lands for roads and schools.

Why is it important?

USFS revenue sharing is the largest source of federal land payments to counties on a national basis (federal mineral royalties are distributed to states). For some counties it provides a significant portion of total local government revenue. Payments became important after WWII when timber harvests on the National Forests increased sharply in response to post-war housing and economic growth.

As the timber economy shifted and ideas about public land management changed, harvests declined and county payments along with it. Congress addressed these changes by authorizing "owl" transition payments in the Pacific Northwest, and later extended the concept of transition payments nationally in 2000 with the SRS act. SRS changed USFS revenue sharing in three fundamental ways: SRS (1) decoupled county payments from National Forest receipts traditionally dominated by timber, (2) introduced new purposes of restoration and stewardship through Title II funds that pay for projects on public lands, and (3) addressed payment equity concerns by adjusting county and school payments based on economic need (the Title I formula is adjusted using each county's per capita personal income).

SRS transition payments are only authorized through FY 2011, at which point Congress must decide to extend and/or reform SRS, or allow it to expire. If SRS expires, counties will again receive payments from the 25% Fund, recoupling payments directly to commercial activities on public land.

Additional Resources

Secure Rural Schools and Community Self Determination Act payments available at: fs.usda.gov/pts/ *(5)*.

Gorte, Ross W. 2008. The Secure Rural Schools and Community Self-Determination Act of 2000: Forest Service Payments to Counties. Congressional Research Service Report RL33822.

Data Sources

U.S. Department of Agriculture. 2016. Forest Service, , Washington, D.C.; Additional sources and methods available at www.headwaterseconomics.org/eps-hdt

What is BLM Revenue Sharing?

This page describes BLM payments to states and local governments. Payments are derived from a variety of revenue-generating activities on BLM land, including revenue from the sale of land and materials, grazing, and minerals leasing.

BLM Payments to States and Local Governments, FY 2015 (FY 2015 $s)

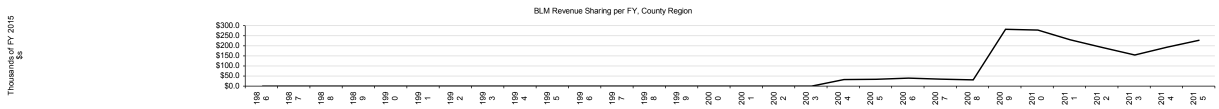
	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Total BLM Payments ($)	27,521	57,364	17,596	1,556	977	25,126	11,599	2,061	15,440	68,805	228,045	50,042,624
Proceeds of Sales	292	1,259	2	14	1	1,210	14	7	301	57	3,157	0
Mineral Leasing Act	0	3,179	0	0	0	0	0	0	0	58	3,237	0
Taylor Grazing Act	25,769	46,713	17,586	1,473	969	21,488	11,514	2,021	13,636	68,403	209,572	14,223,376
State Payments	0	0	0	0	0	0	0	0	0	0	0	274,395
National Grasslands	0	0	0	0	0	0	0	0	0	0	0	0
Miscellaneous Receipts	1,460	6,213	8	70	6	2,428	71	33	1,504	287	12,080	275,388
O&C and CBWR land grants	0	0	0	0	0	0	0	0	0	0	0	35,269,464
Title I	0	0	0	0	0	0	0	0	0	0	0	29,979,045
Title II	0	0	0	0	0	0	0	0	0	0	0	2,983,711
Title III	0	0	0	0	0	0	0	0	0	0	0	2,306,709

Percent of Total

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Proceeds of Sales	1.1%	2.2%	0.0%	0.9%	0.1%	4.8%	0.1%	0.3%	1.9%	0.1%	1.4%	0.0%
Mineral Leasing Act	0.0%	5.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	1.4%	0.0%
Taylor Grazing Act	93.6%	81.4%	99.9%	94.7%	99.2%	85.5%	99.3%	98.1%	88.3%	99.4%	91.9%	28.4%
State Payments	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.5%
National Grasslands	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Miscellaneous Receipts	5.3%	10.8%	0.0%	4.5%	0.6%	9.7%	0.6%	1.6%	9.7%	0.4%	5.3%	0.6%
O&C and CBWR land grants	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	70.5%
Title I	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	59.9%
Title II	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	6.0%
Title III	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.6%

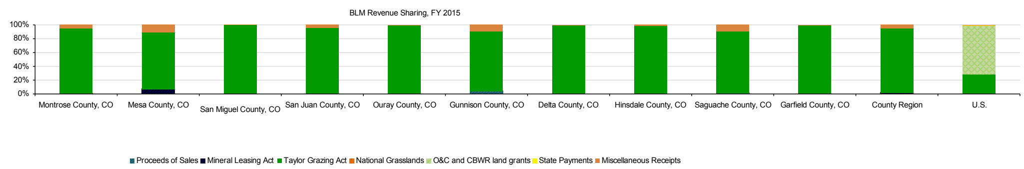
- From FY 1986 to FY 2015, BLM revenue sharing payments grew from $0 to $228,045.

BLM Revenue Sharing per FY, County Region



- In FY 2015, Taylor Grazing Act payments were the greatest portion of BLM revenue sharing in County Region (91.9%), and State Payments payments were the smallest (0%).

BLM Revenue Sharing, FY 2015



Data Sources: U.S. Department of Interior. 2016. Bureau of Land Management, , Washington, D.C.

What is BLM Revenue Sharing?

What do we measure on this page?

This page describes BLM payments to states and local governments. Payments are derived from a variety of revenue-generating activities on BLM land, including revenue from the sale of land and materials, grazing, and minerals leasing.

Proceeds of Sales: These include receipts from the sale of land and materials.

Mineral Leasing Act: These include Oil and Gas Right of Way lease revenue and the National Petroleum Reserve - Alaska Lands. These do not include royalties from mineral leasing on BLM lands, which are distributed by the Office of Natural Resources Revenue (ONRR). For ONRR payments see worksheet 10.

Taylor Grazing Act: The Taylor Grazing Act, June 28, 1934, established grazing allotments on public land and extended tenure to district grazers. In 1936 the Grazing Service (BLM) enacted fees to be shared with the county where allotments and leases are located. Funds are restricted to use for range improvements (e.g., predator control, noxious weed programs) in cooperation with BLM or livestock organizations.

• Section 3 of the Taylor Grazing Act concerns grazing permits issued on public lands within grazing districts established under the Act.

• Section 15 of the Taylor Grazing Act concerns issuing grazing leases on public lands outside the original grazing district established under the Act.

National Grasslands: Revenue derived from the management of National Grasslands under the Bankhead-Jones Farm Tenant Act (7 U.S.C. 1012), and Executive Order 10787, November 6, 1958.

Oregon and California Land Grants: These include (1) the Oregon and California (O&C) land grant payment and (2) Coos Bay Wagon Road (CBWR) payment administered by the Secure Rural Schools and Community Self-Determination Act. Amounts include Title I, Title II, and Title III payments (see the Forest Service revenue sharing section in this report for definitions and information on the Secure Rural Schools and Community Self-Determination Act).

Why is it important?

The BLM is the nation's largest land owner, and activities that take place on BLM lands can be extremely important to adjacent communities. Similarly, the non-taxable status of BLM lands is important to local government who must provide services to county residents, and provide public safety and law enforcement activities on BLM lands. BLM revenue sharing programs provide resources to local governments in lieu of property taxes (and these revenue sharing dollars are supplemented by PILT).

Methods

BLM data on this page are from BLM FRD 196 and FRD 198 reports. The FRD 196 reports receipts by county and state of origin while the FRD 198 reports actual distribution amounts to state and local governments. FRD 198 is not available for some years, so the FRD 196 report is used. To arrive at distribution amounts from receipts, the Legal Allocation of BLM Receipts (Table 3-31 of BLM Public Land Statistics) was used. Some error is likely. In addition, some data are obtained directly from states. Distribution statistics obtained from the state or local government are related to the previous FY's reported distributions (BLM distributions reported for federal FY 2008 are received and reported by state and local government in FY 2009.)

Additional Resources

BLM Public Land Statistics are available at the Annual Reports and Public Land Statistics website: blm.gov/wo/st/en/res/Direct_Links_to_Publications/ann_rpt_and_pls.html *(6)*.

Information about the Taylor Grazing Act is available at: blm.gov/wy/st/en/field_offices/Casper/range/taylor.1.html *(7)*.

Data Sources

U.S. Department of Interior. 2016. Bureau of Land Management, , Washington, D.C.; Additional sources and methods available at www.headwaterseconomics.org/eps-hdt

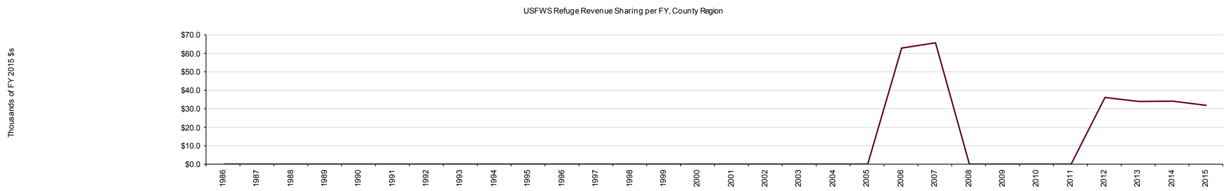
What is U.S. Fish and Wildlife Service Refuge Revenue Sharing?

This page describes U.S. Fish and Wildlife Service Refuge revenue sharing.

USFWS Refuge Revenue Sharing Payments, FY 2015 (FY 2015 $s)

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
USFWS Refuge Revenue Share	0	62	0	0	0	0	481	0	31,290	0	31,833	17,381,146

- From FY 1986 to 2015, U.S. Fish and Wildlife Service Refuge revenue sharing payments grew from $0 to $31,833.



Data Sources: U.S. Department of Interior. 2016. U.S. Fish and Wildlife Service, , Washington, D.C.

What is U.S. Fish and Wildlife Service Refuge Revenue Sharing?

What do we measure on this page?

This page describes U.S. Fish and Wildlife Service Refuge revenue sharing.

Twenty-five percent of the net receipts collected from the sale of various products or privileges from Refuge lands, or three-quarters of one percent (0.75%) of the adjusted purchase price of Refuge land, whichever is greater, is shared with the counties in which the Refuge is located.

Why is it important?

National Wildlife Refuges and other lands administered by the U.S. Fish and Wildlife Service do not pay property taxes to local governments. The Refuge revenue sharing program is intended to compensate counties for non-taxable Refuge lands. As with other revenue sharing programs, these payments can be important if USFWS ownership is a large percentage of all land in the county, reducing the ability of the local government to raise sufficient tax revenue to provide basic services. In addition, linking payments to revenue derived from USFWS lands can create incentives for local government officials to lobby for particular uses of public land.

Methods

Data Limitations: The USFWS publishes a database of Refuge revenue sharing payments for FY 2006 and FY 2007 only, and does not make data available for other years for the nation. Data on Refuge revenue sharing may be obtained directly from the receiving county government. County governments may request county-specific Refuge revenue sharing payment data from U.S. Fish and Wildlife Services, Division of Financial Management, Denver Operations.

Significance of Data Limitations: Data limitations are relatively insignificant on the national scale (USFWS Refuge revenue sharing payments were about 4% of total federal land payments for the United States in FY 2007), however they may be significant for counties that have large areas managed by USFWS.

Additional Resources

A detailed description of USFWS Refuge revenue sharing payments is available on the U.S. Fish and Wildlife Service Realty website at: fws.gov/refuges/realty/rrs.html *(8)*.

The Refuge Revenue Sharing Database is available at: fws.gov/refuges/realty/RRS/2007/RevenueSharing_Search_2007.cfm *(9)*. The database currently only includes payments for FY 2006 and FY 2007. The agency does not provide data for the nation for additional years.

Data Sources

U.S. Department of Interior. 2016. U.S. Fish and Wildlife Service, , Washington, D.C.

What are Federal Mineral Royalties?

This page describes components of federal mineral royalty distributions to state and local governments.

Federal Mineral Royalties by Source, FY 2015 (FY 2015 $s)

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Total Federal Royalty	0	0	0	0	0	6,259	0	0	0	0	6,259	1,834,894,159
Royalties	0	0	0	0	0	0	0	0	0	0	0	1,747,727,581
Coal	0	0	0	0	0	0	0	0	0	0	0	339,832,802
Natural Gas	0	0	0	0	0	0	0	0	0	0	0	455,405,146
Gas Plant Products	0	0	0	0	0	0	0	0	0	0	0	78,409,573
Oil	0	0	0	0	0	0	0	0	0	0	0	597,833,626
Other	0	0	0	0	0	0	0	0	0	0	0	276,246,434
Non-Royalty Revenue	0	0	0	0	0	0	0	0	0	0	0	87,166,577
Rents	0	0	0	0	0	0	0	0	0	0	0	0
Bonus	0	0	0	0	0	0	0	0	0	0	0	0
Other Revenues	0	0	0	0	0	0	0	0	0	0	0	87,166,577
Geothermal	0	0	0	0	0	6,259	0	0	0	0	6,259	4,252,892
GOMESA	0	0	0	0	0	0	0	0	0	0	0	0

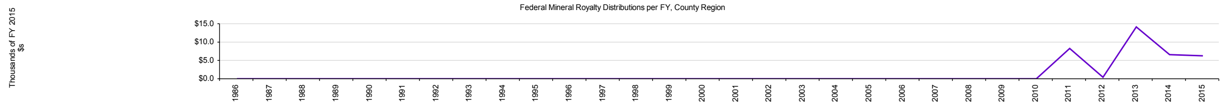
Percent of Total

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Royalties	na	na	na	na	na	0.0%	na	na	na	na	0.0%	95.2%
Coal	na	na	na	na	na	0.0%	na	na	na	na	0.0%	18.5%
Natural Gas	na	na	na	na	na	0.0%	na	na	na	na	0.0%	24.8%
Gas Plant Products	na	na	na	na	na	0.0%	na	na	na	na	0.0%	4.3%
Oil	na	na	na	na	na	0.0%	na	na	na	na	0.0%	32.6%
Other	na	na	na	na	na	0.0%	na	na	na	na	0.0%	15.1%
Non-Royalty Revenue	na	na	na	na	na	0.0%	na	na	na	na	0.0%	4.8%
Rents	na	na	na	na	na	0.0%	na	na	na	na	0.0%	0.0%
Bonus	na	na	na	na	na	0.0%	na	na	na	na	0.0%	0.0%
Other Revenues	na	na	na	na	na	0.0%	na	na	na	na	0.0%	4.8%
Geothermal	na	na	na	na	na	100.0%	na	na	na	na	100.0%	0.2%
GOMESA	na	na	na	na	na	0.0%	na	na	na	na	0.0%	0.0%

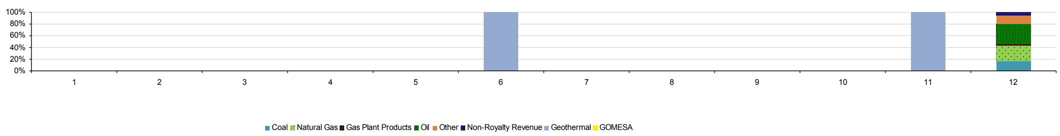
This table shows federal royalties disbursed directly to state and local governments. States may share a portion of their royalties with counties. These state "pass through" disbursements are not reported here. See 'Additional Resources'.

- From FY 1986 to FY 2015, federal mineral royalties grew from $0 to $6,259.
- In FY 2015, oil royalties were the largest component of federal mineral royalties in the U.S. (32.6%), and gas plant products were the smallest (4.3%).
- In FY 2015, other revenues were the largest component of federal mineral non-royalty revenue in the U.S. (4.8%), and rents were the smallest (0%).

Federal Mineral Royalty Distributions per FY, County Region



Components of Federal Mineral Royalty Distributions, FY 2015



Data Sources: U.S. Department of Interior. 2016. Office of Natural Resources Revenue, , Washington, D.C.

What are Federal Mineral Royalties?

What do we measure on this page?

This page describes the components of federal mineral royalty distributions to state and local governments across geographies, and trends for the region.

Royalties, rents, and bonus payments from mining activities on federal land are shared with the state of origin (49% of revenue is returned to states and 51% is retained by the federal government). In addition, revenue from geothermal production on federal lands and a share of royalties from offshore drilling the Gulf of Mexico (GOMESA) are shared directly with county governments. State and local governments determine how to spend their share of federal mineral royalties within broad federal guidelines (priority must be given to areas socially or economically impacted by mineral development for planning, construction/maintenance of public facilities, and provision of public services).

Royalties: Royalty payments represent a stated share or percentage of the value of the mineral produced. The royalty may be an established minimum, a step-scale, or a sliding-scale. A step-scale royalty rate increases by steps as the average production on the lease increases. A sliding-scale royalty rate is based on average production and applies to all production from the lease. A royalty is due when production begins.
Geothermal: Geothermal payments are distributed directly to counties where the activity takes place.
GOMESA: The Gulf of Mexico Energy Security Act of 2006 (GOMESA) makes distributions of offshore federal mineral royalties to coastal states and communities. The four states and their eligible political subdivisions receiving revenues from the GOMESA leases include Alabama, Louisiana, Mississippi, and Texas.
Rents: A rent schedule is established at the time a lease is issued. Rents are annual payments, normally a fixed dollar amount per acre, required to preserve the right to a lease.
Bonuses: Leases issued in areas known or believed to contain minerals are awarded through a competitive bidding process. Bonuses represent the cash amount successfully bid to win the rights to a lease.
Other Revenues: A disbursement that is not a royalty, rent, or bonus. Other revenue may include minimum royalties, settlement payments, gas storage fees, estimated payments, recoupments, and fees for sand and gravel used for beach restoration.

Why is it important?

Mineral royalties are the largest source of revenue derived from extractive activities on public lands. Mineral extraction can place significant demands on federal, state, and local infrastructure and services. Royalty revenue helps meet some of these demands. They are also designed to provide an ongoing public benefit from the depletion of non-renewable resources owned by the public.

Methods

Data Limitations: State governments that receive federal mineral royalty distributions often choose to pass through a share of federal distributions directly to the local government of origin (the location where the royalties were generated). For example, Montana distributes 25 percent of the state government's share of federal mineral royalties with the county of origin. Because information about royalties by county of origin and state government distributions to local governments are not published by ONRR, EPS users must contact each state directly for these data. Headwaters Economics includes a list of state distribution policy, links to data, and contact information for Western U.S. States in the EPS Federal, State, and Local Government Financial Data Methods and Resources document. http://headwaterseconomics.org/wphw/wp-content/uploads/EPS_Federal_Land_Payments_Documentation_1-30-2011.pdf.

Additional Resources

Headwaters Economics provides a methods document specific to the EPS Federal Lands Payments report that includes a list of state distribution policy, links to data, and contact information for Western U.S. States in the EPS-HDT Federal, State, and Local Government Financial Data Methods and Resources document: headwaterseconomics.org/wphw/wp-content/uploads/EPS_Federal_Land_Payments_Documentation_1-30-2011.pdf *(10)*.

For more definitions, see the Glossary of Mineral Terms, Office of Natural Resources Revenue available at: onrr.gov/Stats/pdfdocs/glossary.pdf *(11)*.

Data Sources

U.S. Department of Interior. 2016. Office of Natural Resources Revenue, , Washington, D.C.

Data Sources

The EPS Federal Land Payments report uses published statistics from government sources that are available to the public and cover the entire country. All data used in EPS can be readily verified by going to the original source. The contact information for databases used in this profile is:

- **U.S. Census of Governments**
  Census Bureau, U.S. Department of Commerce
  www.census.gov/govs
  Tel. 800-242-2184

- **U.S. Fish and Wildlife Service**
  Realty Division, U.S. Department of Interior
  www.fws.gov
  Tel. 703-358-1713

- **U.S. Office of Natural Resources Revenue**
  U.S. Department of Interior
  www.onrr.gov
  Tel. 303-231-3078

- **U.S. Bureau of Land Management**
  U.S. Department of Interior
  www.blm.gov
  Tel. 202-208-3801

- **U.S. Forest Service**
  U.S. Department of Agriculture
  www.fs.fed.us
  Tel. 800-832-1355

Methods

EPS core approaches

EPS is designed to focus on long-term trends across a range of important measures. Trend analysis provides a more comprehensive view of changes than spot data for select years. We encourage users to focus on major trends rather than absolute numbers.

EPS displays detailed industry-level data to show changes in the composition of the economy over time and the mix of industries at points in time.

EPS employs cross-sectional benchmarking, comparing smaller geographies such as counties to larger regions, states, and the nation, to give a sense of relative performance.

EPS allows users to aggregate data for multiple geographies, such as multi-county regions, to accommodate a flexible range of user-defined areas of interest and to allow for more sophisticated cross-sectional comparisons.

Adjusting dollar figures for inflation

Because a dollar in the past was worth more than a dollar today, data reported in current dollar terms should be adjusted for inflation. The U.S. Department of Commerce reports personal income figures in terms of current dollars. All income data in EPS are adjusted to real (or constant) dollars using the Consumer Price Index. Figures are adjusted to the latest date for which the annual Consumer Price Index is available.

Links to Additional Resources

For more information about EPS see:

headwaterseconomics.org/EPS

Web pages listed under Additional Resources include:

Throughout this report, references to on-line resources are indicated with italicized numbers in parentheses. These resources are provided as hyperlinks here.

1 headwaterseconomics.org/eps
2 www.census.gov/govs/estimate/
3 www.census.gov/govs/
4 www.doi.gov/nbc/index.cfm
5 www.fs.usda.gov/pts/
6 www.blm.gov/wo/st/en/res/Direct_Links_to_Publications/ann_rpt_and_pls.html
7 www.blm.gov/wy/st/en/field_offices/Casper/range/taylor.1.html
8 www.fws.gov/refuges/realty/rrs.html
9 www.fws.gov/refuges/realty/RRS/2007/RevenueSharing_Search_2007.cfm
10 headwaterseconomics.org/wphw/wp-content/uploads/EPS_Federal_Land_Payments_Documentation_1-30-2011.pdf
11 www.onrr.gov/Stats/pdfdocs/glossary.pdf

A Profile of Mining, Including Oil & Gas

County Region

Selected Geographies:

Montrose County, CO; Mesa County, CO; San Miguel County, CO; San Juan County, CO; Ouray County, CO; Gunnison County, CO; Delta County, CO; Hinsdale County, CO; Saguache County, CO; Garfield County, CO

Benchmark Geographies:

U.S.

Produced by
Economic Profile System
EPS
November 28, 2016

About the Economic Profile System (EPS)

EPS is a free, easy-to-use software application that produces detailed socioeconomic reports of counties, states, and regions, including custom aggregations.

EPS uses published statistics from federal data sources, including Bureau of Economic Analysis and Bureau of the Census, U.S. Department of Commerce; and Bureau of Labor Statistics, U.S. Department of Labor.

The Bureau of Land Management and Forest Service have made significant financial and intellectual contributions to the operation and content of EPS.

See headwaterseconomics.org/EPS for more information about the other tools and capabilities of EPS.

For technical questions, contact Patty Gude at eps@headwaterseconomics.org, or 406-599-7425.

HEADWATERS ECONOMICS

headwaterseconomics.org

Headwaters Economics is an independent, nonprofit research group. Our mission is to improve community development and land management decisions in the West.

www.blm.gov

The Bureau of Land Management, an agency within the U.S. Department of the Interior, administers 249.8 million acres of America's public lands, located primarily in 12 Western States. It is the mission of the Bureau of Land Management to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations.

www.fs.fed.us

The Forest Service, an agency of the U.S. Department of Agriculture, administers national forests and grasslands encompassing 193 million acres. The Forest Service's mission is to achieve quality land management under the "sustainable multiple-use management concept" to meet the diverse needs of people while protecting the resource. Significant intellectual, conceptual, and content contributions were provided by the following individuals: Dr. Pat Reed, Dr. Jessica Montag, Doug Smith, M.S., Fred Clark, M.S., Dr. Susan A. Winter, and Dr. Ashley Goldhor-Wilcock.

Table of Contents

Note to Users:

This is one of fourteen reports that can be created and downloaded from EPS Web. You may want to run another EPS report for either a different geography or topic. Topics include land use, demographics, specific industry sectors, the role of non-labor income, the wildland-urban interface, the role of amenities in economic development, and payments to county governments from federal lands. Throughout the reports, references to online resources are indicated in parentheses. These resources are provided as hyperlinks on each report's final page. The EPS reports are downloadable as Excel, PDF, and Word documents. For further information and to download reports, go to:

headwaterseconomics.org/eps

What industries comprise mining sectors?

This page describes the number of jobs (full and part-time) and the share of total jobs in the mining industry, broken out into four major sub-sectors: oil and gas extraction, coal mining, metal ore mining, and nonmetallic minerals mining.

Employment in Mining, 2014

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Total Private Employment	11,560	50,695	4,688	197	1,041	6,171	6,738	139	790	18,937	100,956	121,079,879
Mining	146	2,801	~2	0	~2	~556	~555	~8	~2	892	~4,964	758,971
Oil & Gas Extraction	~52	~2,781	~1	0	0	~1	~19	0	0	845	~3,699	548,350
Oil & Gas Extraction	0	88	0	0	0	0	~2	0	0	514	~604	137,839
Drilling Oil & Gas Wells	~9	~271	0	0	0	0	0	0	0	3	~283	102,734
Support for Oil & Gas Operations	~43	2,422	~1	0	0	~1	~17	0	0	328	~2,812	307,777
Coal Mining	~65	~28	0	0	0	~516	~485	0	0	0	~1,094	82,946
Coal Mining	~65	0	0	0	0	~516	~331	0	0	0	~912	76,572
Support Activities for Coal Mining	0	~28	0	0	0	0	~154	0	0	0	~182	6,374
Metal Ore Mining	~22	~2	0	0	~2	0	~2	~8	0	0	~36	45,716
Metal Ore Mining	~8	~2	0	0	0	0	0	~8	0	0	~18	41,926
Support Activities for Metal Mining	~14	0	0	0	~2	0	~2	0	0	0	~18	3,790
Nonmetallic Minerals Mining	~6	~2	0	0	0	~36	~9	0	~2	47	~102	81,959
Nonmetallic Minerals Mining	~4	~2	0	0	0	~36	~9	0	~2	47	~100	79,375
Support for Nonmetal Minerals	~2	0	0	0	0	0	0	0	0	0	~2	2,584
Mining Related	~35	156	0	0	0	0	~3	0	0	~581	~775	~226,754
Oil & Gas Pipeline & Related Const.	~32	103	0	0	0	0	0	0	0	~500	~635	167,748
Pipeline Transportation	~3	53	0	0	0	0	~3	0	0	~81	~140	~59,006
Non-Mining	11,414	47,894	~4,686	0	~1,039	~5,615	~6,183	~131	~788	18,045	~95,795	120,320,908

Percent of Total

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Mining	1.3%	5.5%	~0.0%	0.0%	~0.2%	~9.0%	~8.2%	~5.8%	~0.3%	4.7%	~4.9%	0.6%
Oil & Gas Extraction	~0.4%	~5.5%	~0.0%	0.0%	0.0%	~0.0%	~0.3%	0.0%	0.0%	4.5%	~3.7%	0.5%
Oil & Gas Extraction	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	~0.0%	0.0%	0.0%	2.7%	~0.6%	0.1%
Drilling Oil & Gas Wells	~0.1%	~0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	~0.3%	0.1%
Support for Oil & Gas Operations	~0.4%	4.8%	~0.0%	0.0%	0.0%	~0.0%	~0.3%	0.0%	0.0%	1.7%	~2.8%	0.3%
Coal Mining	~0.6%	~0.1%	0.0%	0.0%	0.0%	~8.4%	~7.2%	0.0%	0.0%	0.0%	~1.1%	0.1%
Coal Mining	~0.6%	0.0%	0.0%	0.0%	0.0%	~8.4%	~4.9%	0.0%	0.0%	0.0%	~0.9%	0.1%
Support Activities for Coal Mining	0.0%	~0.1%	0.0%	0.0%	0.0%	0.0%	~2.3%	0.0%	0.0%	0.0%	~0.2%	0.0%
Metal Ore Mining	~0.2%	~0.0%	0.0%	0.0%	~0.2%	0.0%	~0.0%	~5.8%	0.0%	0.0%	~0.0%	0.0%
Metal Ore Mining	~0.1%	~0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	~5.8%	0.0%	0.0%	~0.0%	0.0%
Support Activities for Metal Mining	~0.1%	0.0%	0.0%	0.0%	~0.2%	0.0%	~0.0%	0.0%	0.0%	0.0%	~0.0%	0.0%
Nonmetallic Minerals Mining	~0.1%	~0.0%	0.0%	0.0%	0.0%	~0.6%	~0.1%	0.0%	~0.3%	0.2%	~0.1%	0.1%
Nonmetallic Minerals Mining	~0.0%	~0.0%	0.0%	0.0%	0.0%	~0.6%	~0.1%	0.0%	~0.3%	0.2%	~0.1%	0.1%
Support for Nonmetal Minerals	~0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	~0.0%	0.0%
Mining Related	~0.3%	0.3%	0.0%	0.0%	0.0%	0.0%	~0.0%	0.0%	0.0%	~3.1%	~0.8%	~0.2%
Oil & Gas Pipeline & Related Const.	~0.3%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	~2.6%	~0.6%	0.1%
Pipeline Transportation	~0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	~0.0%	0.0%	0.0%	~0.4%	~0.1%	~0.0%
Non-Mining	98.7%	94.5%	~100.0%	0.0%	~99.8%	~91.0%	~91.8%	~94.2%	~99.7%	95.3%	~94.9%	99.4%

This table does not include employment data for government, agriculture, railroads, or the self-employed because these are not reported by County Business Patterns. Estimates for data that were not disclosed are indicated with tildes (~).

Data Sources: U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.

What industries comprise mining sectors?

What do we measure on this page?

This page describes the number of jobs (full and part-time) and the share of total jobs in the mining industry, broken out into four major sub-sectors: oil and gas extraction, coal mining, metal ore mining, and nonmetallic minerals mining.

Why is this Important?

To understand the potential impact of proposed land management practices, it is important to grasp the relative size of the mining industry and its components, how these have changed over time, and how local trends compare to trends in other geographies. Some important issues to consider are whether a proposed management action would stimulate growth or decline in the industry, how proposed actions relate to on-going trends shown in the data, whether some geographies would be affected more than others, and given the relative size of the industry if changes to it will affect the broader economy.

Methods

According to the North American Industrial Classification system (NAICS), Mining (NAICS code 21) consists of Oil and Gas Extraction (NAICS 211), Mining Except Oil and Gas (NAICS 212) and Support Activities for Mining (NAICS 213). In addition, we add the category "Mining Related" which captures oil and gas pipeline industries and employment. Details on Mining are shown below (NAICS in parentheses):

Oil and Gas Extraction:
Oil and Gas Extraction (2111)
Support Activities: Drilling Oil and Gas Wells (213111; includes directional drilling, redrilling, spudding, tailing, water intake wells), and Support for Oil and Gas Operations (213112; includes exploration, chemical treatment, cleaning, pumping, swabbing, surveying)

Coal Mining:
Coal Mining (2121)
Support Activities for Coal Mining (213113; includes drilling, blasting, shaft sinking, tunneling, exploration)

Metals Mining:
Metal Ore Mining (2122; includes gold, silver, zinc and others)
Support Activities for Metal Mining (213114; includes blasting services, exploration, tunneling, pumping)

Nonmetallic Minerals Mining:
Nonmetallic Minerals and Quarrying (2123; includes stone, volcanic rock, granite, cement, gravel and others)
Support Activities for Nonmetallic Minerals and Quarrying (213115; includes blasting services, test drilling, mine shaft development).

Mining Related:
Pipeline Transportation (486; Industries in the Pipeline Transportation subsector use transmission pipelines to transport products, such as crude oil, natural gas, refined petroleum products, and slurry)
Oil and Gas Pipeline and Related Structures Construction (237120)

Data on this page were obtained from County Business Patterns. We use this source because, compared to other sources, it has fewer data gaps (instances when the federal government will not release information to protect the confidentiality of individual businesses). It also includes both full and part-time employment. The disadvantage of County Business Patterns data is that they do not include employment in government, agriculture, railroads, or the self-employed and as a result under-count the size of industry sectors. Also, County Business Patterns data are based on mid-March employment and do not take into account seasonal fluctuations. For these reasons, the data are most useful for showing long-term trends, displaying differences between geographies, and showing the relationship between sectors over time.

Some data are withheld by the federal government to avoid the disclosure of potentially confidential information. Headwaters

Additional Resources

For an online listing of all NAICS codes, see: naics.com/search.htm *(1)*.

For additional online manuals and definitions of industry codes, see: bls.gov/bls/NAICS.htm *(2)* and census.gov/eos/www/naics *(3)*.

Documentation explaining methods developed by Headwaters Economics for estimating disclosure gaps is available at headwaterseconomics.org/eps *(4)*.

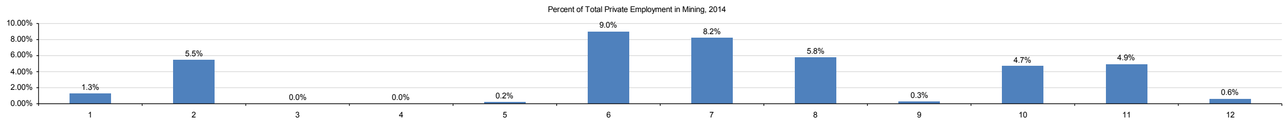
Data Sources

U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.

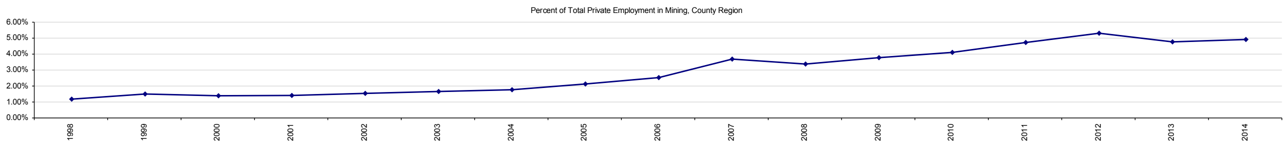
How has mining changed over time?

This page describes long-term trends in mining employment as a percent of all jobs and compares mining to non-mining employment over time for the region.

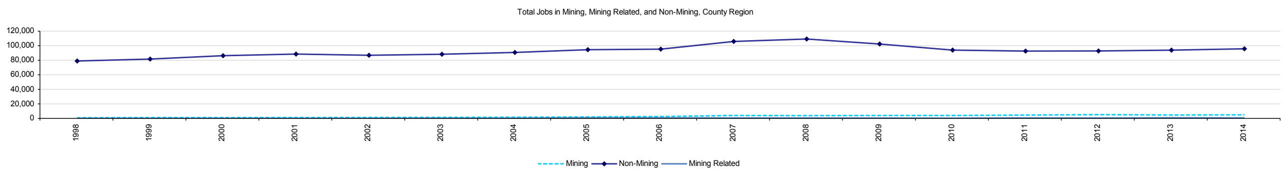
- In 2014, Gunnison County, CO had the largest percent of total mining employment (9%), and San Miguel County, CO had the smallest (0%).



- In 1998, mining represented 1.18 percent of total employment. By 2014, mining represented 4.92 percent of total employment.



- From 1998 to 2014, mining employment grew from 948 to 4,964 jobs, a 423.6 percent increase.
- From 1998 to 2014, non-mining employment grew from 78,966 to 95,795 jobs, a 21.3 percent increase.



Data Sources: U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.

Study Guide and Supplemental Information

How has mining changed over time?

What do we measure on this page?

This page describes long-term trends in mining employment as a percent of all jobs and compares mining to non-mining employment over time for the region.

Why is it important?

In some geographies the mining industry can be a significant driver in the economy. If it is, other sectors of the economy, as well as total employment and total personal income, will likely follow trends in the mining industry. It is important to know whether this is the case because if employment in other sectors fluctuates with the mining industry, then management actions on public lands may affect more than the mining industry itself. If, on the other hand, jobs in the rest of the economy are growing independent of trends in the mining industry, then management actions that potentially affect the mining industry may have impacts that are limited to that industry.

Methods

Data on this page were obtained from County Business Patterns. We use this source because, compared to other sources, it has fewer data gaps (instances when the federal government will not release information to protect the confidentiality of individual businesses). It also includes both full and part-time employment. The disadvantage of County Business Patterns data is that they do not include employment in government, agriculture, railroads, or the self-employed and as a result under-count the size of industry sectors. Also, County Business Patterns data are based on mid-March employment and do not take into account seasonal fluctuations. For these reasons, the data are most useful for showing long-term trends, displaying differences between geographies, and showing the relationship between sectors over time.

Some data are withheld by the federal government to avoid the disclosure of potentially confidential information. Headwaters Economics uses data from the U.S. Department of Commerce to estimate these data gaps.

Additional Resources

A number of online resources are available for more information on components of the mining industry.

For detailed information on oil, gas, and coal see the U.S. Energy Information Administration: eia.doe.gov *(5)*.

BP p.l.c. offers a widely-used and comprehensive overview on global trends in energy called the BP Statistical Review of World Energy: bp.com/sectionbodycopy.do?categoryId=7500&contentId=7068481 *(6)*.

The Bureau of Labor Statistics provides an overview and outlook for the mining industry: bls.gov/oco/cg/cgs004.htm *(7)*. This site also contains other useful links to organizations such as the American Geological Institute and the National Mining Association.

Headwaters Economics has completed a number of studies on fossil fuel development and its impact on the U.S. West. See: headwaterseconomics.org/energy *(8)*.

Documentation explaining methods developed by Headwaters Economics for estimating disclosure gaps is available at headwaterseconomics.org/eps *(4)*.

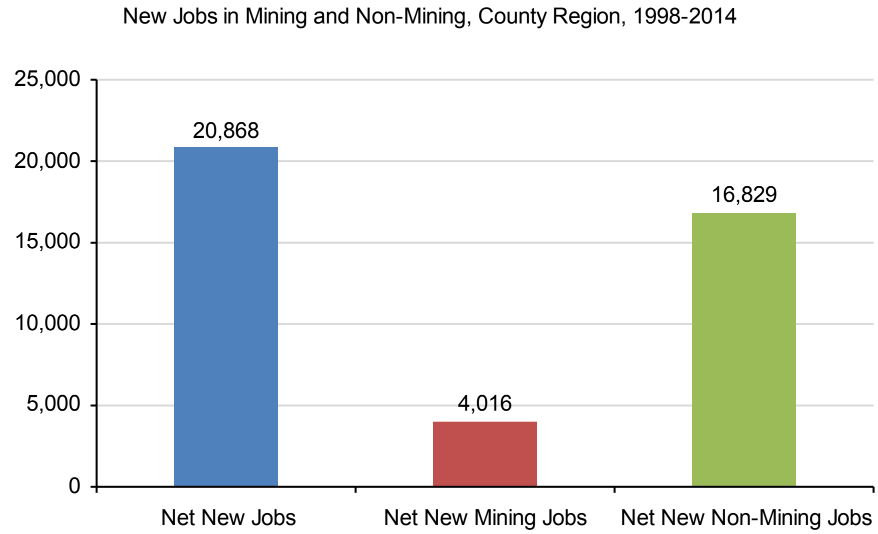
Data Sources

U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.

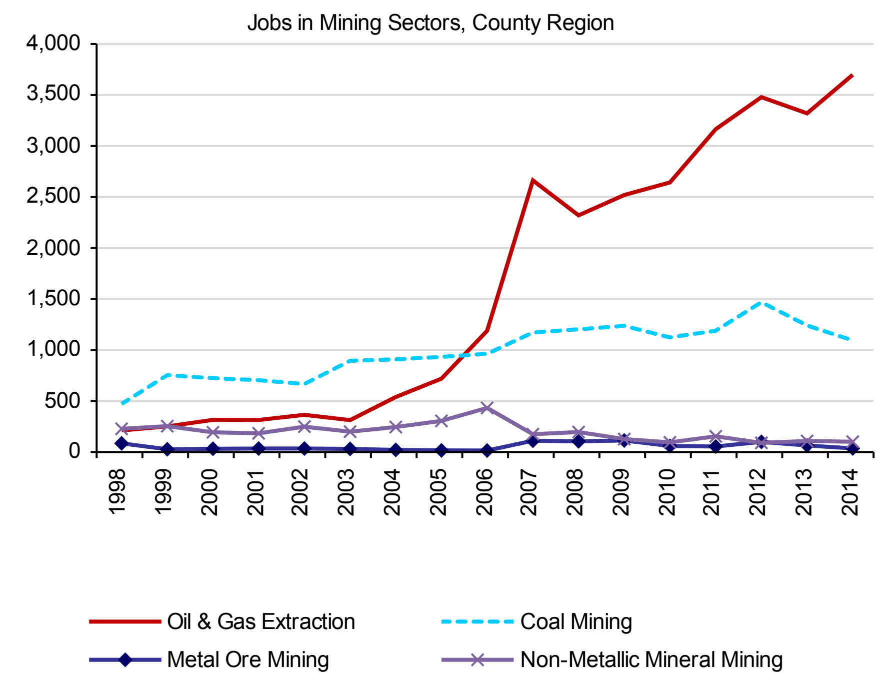
Which mining sectors are changing the fastest?

This page describes the change in mining jobs compared to the change in non-mining jobs and compares how employment in various mining sectors has changed over time for the region.

- From 1998 to 2014, mining employment grew by 4,016 jobs.
- From 1998 to 2014, non-mining employment grew by 16,829 jobs.



- From 1998 to 2014, oil & gas extraction grew from 212 to 3699 jobs, a 1,645% increase.
- From 1998 to 2014, coal mining grew from 472 to 1094 jobs, a 132% increase.
- From 1998 to 2014, metal ore mining shrank from 86 to 36 jobs, a 58% decrease.
- From 1998 to 2014, non-metallic mineral mining shrank from 228 to 102 jobs, a 55% decrease.



Data Sources: U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.

Study Guide and Supplemental Information

Which mining sectors are changing the fastest?

What do we measure on this page?

This page describes the change in mining jobs compared to the change in non-mining jobs and compares how employment in various mining sectors has changed over time for the region.

Why is it important?

To understand the importance of mining in the local economy it is useful to grasp the source of new jobs and the relative contribution of the mining industry to net new jobs. Components of the mining industry may create or lose jobs at a different rate.

Some geographies are more dependent on mining-related employment than others. This is important to understand because activities on public lands that impact the mining industry may affect other sectors of the economy.

Geographies with economies that focus narrowly on resource extraction, particularly on fossil fuel development, can be subject to boom-and-bust cycles as well as other economic challenges, such as slower long-term economic growth. These difficulties are sometimes called the "resource curse" in reference to the apparent paradox that areas rich in natural resources often underperform economically.

Methods

The bottom figure on this page starts in 1998 because that is the year the Census Bureau (and County Business Patterns) shifted to using the new North American Industrial Classification System (NAICS).

Data on this page were obtained from County Business Patterns. We use this source because, compared to other sources, it has fewer data gaps (instances when the federal government will not release information to protect confidentiality of individual businesses). It also includes both full and part-time employment.

The disadvantage of County Business Patterns data is that they do not include employment in government, agriculture, railroads, or the self-employed and as a result under-count the size of industry sectors. Also, County Business Patterns data are based on mid-March employment and do not take into account seasonal fluctuations. For these reasons, the data are most useful for showing long-term trends, displaying differences between geographies, and showing the relationship between sectors over time.

Some data are withheld by the federal government to avoid the disclosure of potentially confidential information. Headwaters Economics uses data from the U.S. Department of Commerce to estimate these data gaps.

Additional Resources

The Bureau of Labor Statistics provides an overview and outlook for the mining industry: bls.gov/oco/cg/cgs004.htm *(7)*. This site also contains other useful links to organizations such as the American Geological Institute and the National Mining Association.

Headwaters Economics has completed a number of studies on fossil fuel development and its impact on the U.S. West. See: headwaterseconomics.org/energy *(8)*.

A useful summary of the "resource curse" can be found in: Humphreys, Macartan, Jeffrey D. Sachs, and Joseph E. Stiglitz, Eds. Escaping the Resource Curse. 2007. New York: Columbia University Press.

Documentation explaining methods developed by Headwaters Economics for estimating disclosure gaps is available at headwaterseconomics.org/eps *(4)*.

Data Sources

U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.

What role do the self-employed play in the mining industry?

This page describes the number of nonemployer businesses (in most cases self-employed individuals) in mining by sector and geography. It offers an additional source to supplement data used in previous pages of this report that do not include the self-employed.

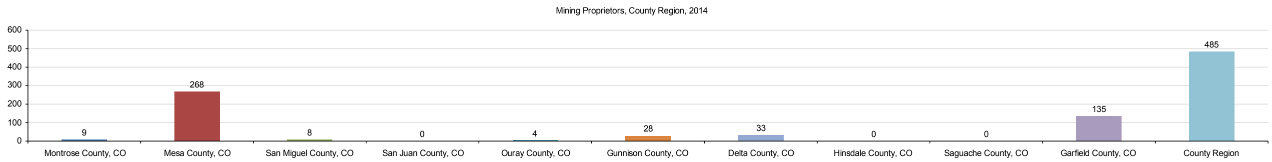
Proprietors in Mining, 2014

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Total Proprietors	3,652	11,180	1,718	111	907	2,291	2,727	142	589	6,097	29,414	23,836,937
Mining	9	268	8	na	4	28	33	0	na	135	485	109,866
Oil & Gas Extraction	0	175	6	0	0	23	22	0	0	89	315	86,291
Mining (Except Oil & Gas)	na	9	na	0	na	na	4	0	na	4	17	5,538
Support Activities for Mining	7	84	na	na	na	4	7	0	0	42	144	18,037
Non-Mining	3,643	10,912	1,710	na	903	2,263	2,694	0	na	5,962	28,087	23,727,071

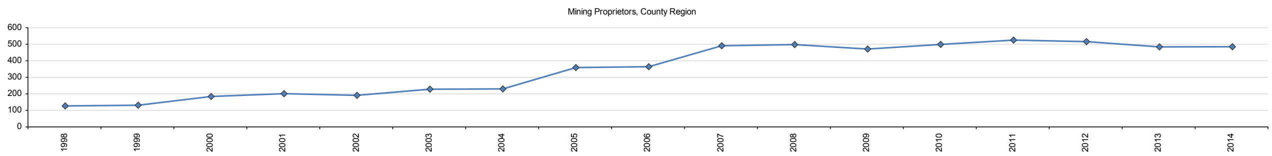
Percent of Total

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Mining	0.2%	2.4%	0.5%	na	0.4%	1.2%	1.2%	0.0%	na	2.2%	1.6%	0.5%
Oil & Gas Extraction	0.0%	1.6%	0.3%	0.0%	0.0%	1.0%	0.8%	0.0%	0.0%	1.5%	1.1%	0.4%
Mining (Except Oil & Gas)	na	0.1%	na	0.0%	na	na	0.1%	0.0%	na	0.1%	0.1%	0.0%
Support Activities for Mining	0.2%	0.8%	na	na	na	0.2%	0.3%	0.0%	0.0%	0.7%	0.5%	0.1%
Non-Mining	99.8%	97.6%	99.5%	na	99.6%	98.8%	98.8%	0.0%	na	97.8%	95.5%	99.5%

- In 2014, County Region had the largest number of mining proprietors (485), and Hinsdale County, CO had the smallest (0).



- From 1998 to 2014, mining proprietors in County Region grew from 127 to 485, a 281.9% increase.



Data Sources: U.S. Department of Commerce. 2016. Census Bureau, Nonemployer Statistics, Washington, D.C.

What role do the self-employed play in the mining industry?

What do we measure on this page?

This page describes the number of nonemployer businesses (in most cases self-employed individuals) in mining by sector and geography. It offers an additional source to supplement data used in previous pages of this report that do not include the self-employed.

Nonemployer Business: A business with no paid employees, with annual business receipts of $1,000 or more, and subject to federal income taxes. Nonemployer businesses can be individual proprietorships, partnerships, or corporations. Most nonemployers are self-employed individuals operating very small unincorporated businesses, which may or may not be the owner's principal source of income.

Why is it important?

Significant portions of the mining industry, especially support activities that include things such as excavation, trucking, servicing, etc., may be conducted by nonemployer businesses. These nonemployer businesses are not reported by County Business Patterns but are reported by Nonemployer Statistics. It is important to use these two data sources in tandem when evaluating the size and trends in mining employment.

Methods

Nonemployer Statistics provides the only source of detailed and comprehensive data on the scope, nature, and activities of U.S. businesses with no paid employment and payroll.

According to the Census Bureau, "Most nonemployers are self-employed individuals operating very small unincorporated businesses, which may or may not be the owner's principal source of income. These firms are excluded from most other business statistics."

Note that the three mining sub-categories in the table Proprietors in Mining are 3-digit NAICS categories (from Nonemployer Statistics). They are different than the four summary categories (from County Business Patterns) shown on previous pages.

The three mining sub-categories in the table Proprietors in Mining are 3-digit NAICS categories (from Nonemployer Statistics). They are different than the four summary categories (from County Business Patterns) shown on previous pages.

The category Mining is the sum of the following NAICS codes shown on this page: Oil and Gas Extraction (211), Mining [except Oil and Gas] (212), and Support Activities for Mining (213).

Depending on the geographies selected, some data may not be available due to disclosure restrictions.

Additional Resources

Nonemployer Statistics data can be found at: census.gov/econ/nonemployer/index.html *(9)*.

Nonemployer business definitions can be found at: census.gov/econ/nonemployer/definitions.htm *(10)*.

Data Sources

U.S. Department of Commerce. 2016. Census Bureau, Nonemployer Statistics, Washington, D.C.

How do mining industry wages compare to wages in other sectors?

This page describes wages (in real terms) from employment in the mining industry, including sub-sectors, compared to wages from employment in all non-mining sectors combined across geographies. It also describes the percent of jobs in each category. These are shown together to illustrate the relative wage levels in mining, including sub-sectors, and how many people are employed in each sub-sector across geographies.

Average Annual Wages, 2015 (2015 $s)

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
All Sectors	$36,713	$41,353	$40,554	$24,200	$35,618	$35,031	$33,178	$28,135	$29,790	$46,534	$40,618	$52,937
Private	$34,472	$40,287	$39,884	$20,639	$35,467	$33,014	$31,114	$26,804	$29,734	$46,997	$39,787	$52,874
Mining	$78,413	$79,308	na	$0	na	na	$73,181	na	na	$86,702	$81,299	$102,468
Oil & Gas Extraction	$0	$122,975	$0	$0	na	$0	$0	$0	$0	$102,953	$106,046	$161,934
Mining (Except Oil & Gas)	na	$36,396	na	$0	na	na	na	na	na	$53,147	$48,151	$74,695
Support Activities for Mining	na	$77,519	na	$0	na	na	na	na	$0	$76,483	$77,243	$85,981
Non-Mining	$34,179	$38,337	~$39,972	~$17,257	~$30,267	~$29,605	$28,343	~$24,258	~$32,565	$43,957	$37,787	$52,557
Government	$44,844	$47,189	$44,317	$55,114	$36,048	$41,777	$38,384	$30,948	$55,675	$44,620	$44,639	$53,289

This table shows wage data from the Bureau of Labor Statistics, which does not report data for proprietors or the value of benefits and uses slightly different industry categories than those shown on previous pages of this report.

Percent of Total Employment, 2015

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Private	78.4%	84.5%	84.9%	74.6%	77.7%	77.0%	71.5%	67.9%	67.4%	80.6%	81.3%	84.8%
Mining	0.5%	4.0%	na	0.0%	na	na	4.4%	na	na	5.7%	3.5%	0.5%
Oil & Gas Extraction	0.0%	0.2%	0.0%	0.0%	na	0.0%	0.0%	0.0%	0.0%	2.3%	0.6%	0.1%
Mining (Except Oil & Gas)	na	0.0%	na	0.0%	na	na	na	na	na	0.2%	0.0%	0.1%
Support Activities for Mining	na	3.8%	na	0.0%	na	na	na	na	0.0%	3.2%	2.5%	0.3%
Non-Mining	77.9%	80.5%	~84.2%	~51.9%	~66.9%	~71.3%	67.2%	~39.1%	~32.9%	74.9%	76.8%	84.3%
Government	21.6%	15.5%	15.1%	1.0%	22.4%	23.0%	28.4%	32.1%	2.8%	19.4%	18.2%	15.2%

This table uses employment data from the Bureau of Labor Statistics, which does not report data for proprietors or the value of benefits and uses slightly different industry categories than those shown on previous pages of this report.

Data Sources: U.S. Department of Labor. 2016. Bureau of Labor Statistics, Quarterly Census of Employment and Wages, Washington, D.C.

How do mining industry wages compare to wages in other sectors?

What do we measure on this page?

This page describes wages (in real terms) from employment in the mining industry, including sub-sectors, compared to wages from employment in all non-mining sectors combined across geographies. It also describes the percent of jobs in each category. These are shown together to illustrate the relative wage levels in mining, including sub-sectors, and how many people are employed in each sub-sector across geographies.

The primary purpose of this page is to compare the average annual wages between sectors, and to investigate the relative number of people employed in high and low-wage sectors.

Why is it important?

The mining industry has the potential to provide high-wage jobs, but this may differ by mining sub-sector and by geography. Some important issues to consider are how mining industry wages compare to wages in other sectors, whether some components of the mining industry pay higher wages than others, and if there are significant wage differences between geographies.

Methods

The wage and employment data on this page are from the Bureau of Labor Statistics, which does not report data for proprietors or the value of benefits and uses slightly different industry categories than those shown on the initial pages of this report.

The three mining sub-sectors in the tables are 3-digit NAICS categories (from Quarterly Census of Employment and Wages) and are different than the four summary categories (from County Business Patterns) shown on the initial pages of this report.

The category Mining is the sum of the following NAICS codes shown on this page: Oil and Gas Extraction (211), Mining [except Oil and Gas] (212), and Support Activities for Mining (213).

Depending on the geographies selected, some data may not be available due to disclosure restrictions.

Some data are withheld by the federal government to avoid the disclosure of potentially confidential information. Headwaters Economics uses custom data aggregations calculated from various NAICS codes. Occasionally, one or more data values underlying these aggregations are non-disclosed. These values are indicated with tildes (~).

Additional Resources

For an overview of how the Bureau of Labor Statistics treats employment, see: bls.gov/bls/employment.htm *(11)*.

For an overview of how the Bureau of Labor Statistics treats pay and benefits, see: bls.gov/bls/wages.htm *(12)*.

Employment and wage estimates are also available from the Bureau of Labor Statistics for over 800 occupations. Looking at mining by occupation, rather than by sector or industry, is helpful since wages can vary dramatically across occupations. For more information, see: bls.gov/oes *(13)*.

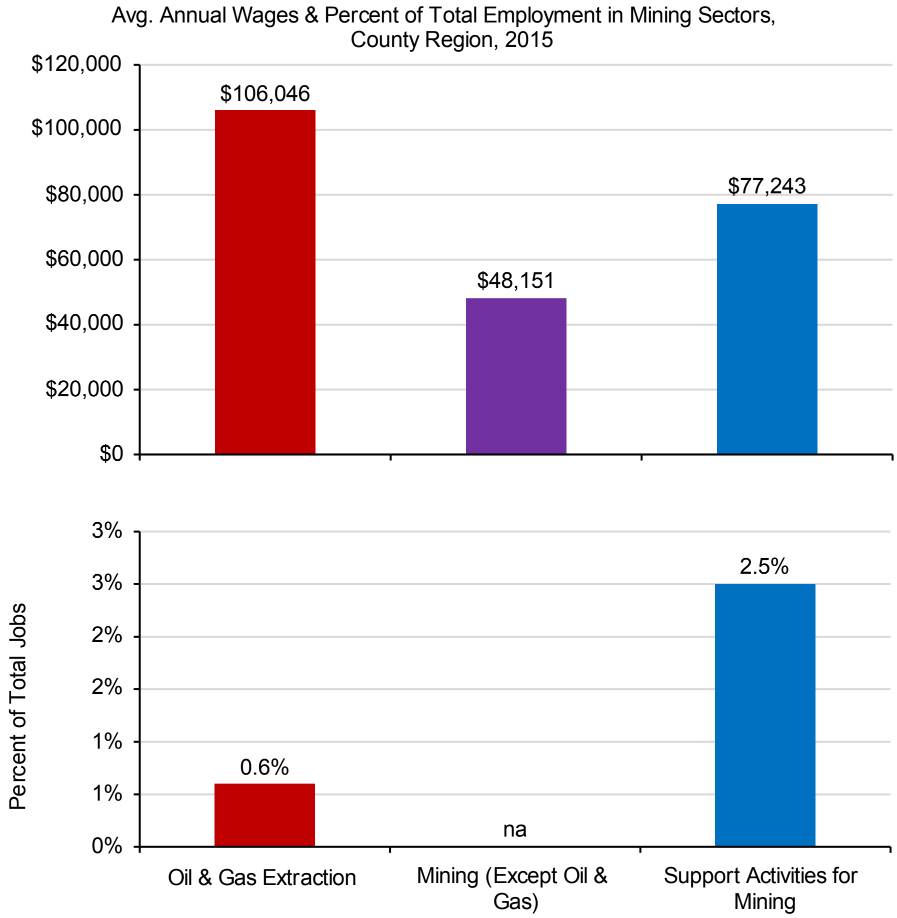
For more information on wages in non-mining industries run the EPS-HDT Socioeconomic Measures report.

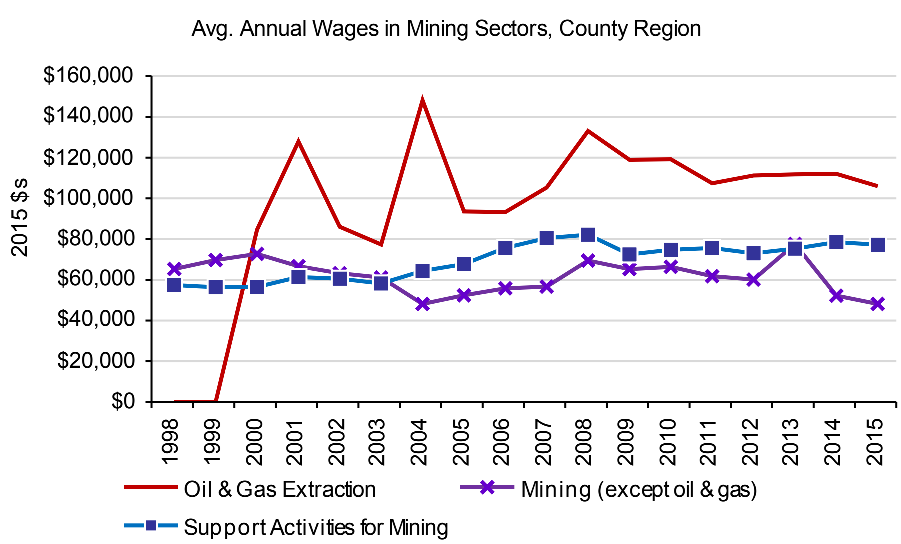
Data Sources

U.S. Department of Labor. 2016. Bureau of Labor Statistics, Quarterly Census of Employment and Wages, Washington, D.C.

How do mining jobs and wages compare?

This page describes average wages (in real terms) and employment levels in different mining sectors for the region. It also shows average wage trends (in real terms) for mining sectors for the region.





- From 1998 to 2015, average wages in mining (except oil & gas) shrank (in real terms) from $65,318 to $48,151 a 26% decrease.
- From 1998 to 2015, average wages in support activities for mining grew (in real terms) from $57,432 to $77,243 a 35% increase.

Data Sources: U.S. Department of Labor. 2016. Bureau of Labor Statistics, Quarterly Census of Employment and Wages, Washington, D.C.

How do mining jobs and wages compare?

What do we measure on this page?

This page describes average wages (in real terms) and employment levels in different mining sectors for the region. It also shows average wage trends (in real terms) for mining sectors for the region.

The figure Avg. Annual Wages and Percent of Total Employment in Mining Sectors is useful for describing how many people are working in relatively high and low-wage mining sectors. The figure Avg. Annual Wages in Mining Sectors is useful for comparing wage trends by mining sector.

Why is it important?

While the mining industry has the potential to offer high wages, not all components of the mining industry pay the same wages or employ the same number of people. A significant increase in mining jobs that pay above the average for all industries will increase overall average earnings per job. On the other hand, a significant increase in mining jobs that pay below the average for all industries will decrease overall average earnings per job. A modest change in mining employment, especially when this industry is a small share of total employment, will not likely affect average earnings in a local area.

Methods

The wage and employment data on this page are from the Bureau of Labor Statistics, which does not report data for proprietors or the value of benefits and uses slightly different industry categories than those shown on the initial pages of this report.

The three mining sub-sectors in the figures are 3-digit NAICS categories (from Quarterly Census of Employment and Wages) and are different than the three summary categories (from County Business Patterns) shown on the initial pages of this report.

What we show as mining in the figures on this page is the sum of the following NAICS codes: Forestry and Logging (113), Woods Product Manufacturing (321), and Paper Manufacturing (322).

The figure Avg. Annual Wages in Mining Sectors starts in 1998 to be consistent with the start date of figures on earlier pages of this report.

Depending on the geographies selected, some data may not be available due to disclosure restrictions.

Additional Resources

For an overview of how the Bureau of Labor Statistics treats employment, see: bls.gov/bls/employment.htm *(11)*.

For an overview of how the Bureau of Labor Statistics treats pay and benefits, see: bls.gov/bls/wages.htm *(12)*.

If there are significant undisclosed data on this page, other sources for mining wage data include:

The Bureau of Labor Statistics' Quarterly Census of Employment and Wages, which has data for industries at the state level, is available at: bls.gov/cew/ *(14)*.

The Bureau of Labor Statistics' Occupational Outlook Handbook, 2010-2011 Edition, which has detailed industry earnings and wages data at the national level, is available at: bls.gov/oco *(15)*.

The County Business Patterns database, which reports industry-level employment and payroll and can be used to estimate earnings, is available at: census.gov/econ/cbp/index.html *(16)*.

Data Sources

U.S. Department of Labor. 2016. Bureau of Labor Statistics, Quarterly Census of Employment and Wages, Washington, D.C.

How does regional mining employment compare to the U.S.?

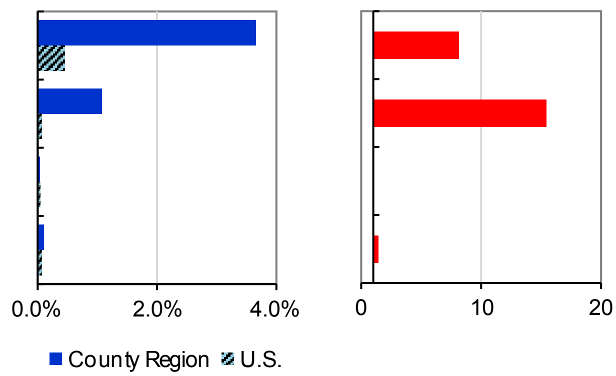
This page describes how the region is specialized (or under-specialized) in mining employment. The figure illustrates the difference between the region and the U.S. by comparing mining jobs as a share of total employment and with location quotients.

Location quotient: A ratio that compares an industry's share of total employment in a region to the national share. More precisely, it is the percent of local employment in a sector divided by the percent employment in the same sector in the U.S. In other words, it is a ratio that measures specialization, using the U.S. as a benchmark. A location quotient of more than 1.0 means the local area is more specialized in that sector relative to the U.S. A location quotient of less than 1.0 means it is less specialized.

Percent of Total Private Employment in Mining Sectors, County Region vs. U.S., 2014

	Employment Share		Location Quotient
Mining Sector	County Region	U.S.	
Oil & Gas Extraction	˜3.7%	0.5%	8.1
Coal Mining	˜1.1%	0.1%	15.4
Metallic Ore Mining	˜0.0%	0.0%	1.0
Nonmetallic Ore Mining	˜0.1%	0.1%	1.4

Employment Share — County Region vs. U.S.; Location Quotient — County Region vs. U.S.



- In 2014, coal mining had the highest location quotient score (15.4), and metallic ore mining had the lowest (1).

Data Sources: U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.

How does regional mining employment compare to the U.S.?

What do we measure on this page?

This page describes how the region is specialized (or under-specialized) in mining employment. The figure illustrates the difference between the region and the U.S. by comparing mining jobs as a share of total employment and with location quotients.

Location quotient: A ratio that compares an industry’s share of total employment in a region to the national share. More precisely, it is the percent of local employment in a sector divided by the percent employment in the same sector in the U.S. In other words, it is a ratio that measures specialization, using the U.S. as a benchmark. A location quotient of more than 1.0 means the local area is more specialized in that sector relative to the U.S. A location quotient of less than 1.0 means it is less specialized.

The term "benchmark" in this report should not be construed as having the same meaning as in the National Forest Management Act (NFMA).

Why is it important?

Geographies with economies that focus narrowly on resource extraction, particularly on fossil fuel development, can be subject to boom-and-bust cycles as well as other economic challenges, such as slower long-term economic growth. These difficulties are sometimes called the "resource curse" in reference to the apparent paradox that areas rich in natural resources often underperform economically.

A useful way to think about location quotients is as a measure of whether a place or geography produces enough goods or services from an industry to satisfy local demand for those goods or services. Results above or below the 1.0 standard indicate the degree to which a place or geography may import or export a good or service. Although there is no precise cutoff, location quotients above 2.0 indicate a strong industry concentration (and that an area is likely exporting goods or services) and those less than .5 indicate a weak industry concentration (and that an area is likely importing goods or services).

A large location quotient for a particular sector does not necessarily mean that sector is a significant contributor to the economy. LQs greater than 1.0 only suggest potential export capacity when compared to the U.S. and do not take into account local demand. Local demand may be greater than a national average, and therefore all goods and services may be consumed locally (i.e., not exported). LQs can change from year to year, and can vary when income or wage data are used rather than employment.

Methods

LQ = (ei/e) divided by (Ei/E)
Where: ei = Local employment in industry i, e = Total local employment, Ei = U.S. employment in industry i, E = Total U.S. employment.
Some data are withheld by the federal government to avoid the disclosure of potentially confidential information. Headwaters Economics uses data from the U.S. Department of Commerce to estimate these data gaps. These values are indicated with tildes (~).

Additional Resources

For a review of literature on economic diversity, see Sterling, Andrew. 1998. “On the Economics and Analysis of Diversity.” Electronic Working Papers Series, University of Sussex, available at: sussex.ac.uk/Units/spru/publications/imprint/sewps/sewp28/sewp28.pdf *(17)*; and Malizia, E. E. and K. Shanzai. 2006. “The Influence of Economic Diversity on Unemployment and Stability.” Journal of Regional Science. 33(2): 221-235.

A useful summary of the "resource curse" can be found in: Humphreys, Macartan, Jeffrey D. Sachs, and Joseph E. Stiglitz, Eds. Escaping the Resource Curse. 2007. New York: Columbia University Press.

A report by Headwaters Economics - Fossil Fuel Extraction as a County Economic Development Strategy: Are Energy Focusing Counties Benefiting? - looks specifically at the economic performance of energy focused economies in the U.S. West. It is available at: headwaterseconomics.org/energy *(8)*.

A succinct definition of a location quotient is offered by Florida State University's Department of Urban and Regional Planning: mailer.fsu.edu/~tchapin/garnet-tchapin/urp5261/topics/econbase/lq.htm *(18)*.

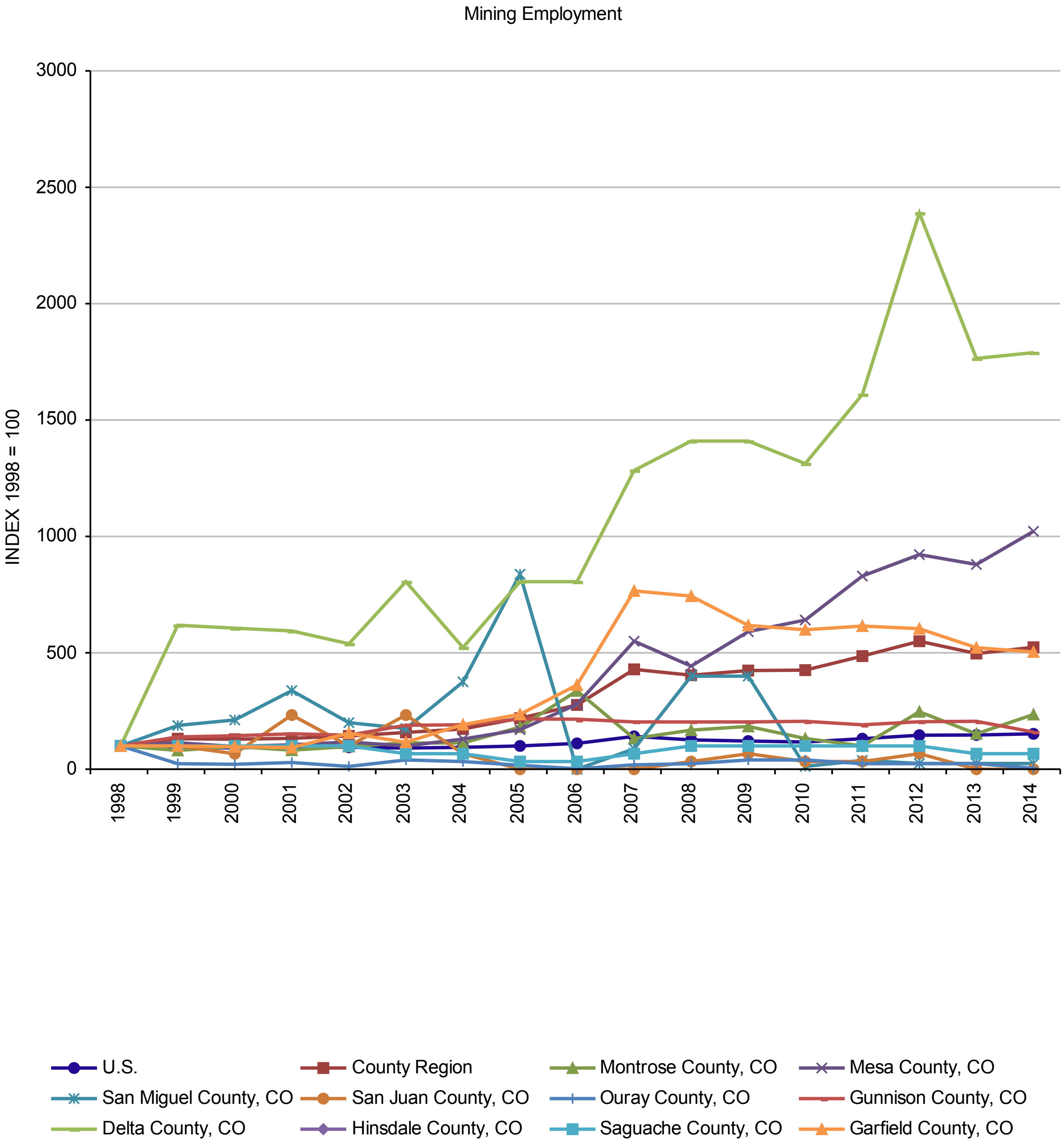
Documentation explaining methods developed by Headwaters Economics for estimating disclosure gaps is available at headwaterseconomics.org/eps *(4)*.

Data Sources

U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.

How does mining employment change compare across geographies?

This page describes the change in mining employment for all selected geographies and the U.S. The information is indexed (1998=100) so that data from geographies with different size economies can be compared and to make it easier to understand the relative rate of growth or decline of mining employment over time.



- From 1998 to 2014, County Region had the fastest rate of change in mining employment, and Montrose County, CO had the slowest.

Data Sources: U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.

How does mining employment change compare across geographies?

What do we measure on this page?

This page describes the change in mining employment for all selected geographies and the U.S. The information is indexed (1998=100) so that data from geographies with different size economies can be compared and to make it easier to understand the relative rate of growth or decline of mining employment over time.

Index: Indexed numbers are compared with a base value. In the line chart, employment in 1998 is the base value, and is set to 100. The employment values for subsequent years are expressed as 100 times the ratio to the base value. The indexing used in the line chart enables easier comparisons between geographies over time.

The term "benchmark" in this report should not be construed as having the meaning as in the National Forest Management Act (NFMA).
Note: If many geographies are selected, it may be difficult to read the figures on this page.

Why is it important?

Not all geographies have attracted or lost mining industries and employment at the same rate. An index makes it clear where the rate of mining growth or decline has been the fastest. Lines above 100 indicate positive absolute growth while those below 100 show absolute decline. The steeper the curve the faster the rate of change.

It may be helpful to look for large year-to-year rises or dips in figure lines to identify rapid employment changes. If the reasons behind these fluctuations are not evident, it may be helpful to talk with regional experts or locals to learn more about what caused abrupt changes.

Geographies with economies that focus narrowly on resource extraction, particularly on fossil fuel development, can be subject to boom-and-bust cycles as well as other economic challenges, such as slower long-term economic growth. These difficulties are sometimes called the "resource curse" in reference to the apparent paradox that areas rich in natural resources often underperform economically.

Methods

The figure begins in 1998 because that is the year the Census Bureau (and County Business Patterns) shifted to using the new North American Industrial Classification System (NAICS).
Some data are withheld by the federal government to avoid the disclosure of potentially confidential information. Headwaters Economics uses data from the U.S. Department of Commerce to estimate these data gaps.

Additional Resources

For detailed information on oil, gas, and coal see the U.S. Energy Information Administration: eia.doe.gov *(5)*.

BP offers a widely-used and comprehensive overview on global trends in energy called the BP Statistical Review of World Energy: bp.com/sectionbodycopy.do?categoryId=7500&contentId=7068481 *(6)*.

The Bureau of Labor Statistics provides an overview and outlook of the mining industry: bls.gov/oco/cg/cgs004.htm *(7)*. This site also contains useful links to organizations such as the American Geological Institute and the National Mining Association.

For a review of literature on economic diversity, see Sterling, Andrew. 1998. “On the Economics and Analysis of Diversity.” Electronic Working Papers Series, University of Sussex, available at: sussex.ac.uk/Units/spru/publications/imprint/sewps/sewp28/sewp28.pdf (17); and Malizia, E. E. and K. Shanzai. 2006. “The Influence of Economic Diversity on Unemployment and Stability.” Journal of Regional Science. 33(2): 221-235.

A useful summary of the "resource curse" can be found in: Humphreys, Macartan, Jeffrey D. Sachs, and Joseph E. Stiglitz, Eds. Escaping the Resource Curse. 2007. New York: Columbia University Press.

Headwaters Economics has completed a number of studies on fossil fuel development and its impact on the West, See: headwaterseconomics.org/energy *(8)*.

Documentation explaining methods developed by Headwaters Economics for estimating disclosure gaps is available at headwaterseconomics.org/eps *(4)*.

Data Sources

U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.

Data Sources

The EPS Services report uses published statistics from government sources that are available to the public and cover the entire country. All data used in EPS can be readily verified by going to the original source. The contact information for databases used in this profile is:

- **County Business Patterns**
  Census Bureau, U.S. Department of Commerce
  http://www.census.gov/epcd/cbp/view/cbpview.html
  Tel. 301-763-2580

- **Nonemployer Statistics**
  Bureau of the Census, U.S. Department of Commerce
  http://www.census.gov/econ/nonemployer/index.html
  Tel. 301-763-2580

- **Quarterly Census of Employment and Wages**
  Bureau of Labor Statistics, U.S. Department of Labor
  http://www.bls.gov/cew
  Tel. 202-691-6567

Methods

EPS core approaches: EPS is designed to focus on long-term trends across a range of important measures. Trend analysis provides a more comprehensive view of changes than spot data for select years. We encourage users to focus on major trends rather than absolute numbers. EPS displays detailed industry-level data to show changes in the composition of the economy over time and the mix of industries at points in time. EPS employs cross-sectional benchmarking, comparing smaller geographies such as counties to larger regions, states, and the nation, to give a sense of relative performance. EPS allows users to aggregate data for multiple geographies, such as multi-county regions, to accommodate a flexible range of user-defined areas of interest and to allow for more sophisticated cross-sectional comparisons.

SIC to NAICS: Starting in the 1930s, the Standard Industrial Classification (SIC) system has served as the structure for the collection, aggregation, presentation, and analysis of the U.S. economy. Under SIC, which employed a four-digit coding structure, an industry consists of a group of establishments primarily engaged in producing or handling the same product or group of products or in rendering the same services. As the U.S. economy shifted from a primary emphasis on manufacturing to a more complex services economy, SIC became less useful as a tool for describing the economy's changing industrial composition.

The North American Industry Classification System (NAICS), developed using a production-oriented conceptual framework, groups establishments into industries based on the activity in which they are primarily engaged. NAICS uses a six-digit hierarchical coding system to classify all economic activity into twenty industry sectors. Five sectors are mainly goods-producing sectors and fifteen are entirely services-producing sectors.

County Business Patterns started organizing their data using NAICS in 1998, Census in 2000, and Bureau of Economic Analysis's Regional Economic Information System in 2001. Because the methods underlying SIC and NAICS are fundamentally different (what was sold vs. how it was produced), NAICS is not backward compatible with SIC. There are a few circumstances where it is acceptable to show uninterrupted trends across the SIC-NAICS discontinuity. Total personal income, total labor income, and non-labor income can all be plotted continuously without a problem. In addition, a few industries can also be plotted without a break, though this is not the case for services.

Adjusting dollar figures for inflation: Because a dollar in the past was worth more than a dollar today, data reported in current dollar terms should be adjusted for inflation. The U.S. Department of Commerce reports personal income figures in terms of current dollars. All income data in EPS-HDT are adjusted to real (or constant) dollars using the Consumer Price Index. Figures are adjusted to the latest date for which the annual Consumer Price Index is available.

Data gaps and estimation: Some data are withheld by the federal government to avoid the disclosure of potentially confidential information. Headwaters Economics uses supplemental data from the U.S. Department of Commerce to estimate these data gaps. These are indicated in italics in tables. Documentation explaining methods developed by Headwaters Economics for estimating disclosure gaps is available at headwaterseconomics.org/eps.

For more information about EPS see:

headwaterseconomics.org/EPS

Web pages listed under Additional Resources include:

Throughout this report, references to on-line resources are indicated with italicized numbers in parentheses. These resources are provided as hyperlinks here.

1 www.naics.com/search.htm
2 www.bls.gov/bls/NAICS.htm
3 www.census.gov/eos/www/naics
4 headwaterseconomics.org/eps
5 www.eia.doe.gov
6 www.bp.com/sectionbodycopy.do?categoryId=7500&contentId=7068481
7 www.bls.gov/oco/cg/cgs004.htm
8 headwaterseconomics.org/energy
9 www.census.gov/econ/nonemployer/index.html
10 www.census.gov/econ/nonemployer/definitions.htm
11 www.bls.gov/bls/employment.htm
12 www.bls.gov/bls/wages.htm
13 www.bls.gov/oes
14 www.bls.gov/cew/
15 www.bls.gov/oco
16 www.census.gov/econ/cbp/index.html
17 www.sussex.ac.uk/Units/spru/publications/imprint/sewps/sewp28/sewp28.pdf
18 www.mailer.fsu.edu/~tchapin/garnet-tchapin/urp5261/topics/econbase/lq.htm

A Profile of Timber and Wood Products

County Region

Selected Geographies:

Montrose County, CO; Mesa County, CO; San Miguel County, CO; San Juan County, CO; Ouray County, CO; Gunnison County, CO; Delta County, CO; Hinsdale County, CO; Saguache County, CO; Garfield County, CO

Benchmark Geographies:

U.S.

Produced by

Economic Profile System

EPS

November 28, 2016

About the Economic Profile System (EPS)

EPS is a free, easy-to-use software application that produces detailed socioeconomic reports of counties, states, and regions, including custom aggregations.

EPS uses published statistics from federal data sources, including Bureau of Economic Analysis and Bureau of the Census, U.S. Department of Commerce; and Bureau of Labor Statistics, U.S. Department of Labor.

The Bureau of Land Management and Forest Service have made significant financial and intellectual contributions to the operation and content of EPS.

See headwaterseconomics.org/EPS for more information about the other tools and capabilities of EPS.

For technical questions, contact Patty Gude at eps@headwaterseconomics.org, or 406-599-7425.

headwaterseconomics.org

Headwaters Economics is an independent, nonprofit research group. Our mission is to improve community development and land management decisions in the West.

www.blm.gov

The Bureau of Land Management, an agency within the U.S. Department of the Interior, administers 249.8 million acres of America's public lands, located primarily in 12 Western States. It is the mission of the Bureau of Land Management to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations.

www.fs.fed.us

The Forest Service, an agency of the U.S. Department of Agriculture, administers national forests and grasslands encompassing 193 million acres. The Forest Service's mission is to achieve quality land management under the "sustainable multiple-use management concept" to meet the diverse needs of people while protecting the resource. Significant intellectual, conceptual, and content contributions were provided by the following individuals: Dr. Pat Reed, Dr. Jessica Montag, Doug Smith, M.S., Fred Clark, M.S., Dr. Susan A. Winter, and Dr. Ashley Goldhor-Wilcock.

Table of Contents

Note to Users:

This is one of fourteen reports that can be created and downloaded from EPS Web. You may want to run another EPS report for either a different geography or topic. Topics include land use, demographics, specific industry sectors, the role of non-labor income, the wildland-urban interface, the role of amenities in economic development, and payments to county governments from federal lands. Throughout the reports, references to online resources are indicated in parentheses. These resources are provided as hyperlinks on each report's final page. The EPS reports are downloadable as Excel, PDF, and Word documents. For further information and to download reports, go to:

headwaterseconomics.org/eps

What industries comprise timber sectors?

This page describes the number of jobs (full and part-time) and the share of total jobs in the timber industry, broken out by three major categories: growing and harvesting, sawmills and paper mills, and wood products manufacturing.

Employment in Timber, 2014

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Total Private Employment	11,560	50,695	4,688	197	1,041	6,171	6,738	139	790	18,937	100,956	121,079,879
Timber	~197	~61	~2	0	0	~4	~51	0	0	~27	~342	796,080
Growing & Harvesting	~19	~1	0	0	0	0	~8	0	0	~3	~31	64,674
Forestry & Logging	~4	0	0	0	0	0	~7	0	0	~2	~13	54,183
Support Activities for Forestry	~15	~1	0	0	0	0	~1	0	0	~1	~18	10,491
Sawmills & Paper Mills	~158	~15	0	0	0	~2	~38	0	0	~15	~228	254,837
Sawmills & Wood Preservation	~143	~15	0	0	0	0	~7	0	0	~7	~172	79,898
Pulp, Paper, & Paperboard Mills	0	0	0	0	0	0	0	0	0	0	0	106,618
Veneer, Plywood, & Engineered Wood	~15	0	0	0	0	~2	~31	0	0	~8	~56	68,321
Wood Products Manufacturing	~20	45	~2	0	0	~2	~5	0	0	~9	~83	476,569
Other Wood Product Mfg.	~20	45	~2	0	0	~2	~3	0	0	~7	~79	217,183
Converted Paper Product Mfg.	0	0	0	0	0	0	~2	0	0	~2	~4	245,358
Non-Timber	~11,363	~50,634	~4,686	0	0	~6,167	~6,687	0	0	~18,910	~98,447	120,283,799

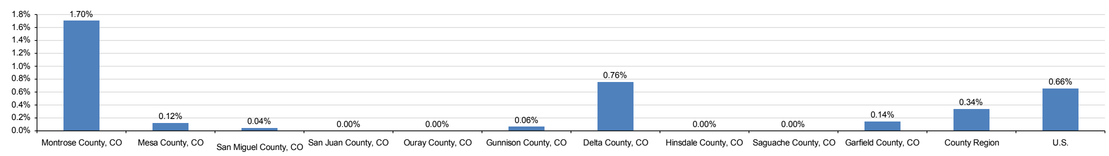
Percent of Total

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Timber	~1.7%	~0.1%	~0.0%	0.0%	0.0%	~0.1%	~0.8%	0.0%	0.0%	~0.1%	~0.3%	0.7%
Growing & Harvesting	~0.2%	~0.0%	0.0%	0.0%	0.0%	0.0%	~0.1%	0.0%	0.0%	~0.0%	~0.0%	0.1%
Forestry & Logging	~0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	~0.1%	0.0%	0.0%	~0.0%	~0.0%	0.0%
Support Activities for Forestry	~0.1%	~0.0%	0.0%	0.0%	0.0%	0.0%	~0.0%	0.0%	0.0%	~0.0%	~0.0%	0.0%
Sawmills & Paper Mills	~1.4%	~0.0%	0.0%	0.0%	0.0%	~0.0%	~0.6%	0.0%	0.0%	~0.1%	~0.2%	0.2%
Sawmills & Wood Preservation	~1.2%	~0.0%	0.0%	0.0%	0.0%	0.0%	~0.1%	0.0%	0.0%	~0.0%	~0.2%	0.1%
Pulp, Paper, & Paperboard Mills	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
Veneer, Plywood, & Engineered Wood	~0.1%	0.0%	0.0%	0.0%	0.0%	~0.0%	~0.5%	0.0%	0.0%	~0.0%	~0.1%	0.1%
Wood Products Manufacturing	~0.2%	0.1%	~0.0%	0.0%	0.0%	~0.0%	~0.1%	0.0%	0.0%	~0.0%	~0.1%	0.4%
Other Wood Product Mfg.	~0.2%	0.1%	~0.0%	0.0%	0.0%	~0.0%	~0.0%	0.0%	0.0%	~0.0%	~0.1%	0.2%
Converted Paper Product Mfg.	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	~0.0%	0.0%	0.0%	~0.0%	~0.0%	0.2%
Non-Timber	~98.3%	~99.9%	~100.0%	0.0%	0.0%	~99.9%	~99.2%	0.0%	0.0%	~99.9%	~97.5%	99.3%

This table does not include employment data for government, agriculture, railroads, or the self-employed because these are not reported by County Business Patterns. Estimates for data that were not disclosed are indicated with tildes (~).

- In 2014, Montrose County, CO had the largest percent of total timber employment (1.7%), and San Juan County, CO had the smallest (0%).

Percent of Total Private Employment in Timber, 2014



Data Sources: U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.

Study Guide and Supplemental Information

What industries comprise timber sectors?

What do we measure on this page?

This page describes the number of jobs (full and part-time) and the share of total jobs in the timber industry, broken out by three major categories: growing and harvesting, sawmills and paper mills, and wood products manufacturing.

Growing and Harvesting: These are jobs associated with growing and harvesting of trees on a long production cycle. It includes people employed in forest nurseries, as well as those involved in the cutting of trees and transportation of timber.

Sawmills and Paper Mills: These are jobs associated with converting logs into lumber, boards, poles, shingles, and similar milled products. It includes those involved in the conversion of logs and chips into pulp and paper as well as the creation of veneer and plywood.

Wood Products Manufacturing: These are jobs associated with manufacturing. It includes the production of corrugated boxes, gum and wood chemical products, cabinets, furniture, and other wood manufactured products.

Why is this Important?

To understand the potential impact of proposed land management practices, it is important to grasp the relative size of the timber industry and its components, how these have changed over time, and how local trends compare to trends in other geographies. Some important issues to consider are whether a proposed management action would stimulate growth or decline in the industry, how proposed actions relate to on-going trends shown in the data, whether some geographies would be affected more than others, and given the relative size of the industry if changes to it will affect the broader economy.

Methods

The terms "growing and harvesting," "sawmills and paper mills," and "woods products manufacturing" are not official North American Classification system (NAICS) terms. They are used in this report to differentiate major components of the timber and wood products industry, and to distinguish between different levels of value-added production. The first level of production is the growing and harvesting of trees. This is followed by milling. In some cases the milling results in a final product (e.g., paper), while in others it is an intermediary product (e.g., pulp). Some milled products go on to further value-added production (e.g., cabinets). This last level includes products that are typically manufactured after leaving a mill.

The three major timber and wood products categories are made up of the following NAICS codes:
Growing and Harvesting: forestry and logging (113), support activities for forestry (1153).
Sawmills and Paper Mills: sawmills and wood preservation (3211), pulp, paper, and paperboard mills (3221), veneer, plywood, and engineered wood product manufacturing (3212).
Wood Products Manufacturing: other wood product manufacturing (3219) and converted paper product manufacturing (3222).

Data on this page were obtained from County Business Patterns. We use this source because, compared to other sources, it has fewer data gaps (instances when the federal government will not release information to protect the confidentiality of individual businesses). It also includes both full and part-time employment. The disadvantage of County Business Patterns data is that they do not include employment in government, agriculture, railroads, or the self-employed and as a result under-count the size of industry sectors. Also, County Business Patterns data are based on mid-March employment and do not take into account seasonal fluctuations. For these reasons, the data are most useful for showing long-term trends, displaying differences between geographies, and showing the relationship between sectors over time.

Some data are withheld by the federal government to avoid the disclosure of potentially confidential information. Headwaters Economics uses data from the U.S. Department of Commerce to estimate these data gaps. These values are indicated with tildes (~).

Additional Resources

For an online listing of all NAICS codes, see: naics.com/search.htm *(1)*.

For additional online manuals and definitions of industry codes, see: bls.gov/bls/NAICS.htm *(2)* and census.gov/eos/www/naics *(3)*.

Documentation explaining methods developed by Headwaters Economics for estimating disclosure gaps is available at headwaterseconomics.org/eps *(4)*.

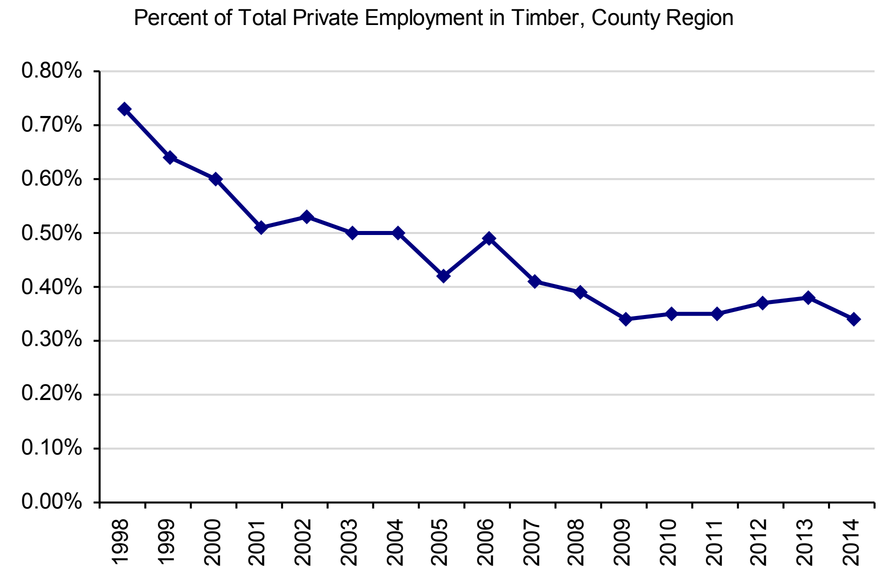
Data Sources

U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.

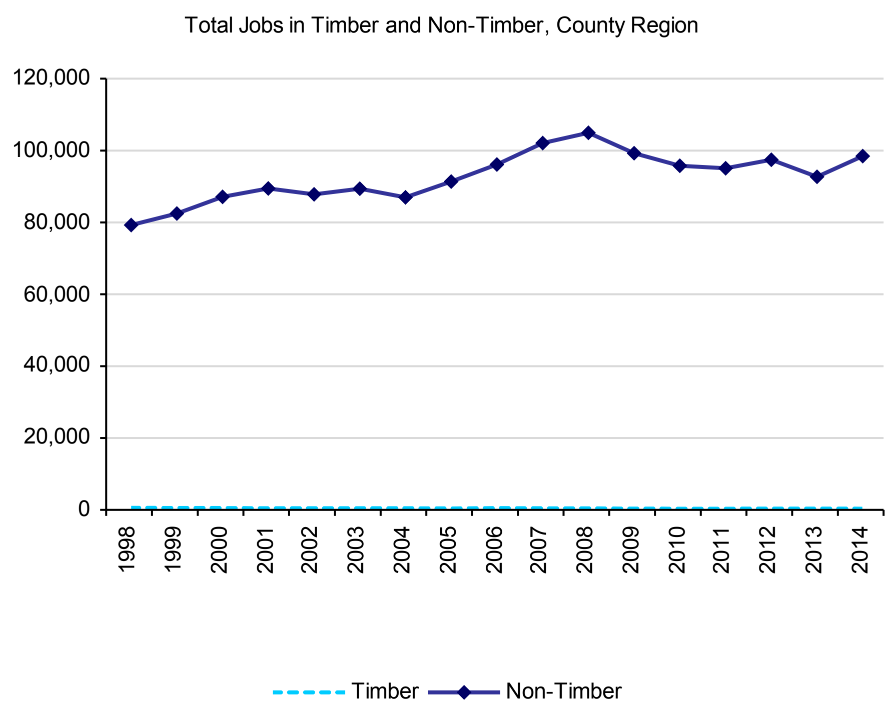
How has timber changed over time?

This page describes long-term trends in timber employment as a percent of all jobs and compares timber to non-timber employment over time.

- In 1998, timber represented 0.73 percent of total employment. By 2014, timber represented 0.34 percent of total employment.



- From 1998 to 2014, timber employment shrank from 582 to 342 jobs, a 41.2 percent decrease.
- From 1998 to 2014, non-timber employment grew from 79,265 to 98,447 jobs, a 24.2 percent increase.



Data Sources: U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.

How has timber changed over time?

What do we measure on this page?

This page describes long-term trends in timber employment as a percent of all jobs and compares timber to non-timber employment over time.

Why is it important?

In some geographies the timber industry can be a significant driver in the economy. If it is, other sectors of the economy, as well as total employment and total personal income, will likely follow trends in the timber industry. It is important to know whether this is the case because if employment in other sectors fluctuate with the timber industry, then management actions on public lands may affect more than the timber industry itself. If, on the other hand, jobs in the rest of the economy are growing independent of trends in the timber industry, then management actions that potentially affect the timber industry may have impacts that are limited to that industry.

Methods

The figures on this page starts in 1998 because that is the year the Census Bureau (and County Business Patterns) shifted to using the new North American Industrial Classification System (NAICS).

Data on this page were obtained from County Business Patterns. We use this source because, compared to other sources, it has fewer data gaps (instances when the federal government will not release information to protect the confidentiality of individual businesses). It also includes both full and part-time employment. The disadvantage of County Business Patterns data is that they do not include employment in government, agriculture, railroads, or the self-employed and as a result under-count the size of industry sectors. Also, County Business Patterns data are based on mid-March employment and do not take into account seasonal fluctuations. For these reasons, the data are most useful for showing long-term trends, displaying differences between geographies, and showing the relationship between sectors over time.

Some data are withheld by the federal government to avoid the disclosure of potentially confidential information. Headwaters Economics uses data from the U.S. Department of Commerce to estimate these data gaps.

Additional Resources

The Forest Service produced a number of publications that offer an overview of the timber industry, including how it has changed over time, as part of the Interim Update of the 2000 Renewable Resource Planning Act Assessment. See: fs.fed.us/research/rpa/pubs-supporting-interim-update-of-2000-rpa-assessment.shtml *(5)*.

Documentation explaining methods developed by Headwaters Economics for estimating disclosure gaps is available at headwaterseconomics.org/eps *(4)*.

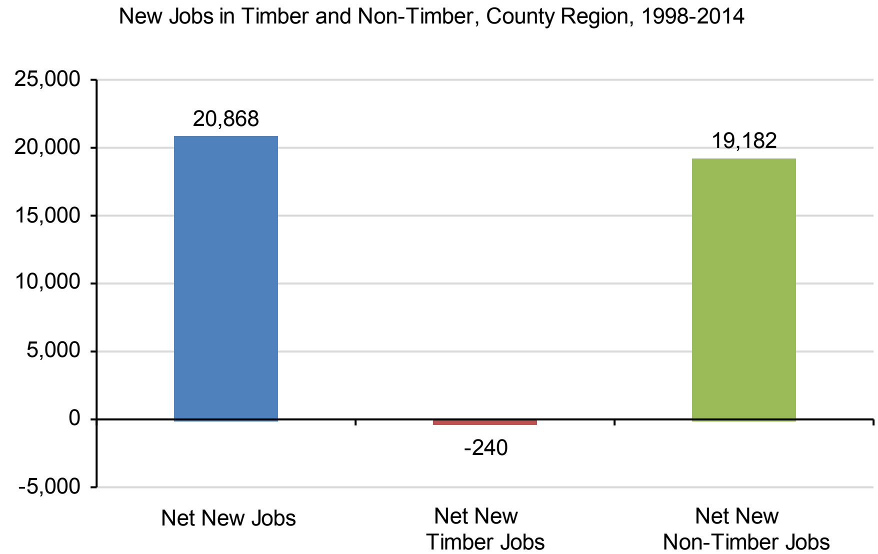
Data Sources

U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.

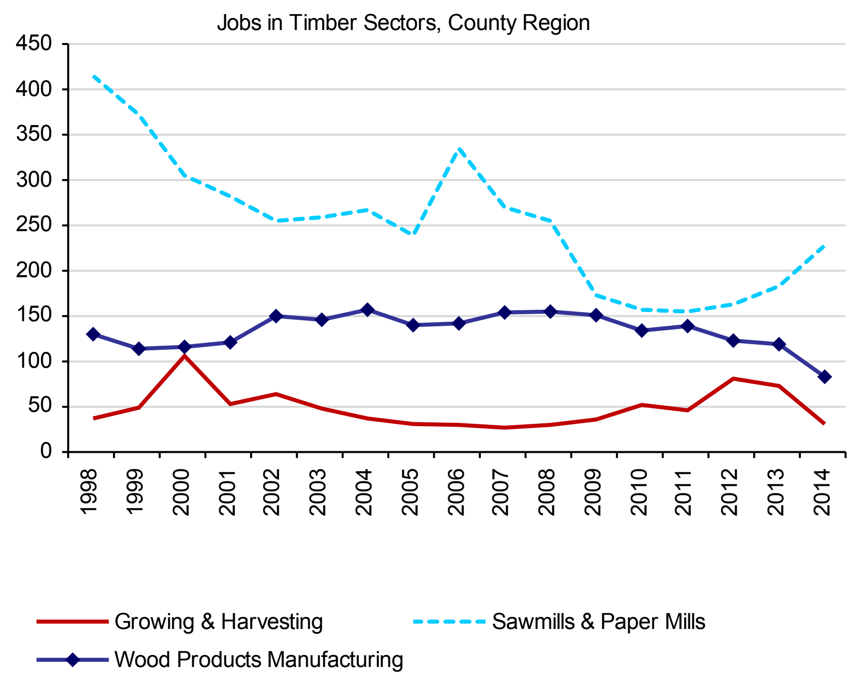
Which timber sectors are changing the fastest?

This page describes the change in timber jobs compared to the change in non-timber jobs and compares how employment in various timber sectors has changed over time.

- From 1998 to 2014, timber employment shrank by 240 jobs.
- From 1998 to 2014, non-timber employment grew by 19,182 jobs.



- From 1998 to 2014, Harvest shrank from 37 to 31 jobs, a 16.2% decrease.
- From 1998 to 2014, Mills shrank from 415 to 228 jobs, a 45.1% decrease.
- From 1998 to 2014, Mfg shrank from 130 to 83 jobs, a 36.2% decrease.



Data Sources: U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.

Study Guide and Supplemental Information

Which timber sectors are changing the fastest?

What do we measure on this page?

This page describes the change in timber jobs compared to the change in non-timber jobs and compares how employment in various timber sectors has changed over time.

Why is it important?

To understand the importance of timber and wood products in the local economy it is useful to grasp the source of new jobs and the relative contribution of the timber industry to net new jobs.

Components of the timber industry may create or lose jobs at different rates. A growth in wood products manufacturing employment, for example, can indicate increased value-added activity. Alternatively, a loss of sawmills and paper mills employment can indicate the closure of a mill with important impacts on the community where the mill was located.

Some geographies are more dependent on timber-related employment than others. This is important to understand because activities on public lands that impact the timber industry may affect other sectors of the economy.

Geographies with economies that focus on resource extraction and commodity production can be subject to boom-and-bust cycles as well as other economic challenges, such as slower long-term economic growth.

In the case of timber and wood products, mechanization, rising transportation costs, volatile prices, competition from abroad, shifting public values related to the management of public lands, the restructuring of timber companies as Real Estate Investment Trusts, and other factors have led to business and employment declines in many communities.

Methods

The bottom figure on this page starts in 1998 because that is the year the Census Bureau (and County Business Patterns) shifted to using the new North American Industrial Classification System (NAICS).

Data on this page were obtained from County Business Patterns. We use this source because, compared to other sources, it has fewer data gaps (instances when the federal government will not release information to protect confidentiality of individual businesses). It also includes both full and part-time employment.

The disadvantage of County Business Patterns data is that they do not include employment in government, agriculture, railroads, or the self-employed and as a result under-count the size of industry sectors. Also, County Business Patterns data are based on mid-March employment and do not take into account seasonal fluctuations. For these reasons, the data are most useful for showing long-term trends, displaying differences between geographies, and showing the relationship between sectors over time.

Some data are withheld by the federal government to avoid the disclosure of potentially confidential information. Headwaters Economics uses data from the U.S. Department of Commerce to estimate these data gaps.

Additional Resources

The Bureau of Labor Statistics provides an overview and outlook of the timber industry (as part of agriculture, forestry, and fishing). See: bls.gov/oco/cg/cgs001.htm *(6)*.

A useful book on the evolving competitive environment for commodity industries in rural areas is: Gaston, William A., and Karen J. Baehler. 1995. Rural Development in the United States: Connecting Theory, Practice, and Possibilities. Washington: Island Press.

Documentation explaining methods developed by Headwaters Economics for estimating disclosure gaps is available at headwaterseconomics.org/eps *(4)*.

Data Sources

U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.

What role do the self-employed play in the timber industry?

This page describes the number of nonemployer businesses (in most cases self-employed individuals) in timber by sector and geography. It offers an additional source to supplement data used in previous pages of this report that do not include the self-employed.

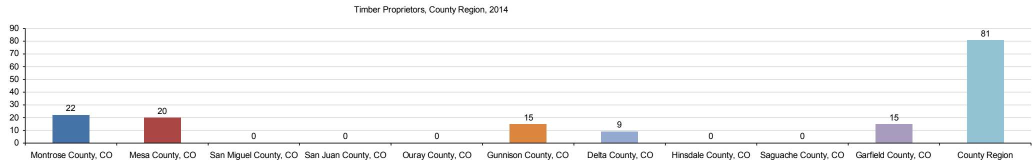
Proprietors in Timber, 2014

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Total Proprietors	3,652	11,180	1,718	111	907	2,291	2,727	142	589	6,097	29,414	23,836,937
Timber	22	20	na	0	na	15	9	na	na	15	81	72,196
Forestry & Logging	14	9	na	0	na	5	9	na	na	6	43	45,510
Wood Products Manufacturing	8	11	na	0	na	10	na	na	na	9	38	25,225
Paper Manufacturing	0	na	0	0	0	0	0	0	0	0	0	1,461
Non-Timber	3,630	11,160	na	0	na	2,276	2,718	na	na	6,082	25,866	23,764,741

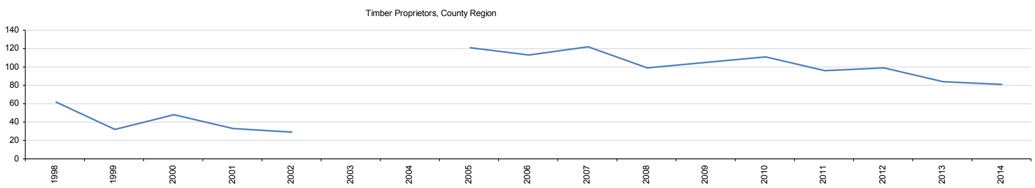
Percent of Total

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Timber	0.6%	0.2%	na	0.0%	na	0.7%	0.3%	na	na	0.2%	0.3%	0.3%
Forestry & Logging	0.4%	0.1%	na	0.0%	na	0.2%	0.3%	na	na	0.1%	0.1%	0.2%
Wood Products Manufacturing	0.2%	0.1%	na	0.0%	na	0.4%	na	na	na	0.1%	0.1%	0.1%
Paper Manufacturing	0.0%	na	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Non-Timber	99.4%	99.8%	na	0.0%	na	99.3%	99.7%	na	na	99.8%	87.9%	99.7%

- In 2014, County Region had the largest number of timber proprietors (81), and San Juan County, CO had the smallest (0).



- From 1998 to 2014, timber proprietors in the County Region grew from 62 to 81, a 30.6% increase.



Data Sources: U.S. Department of Commerce. 2016. Census Bureau, Nonemployer Statistics, Washington, D.C.

What role do the self-employed play in the timber industry?

What do we measure on this page?

This page describes the number of nonemployer businesses (in most cases self-employed individuals) in timber by sector and geography. It offers an additional source to supplement data used in previous pages of this report that do not include the self-employed.

Nonemployer Business: A business with no paid employees, with annual business receipts of $1,000 or more, and subject to federal income taxes. Nonemployer businesses can be individual proprietorships, partnerships, or corporations. Most nonemployers are self-employed individuals operating very small unincorporated businesses, which may or may not be the owner's principal source of income.

Why is it important?

Significant portions of the timber industry, especially related to forestry and logging activities that include things such as cutting, harvesting, and transporting timber, may be conducted by nonemployer businesses. These nonemployer businesses are not reported by County Business Patterns but are reported by Nonemployer Statistics. It is important to use these two data sources in tandem when evaluating the size and trends in timber employment.

Methods

Nonemployer Statistics provides the only source of detailed and comprehensive data on the scope, nature, and activities of U.S. businesses with no paid employment and payroll.

According to the Census Bureau, "Most nonemployers are self-employed individuals operating very small unincorporated businesses, which may or may not be the owner's principal source of income. These firms are excluded from most other business statistics."

The three timber sub-categories in the table Proprietors in Timber are 3-digit NAICS categories (from Nonemployer Statistics). They are different than the three summary categories (from County Business Patterns) shown on previous pages.

What we show as Timber in the table and figures on this page is the sum of the following NAICS codes: Forestry and Logging (113), Wood Products Manufacturing (321), and Paper Manufacturing (322).

Depending on the geographies selected, some data may not be available due to disclosure restrictions.

Additional Resources

Nonemployer Statistics data can be found at: census.gov/econ/nonemployer/index.html *(7)*.

Nonemployer business definitions can be found at: census.gov/econ/nonemployer/definitions.htm *(8)*.

Data Sources

U.S. Department of Commerce. 2016. Census Bureau, Nonemployer Statistics, Washington, D.C.

How do timber industry wages compare to wages in other sectors?

This page describes wages (in real terms) from employment in the timber industry, including sub-sectors, compared to wages from employment in all non-timber sectors combined. It also describes the percent of jobs in each category. These are shown together to illustrate the relative wage levels in timber, including sub-sectors, and how many people are employed in each sub-sector.

Average Annual Wages, 2015 (2015 $s)

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
All Sectors	$36,713	$41,353	$40,554	$24,200	$35,618	$35,031	$33,178	$28,135	$29,790	$46,534	$40,618	$52,937
Private	$34,472	$40,287	$39,884	$20,639	$35,467	$33,014	$31,114	$26,804	$29,734	$46,997	$39,787	$52,874
Timber	˜$47,461	$33,587	$0	$0	$0	˜$0	˜$37,532	$0	˜$0	˜$38,302	$40,561	$52,747
Forestry & Logging	na	$0	$0	$0	$0	na	na	$0	$0	na	$0	$43,603
Wood Products Manufacturing	$47,461	$33,587	$0	$0	$0	na	$37,532	$0	na	$38,302	$40,561	$41,485
Paper Manufacturing	na	$0	$0	$0	$0	$0	na	$0	$0	$0	$0	$65,715
Non-Timber	$34,247	$40,299	˜$37,954	˜$18,014	˜$28,503	$29,205	$28,065	˜$31,298	$28,713	$45,819	$39,151	$52,875
Government	$44,844	$47,189	$44,317	$55,114	$36,048	$41,777	$38,384	$30,948	$55,675	$44,620	$44,639	$53,289

This table shows wage data from the Bureau of Labor Statistics, which does not report data for proprietors or the value of benefits and uses slightly different industry categories than those shown on previous pages of this report.

Percent of Total Employment, 2015

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Private	78.4%	84.5%	84.9%	74.6%	77.7%	77.0%	71.5%	67.9%	67.4%	80.6%	81.3%	84.8%
Timber	˜0.8%	0.1%	0.0%	0.0%	0.0%	˜0.0%	˜0.6%	0.0%	˜0.0%	˜0.2%	0.2%	0.6%
Forestry & Logging	na	0.0%	0.0%	0.0%	0.0%	na	na	0.0%	0.0%	na	0.0%	0.0%
Wood Products Manufacturing	0.8%	0.1%	0.0%	0.0%	0.0%	na	0.6%	0.0%	na	0.2%	0.2%	0.3%
Paper Manufacturing	na	0.0%	0.0%	0.0%	0.0%	0.0%	na	0.0%	0.0%	0.0%	0.0%	0.3%
Non-Timber	70.9%	84.1%	˜74.7%	˜43.0%	˜48.7%	65.8%	64.6%	˜20.4%	46.7%	74.3%	76.5%	84.2%
Government	21.6%	15.5%	15.1%	1.0%	22.4%	23.0%	28.4%	32.1%	2.8%	19.4%	18.2%	15.2%

This table uses employment data from the Bureau of Labor Statistics, which does not report data for proprietors or the value of benefits and uses slightly different industry categories than those shown on previous pages of this report.

Data Sources: U.S. Department of Labor. 2016. Bureau of Labor Statistics, Quarterly Census of Employment and Wages, Washington, D.C.

How do timber industry wages compare to wages in other sectors?

What do we measure on this page?

This page describes wages (in real terms) from employment in the timber industry, including sub-sectors, compared to wages from employment in all non-timber sectors combined. It also describes the percent of jobs in each category. These are shown together to illustrate the relative wage levels in timber, including sub-sectors, and how many people are employed in each sub-sector.

The primary purpose of this page is to compare the average annual wages between sectors, and to investigate the relative number of people employed in high and low-wage sectors.

Why is it important?

The timber industry has the potential to provide high-wage jobs, but this may differ by timber sub-sector and by geography. Some important issues to consider are how timber industry wages compare to wages in other sectors, whether some components of the timber industry pay higher wages than others, and if there are significant wage differences between geographies.

Methods

The wage and employment data on this page are from the Bureau of Labor Statistics, which does not report data for proprietors or the value of benefits and uses slightly different industry categories than those shown on the initial pages of this report.

The three timber sub-sectors in the tables are 3-digit NAICS categories (from Quarterly Census of Employment and Wages) and are different than the three summary categories (from County Business Patterns) shown on the initial pages of this report.

What we show as Timber in the tables on this page is the sum of the following NAICS codes: Forestry and Logging (113), Woods Product Manufacturing (321), and Paper Manufacturing (322).

Depending on the geographies selected, some data may not be available due to disclosure restrictions.

Some data are withheld by the federal government to avoid the disclosure of potentially confidential information. Headwaters Economics uses custom data aggregations calculated from various NAICS codes. Occasionally, one or more data values underlying these aggregations are non-disclosed. These values are indicated with tildes (~).

Additional Resources

For an overview of how the Bureau of Labor Statistics treats employment, see: bls.gov/bls/employment.htm *(9)*.

For an overview of how the Bureau of Labor Statistics treats pay and benefits, see: bls.gov/bls/wages.htm *(10)*.

Employment and wage estimates are also available from the Bureau of Labor Statistics for over 800 occupations. Looking at timber by occupation, rather than by sector or industry, is helpful since wages can vary dramatically across occupations. For more information, see: bls.gov/oes *(11)*.

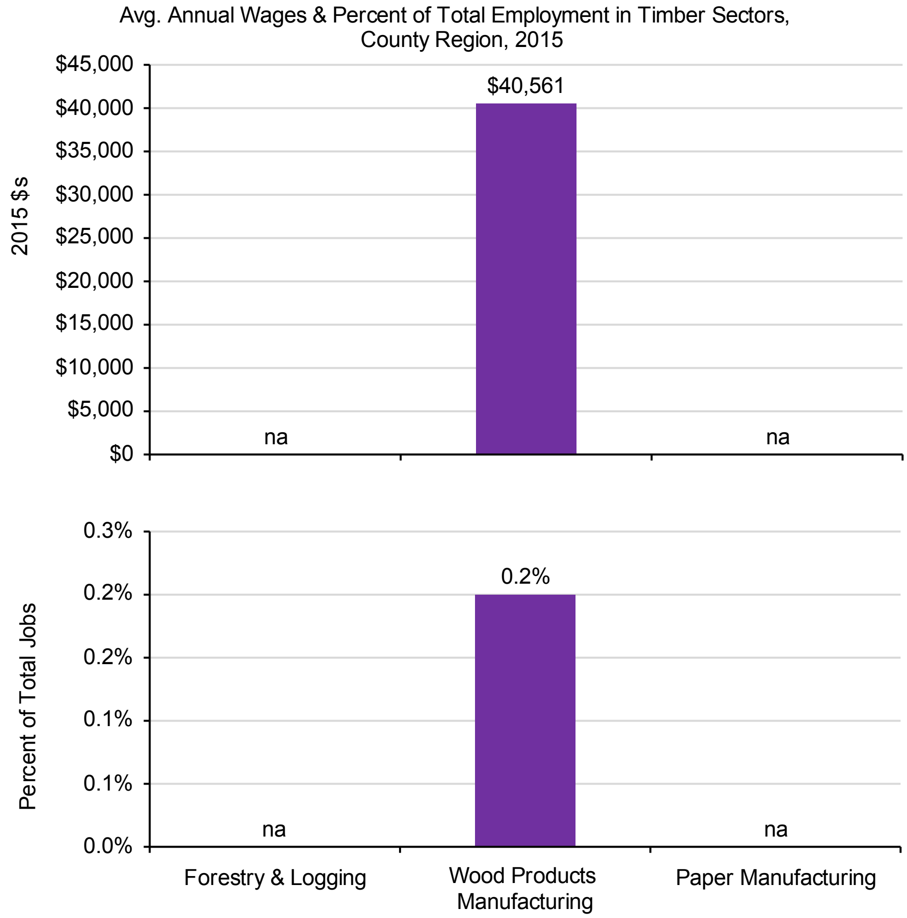
For more information on wages in non-timber industries run the EPS Socioeconomic Measures report.

Data Sources

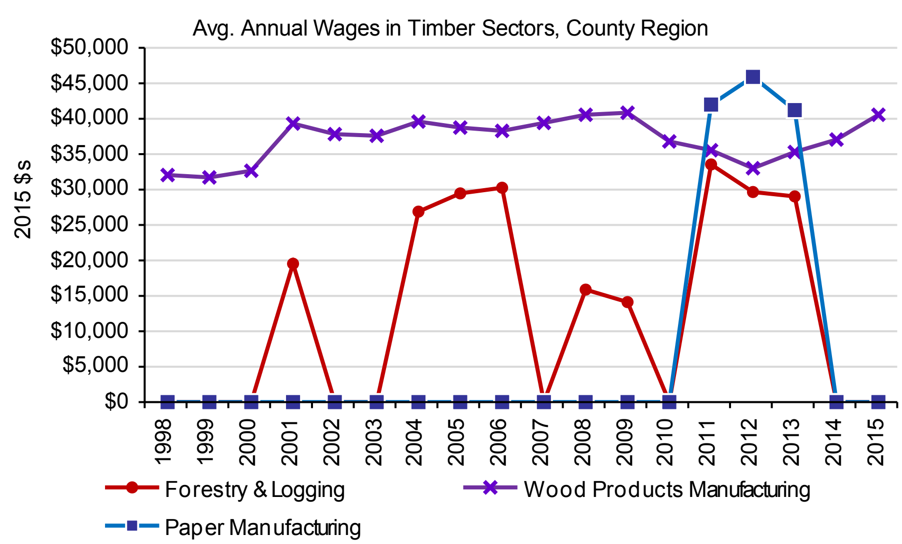
U.S. Department of Labor. 2016. Bureau of Labor Statistics, Quarterly Census of Employment and Wages, Washington, D.C.

How do timber jobs and wages compare?

This page describes wages (in real terms) and employment levels in different timber sectors. It also shows average wage trends (in real terms) for timber sectors.



- From 1998 to 2015, average wages in wood products manufacturing grew (in real terms) from $32,064 to $40,561, a 27% increase.



Data Sources: U.S. Department of Labor. 2016. Bureau of Labor Statistics, Quarterly Census of Employment and Wages, Washington, D.C.

How do timber jobs and wages compare?

What do we measure on this page?

This page describes wages (in real terms) and employment levels in different timber sectors. It also shows average wage trends (in real terms) for timber sectors.

Why is it important?

While the timber industry has the potential to offer high wages, not all components of the timber industry pay the same wages or employ the same number of people. A significant increase in timber jobs that pay above the average for all industries will increase overall average earnings per job. On the other hand, a significant increase in timber jobs that pay below the average for all industries will decrease overall average earnings per job. A modest change in timber employment, especially when this industry is a small share of total employment, will not likely affect average earnings in a local area.

Methods

The wage and employment data on this page are from the Bureau of Labor Statistics, which does not report data for proprietors or the value of benefits and uses slightly different industry categories than those shown on the initial pages of this report.

The three timber sub-sectors in the figures are 3-digit NAICS categories (from Quarterly Census of Employment and Wages) and are different than the three summary categories (from County Business Patterns) shown on the initial pages of this report.

What we show as Timber in the figures on this page is the sum of the following NAICS codes: Forestry and Logging (113), Wood Products Manufacturing (321), and Paper Manufacturing (322).

The figure *Avg. Annual Wages in Timber Sectors* starts in 1998 to be consistent with the start date of figures on earlier pages of this report.

Depending on the geographies selected, some data may not be available due to disclosure restrictions.

Additional Resources

For an overview of how the Bureau of Labor Statistics treats employment, see: bls.gov/bls/employment.htm *(9)*.

For an overview of how the Bureau of Labor Statistics treats pay and benefits, see: bls.gov/bls/wages.htm *(10)*.

If there are significant undisclosed data on this page, other sources for timber wage data include:

The Bureau of Labor Statistics' Quarterly Census of Employment and Wages, which has data for industries at the state level, is available at: data.bls.gov:8080/PDQ/outside.jsp?survey=en *(12)*.

The Bureau of Labor Statistics' Occupational Outlook Handbook, 2010-2011 Edition, which has detailed industry earnings and wages data at the national level, is available at: bls.gov/oco *(13)*.

The County Business Patterns database, which reports industry-level employment and payroll and can be used to estimate earnings, is available at: census.gov/econ/cbp/index.html *(14)*.

Data Sources

U.S. Department of Labor. 2016. Bureau of Labor Statistics, Quarterly Census of Employment and Wages, Washington, D.C.

How does regional timber employment compare to the U.S.?

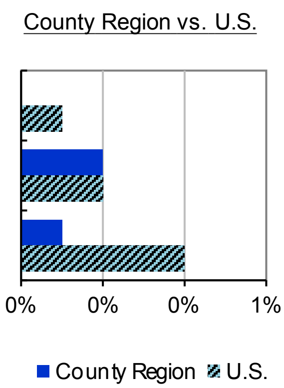
This page describes how the region is specialized (or under-specialized) in timber employment. The figure illustrates the difference between the region and the U.S. by comparing timber jobs as a share of total employment and with location quotients.

Location quotient: A ratio that compares an industry's share of total employment in a region to the national share. More precisely, it is the percent of local employment in a sector divided by the percent employment in the same sector in the U.S. In other words, it is a ratio that measures specialization, using the U.S. as a benchmark. A location quotient of more than 1.0 means the local area is more specialized in that sector relative to the U.S. A location quotient of less than 1.0 means it is less specialized.

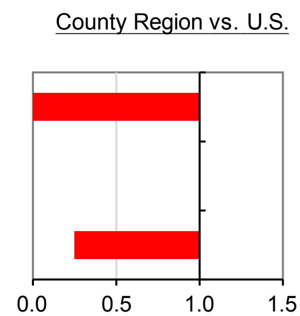
Percent of Total Private Employment in Timber Sectors, County Region vs. U.S., 2014

	Employment Share		Location Quotient
Timber Sector	County Region	U.S.	
Growing & Harvesting	˜0.0%	0.1%	0.0
Sawmills & Paper Mills	˜0.2%	0.2%	1.0
Wood Products Mfg.	˜0.1%	0.4%	0.3

Employment Share



Location Quotient



- In 2014, sawmills & paper mills had the highest location quotient score (1), and growing & harvesting had the lowest (0).

Data Sources: U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.

How does regional timber employment compare to the U.S.?

What do we measure on this page?

This page describes how the region is specialized (or under-specialized) in timber employment. The figure illustrates the difference between the region and the U.S. by comparing timber jobs as a share of total employment and with location quotients.

Location quotient: A ratio that compares an industry's share of total employment in a region to the national share. More precisely, it is the percent of local employment in a sector divided by the percent employment in the same sector in the U.S. In other words, it is a ratio that measures specialization, using the U.S. as a benchmark. A location quotient of more than 1.0 means the local area is more specialized in that sector relative to the U.S. A location quotient of less than 1.0 means it is less specialized.

The term "benchmark" in this report should not be construed as having the same meaning as in the National Forest Management Act (NFMA).

Why is it important?

Geographies with economies that focus on resource extraction and commodity production can be subject to boom-and-bust cycles as well as other economic challenges, such as slower long-term economic growth.

In the case of timber and wood products, mechanization, rising transportation costs, volatile prices, competition from abroad, shifting public values related to the management of public lands, the restructuring of timber companies as Real Estate Investment Trusts, and other factors have led to business and employment declines in many communities.

A useful way to think about location quotients is as a measure of whether a place or geography produces enough goods or services from an industry to satisfy local demand for those goods or services. Results above or below the 1.0 standard indicate the degree to which a place or geography may import or export a good or service. Although there is no precise cutoff, location quotients above 2.0 indicate a strong industry concentration (and that an area is likely exporting goods or services) and those less than .5 indicate a weak industry concentration (and that an area is likely importing goods or services).

A few caveats: (1) A large location quotient for a particular sector does not necessarily mean that sector is a significant contributor to the economy. (2) LQs greater than 1.0 only suggest potential export capacity when compared to the U.S. and do not take into account local demand. Local demand may be greater than a national average, and therefore all goods and services may be consumed locally (i.e., not exported). (3) LQs change from year to year. (4) LQs can vary when income or wage data are used rather than employment.

Methods

LQ = (ei/e) divided by (Ei/E)
Where: ei = Local employment in industry i, e = Total local employment, Ei = U.S. employment in industry i, E = Total U.S. employment.

Some data are withheld by the federal government to avoid the disclosure of potentially confidential information. Headwaters Economics uses data from the U.S. Department of Commerce to estimate these data gaps. These values are indicated with tildes (~).

Additional Resources

For a review of literature on economic diversity, see Sterling, Andrew. 1998. "On the Economics and Analysis of Diversity." Electronic Working Papers Series, University of Sussex, available at: sussex.ac.uk/Units/spru/publications/imprint/sewps/sewp28/sewp28.pdf (15); and Malizia, E. E. and K. Shanzai. 2006. "The Influence of Economic Diversity on Unemployment and Stability." Journal of Regional Science. 33(2): 221-235.

A useful book on the evolving competitive environment for commodity industries in rural areas is: Gaston, William A., and Karen J. Baehler. 1995. Rural Development in the United States: Connecting Theory, Practice, and Possibilities. Washington: Island Press.

A succinct definition of a location quotient is offered by Florida State University's Department of Urban and Regional Planning: mailer.fsu.edu/~tchapin/garnet-tchapin/urp5261/topics/econbase/lq.htm *(16)*.

For an example of location quotients used in a regional economic study, see: wwjobcenter.org/2009%20SOW%20Report(FINAL).pdf *(17)*.

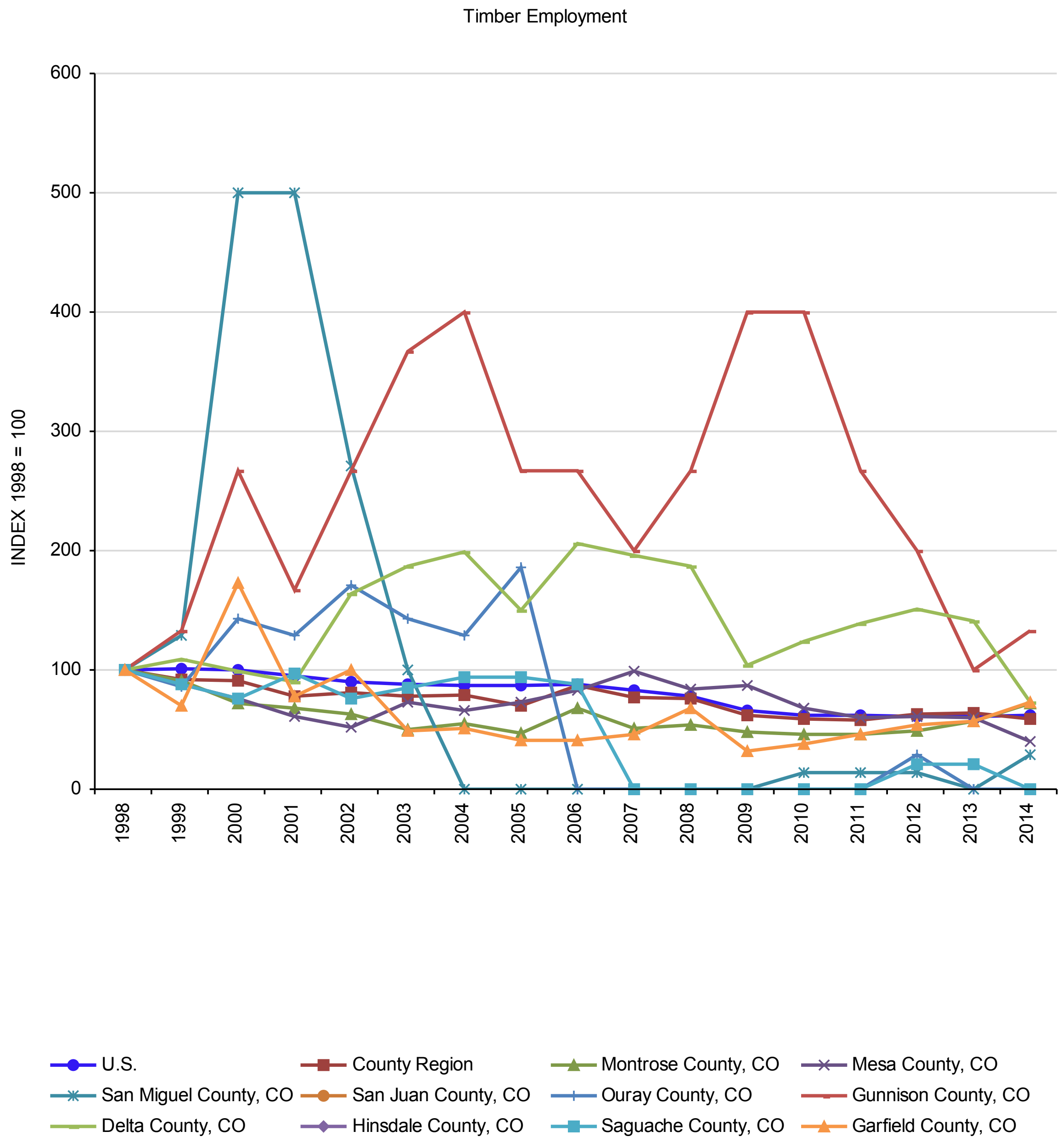
Documentation explaining methods developed by Headwaters Economics for estimating disclosure gaps is available at headwaterseconomics.org/eps *(4)*.

Data Sources

U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.

How does timber employment change compare across geographies?

This page describes the change in timber employment for all selected geographies and the U.S. The information is indexed (1998=100) so that data from geographies with different size economies can be compared and to make it easier to understand the relative rate of growth or decline of timber employment over time.



- From 1998 to 2014, County Region had the fastest rate of change in timber employment, and Montrose County, CO had the slowest.

Data Sources: U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.

How does timber employment change compare across geographies?

What do we measure on this page?

This page describes the change in timber employment for all selected geographies and the U.S. The information is indexed (1998=100) so that data from counties with different size economies can be compared to each other, and to larger geographies. Indexing makes it easier to understand the relative rate of change in timber employment over time.

Index: Indexed numbers are compared with a base value. In the line chart, employment in 1998 is the base value, and is set to 100. The employment values for subsequent years are expressed as 100 times the ratio to the base value. The indexing used in the line chart enables easier comparisons between geographies over time.

The term "benchmark" in this report should not be construed as having the meaning as in the National Forest Management Act (NFMA).

Note: If many geographies are selected, it may be difficult to read the figure on this page.

Why is it important?

Not all geographies have attracted or lost timber industries and employment at the same rate. An index makes it clear where the rate of timber growth or decline has been the fastest. Lines above 100 indicate positive absolute growth while those below 100 show absolute decline. The steeper the curve the faster the rate of change.

It may be helpful to look for large year-to-year rises or dips in figure lines to identify rapid employment changes. If the reasons behind these fluctuations are not evident, it may be helpful to talk with regional experts or locals to learn more about what caused abrupt changes.

Geographies with economies that focus on resource extraction and commodity production can be subject to boom-and-bust cycles as well as other economic challenges, such as slower long-term economic growth.

In the case of timber and wood products, mechanization, rising transportation costs, volatile prices, competition from abroad, shifting public values related to the management of public lands, the restructuring of timber companies as Real Estate Investment Trusts, and other factors have led to business and employment declines in many communities.

Methods

The figure begins in 1998 because that is the year the Census Bureau (and County Business Patterns) shifted to using the new North American Industrial Classification System (NAICS).

Some data are withheld by the federal government to avoid the disclosure of potentially confidential information. Headwaters Economics uses data from the U.S. Department of Commerce to estimate these data gaps.

Additional Resources

The Forest Service provides a number of publications that offer an overview of the timber industry, as part of the Interim Update of the 2000 Renewable Resource Planning Act Assessment. See: fs.fed.us/research/rpa/pubs-supporting-interim-update-of-2000-rpa-assessment.shtml *(5)*.

The Bureau of Labor Statistics provides an overview and outlook of the timber industry (as part of agriculture, forestry, and fishing). See: bls.gov/oco/cg/cgs001.htm *(6)*.

A useful book on the evolving competitive environment for commodity industries in rural areas is: Gaston, William A., and Karen J. Baehler. 1995. Rural Development in the United States: Connecting Theory, Practice, and Possibilities. Washington: Island Press.

Documentation explaining methods developed by Headwaters Economics for estimating disclosure gaps is available at headwaterseconomics.org/eps *(4)*.

Data Sources

U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.

Data Sources

The EPS Services report uses published statistics from government sources that are available to the public and cover the entire country. All data used in EPS can be readily verified by going to the original source. The contact information for databases used in this profile is:

- **County Business Patterns**
  Census Bureau, U.S. Department of Commerce
  http://www.census.gov/epcd/cbp/view/cbpview.html
  Tel. 301-763-2580

- **Nonemployer Statistics**
  Bureau of the Census, U.S. Department of Commerce
  http://www.census.gov/econ/nonemployer/index.html
  Tel. 301-763-2580

- **Quarterly Census of Employment and Wages**
  Bureau of Labor Statistics, U.S. Department of Labor
  http://www.bls.gov/cew
  Tel. 202-691-6567

Methods

EPS core approaches: EPS is designed to focus on long-term trends across a range of important measures. Trend analysis provides a more comprehensive view of changes than spot data for select years. We encourage users to focus on major trends rather than absolute numbers. EPS displays detailed industry-level data to show changes in the composition of the economy over time and the mix of industries at points in time. EPS employs cross-sectional benchmarking, comparing smaller geographies such as counties to larger regions, states, and the nation, to give a sense of relative performance. EPS allows users to aggregate data for multiple geographies, such as multi-county regions, to accommodate a flexible range of user-defined areas of interest and to allow for more sophisticated cross-sectional comparisons.

SIC to NAICS: Starting in the 1930s, the Standard Industrial Classification (SIC) system has served as the structure for the collection, aggregation, presentation, and analysis of the U.S. economy. Under SIC, which employed a four-digit coding structure, an industry consists of a group of establishments primarily engaged in producing or handling the same product or group of products or in rendering the same services. As the U.S. economy shifted from a primary emphasis on manufacturing to a more complex services economy, SIC became less useful as a tool for describing the economy's changing industrial composition.

The North American Industry Classification System (NAICS), developed using a production-oriented conceptual framework, groups establishments into industries based on the activity in which they are primarily engaged. NAICS uses a six-digit hierarchical coding system to classify all economic activity into twenty industry sectors. Five sectors are mainly goods-producing sectors and fifteen are entirely services-producing sectors.

County Business Patterns started organizing their data using NAICS in 1998, Census in 2000, and Bureau of Economic Analysis's Regional Economic Information System in 2001. Because the methods underlying SIC and NAICS are fundamentally different (what was sold vs. how it was produced), NAICS is not backward compatible with SIC. There are a few circumstances where it is acceptable to show uninterrupted trends across the SIC-NAICS discontinuity. Total personal income, total labor income, and non-labor income can all be plotted continuously without a problem. In addition, a few industries can also be plotted without a break, though this is not the case for services.

Adjusting dollar figures for inflation: Because a dollar in the past was worth more than a dollar today, data reported in current dollar terms should be adjusted for inflation. The U.S. Department of Commerce reports personal income figures in terms of current dollars. All income data in EPS-HDT are adjusted to real (or constant) dollars using the Consumer Price Index. Figures are adjusted to the latest date for which the annual Consumer Price Index is available.

Data gaps and estimation: Some data are withheld by the federal government to avoid the disclosure of potentially confidential information. Headwaters Economics uses supplemental data from the U.S. Department of Commerce to estimate these data gaps. These are indicated in italics in tables. Documentation explaining methods developed by Headwaters Economics for estimating disclosure gaps is available at headwaterseconomics.org/eps.

For more information about EPS see:

headwaterseconomics.org/EPS

Web pages listed under Additional Resources include:

Throughout this report, references to on-line resources are indicated with italicized numbers in parentheses. These resources are provided as hyperlinks here.

1 www.naics.com/search.htm
2 www.bls.gov/bls/NAICS.htm
3 www.census.gov/eos/www/naics
4 headwaterseconomics.org/eps
5 www.fs.fed.us/research/rpa/pubs-supporting-interim-update-of-2000-rpa-assessment.shtml
6 www.bls.gov/oco/cg/cgs001.htm
7 www.census.gov/econ/nonemployer/index.html
8 www.census.gov/econ/nonemployer/definitions.htm
9 www.bls.gov/bls/employment.htm
10 www.bls.gov/bls/wages.htm
11 www.bls.gov/oes
12 www.data.bls.gov:8080/PDQ/outside.jsp?survey=en
13 www.bls.gov/oco
14 www.census.gov/econ/cbp/index.html
15 www.sussex.ac.uk/Units/spru/publications/imprint/sewps/sewp28/sewp28.pdf
16 www.mailer.fsu.edu/~tchapin/garnet-tchapin/urp5261/topics/econbase/lq.htm
17 www.wwjobcenter.org/2009%20SOW%20Report(FINAL).pdf

A Profile of Development and the Wildland-Urban Interface (WUI)

County Region

Selected Geographies:

Montrose County, CO; Mesa County, CO; San Miguel County, CO; San Juan County, CO; Ouray County, CO; Gunnison County, CO; Delta County, CO; Hinsdale County, CO; Saguache County, CO; Garfield County, CO

Benchmark Geographies:

West

Produced by

Economic Profile System

EPS

November 28, 2016

About the Economic Profile System (EPS)

EPS is a free, easy-to-use software application that produces detailed socioeconomic reports of counties, states, and regions, including custom aggregations.

EPS uses published statistics from federal data sources, including Bureau of Economic Analysis and Bureau of the Census, U.S. Department of Commerce; and Bureau of Labor Statistics, U.S. Department of Labor.

The Bureau of Land Management and Forest Service have made significant financial and intellectual contributions to the operation and content of EPS.

See headwaterseconomics.org/EPS for more information about the other tools and capabilities of EPS.

For technical questions, contact Patty Gude at eps@headwaterseconomics.org, or 406-599-7425.

headwaterseconomics.org

Headwaters Economics is an independent, nonprofit research group. Our mission is to improve community development and land management decisions in the West.

www.blm.gov

The Bureau of Land Management, an agency within the U.S. Department of the Interior, administers 249.8 million acres of America's public lands, located primarily in 12 Western States. It is the mission of the Bureau of Land Management to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations.

www.fs.fed.us

The Forest Service, an agency of the U.S. Department of Agriculture, administers national forests and grasslands encompassing 193 million acres. The Forest Service's mission is to achieve quality land management under the "sustainable multiple-use management concept" to meet the diverse needs of people while protecting the resource. Significant intellectual, conceptual, and content contributions were provided by the following individuals: Dr. Pat Reed, Dr. Jessica Montag, Doug Smith, M.S., Fred Clark, M.S., Dr. Susan A. Winter, and Dr. Ashley Goldhor-Wilcock.

Table of Contents

Note to Users:

This is one of fourteen reports that can be created and downloaded from EPS Web. You may want to run another EPS report for either a different geography or topic. Topics include land use, demographics, specific industry sectors, the role of non-labor income, the wildland-urban interface, the role of amenities in economic development, and payments to county governments from federal lands. Throughout the reports, references to online resources are indicated in parentheses. These resources are provided as hyperlinks on each report's final page. The EPS reports are downloadable as Excel, PDF, and Word documents. For further information and to download reports, go to:

headwaterseconomics.org/eps

How much of the WUI has been developed, and how much has not yet been developed?

This page evaluates the wildland-urban interface (WUI) for the eleven western continental states, showing both square miles and the proportion of the WUI that has been developed and how much remains to be developed.

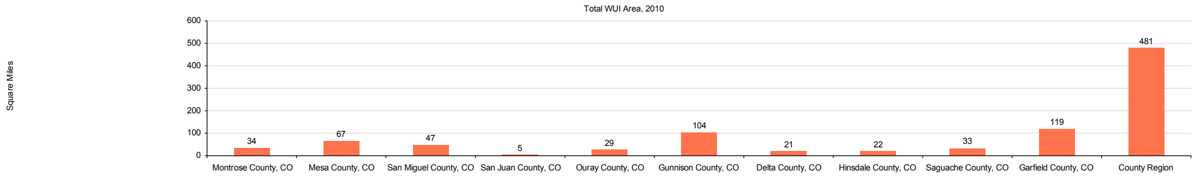
Wildland-Urban Interface (Square Miles), 2010

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	West
Total WUI Area	34	67	47	5	29	104	21	22	33	119	481	23,596
WUI Area with Homes	1	2	8	0	2	8	3	4	4	10	40	3,837
WUI Area without Homes	34	66	39	4	27	96	18	18	30	109	441	19,759

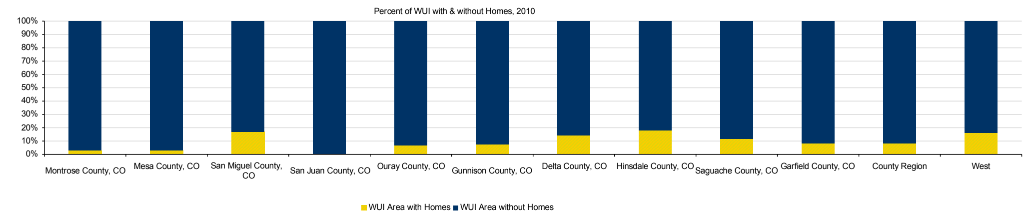
Percent of Total

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	West
WUI Area with Homes	2.9%	3.0%	17.0%	0.0%	6.9%	7.7%	14.3%	18.2%	12.1%	8.4%	8.3%	16.3%
WUI Area without Homes	100.0%	98.5%	83.0%	80.0%	93.1%	92.3%	85.7%	81.8%	90.9%	91.6%	91.7%	83.7%

- In 2010, County Region had the largest total WUI area (481 square miles), and San Juan County, CO had the smallest (5 square miles).



- In 2010, Hinsdale County, CO had the largest percent of the WUI with homes (18.2%), and San Juan County, CO had the smallest (0%).



Data Sources: Gude, P.H., Rasker, R., and van den Noort, J. 2008. Potential for Future Development on Fire-Prone Lands. Journal of Forestry 106(4):198-205; U.S. Department of Commerce. 2011. TIGER/Line 2010 Census Blocks and 2010 Summary File 1, Washington, D.C.

Study Guide and Supplemental Information

How much of the WUI has been developed, and how much has not yet been developed?

What do we measure on this page?

This page evaluates the wildland-urban interface (WUI) for the 11 western continental states, showing both square miles and the proportion of the WUI that has been developed and how much remains to be developed.

Wildland-Urban Interface (WUI): This report defines WUI as private forestlands that are within 500 meters of public forestlands. (See Methods section on final page for discussion of this threshold.) We focus on adjacency to public forests since roughly 70% of western forests are publicly-owned and since wildfire is a natural disturbance in these forests, creating a potential risk to adjacent private lands. In this report, the term "wildland-urban interface" (WUI) is sometimes used interchangeably with "fire-prone lands."
WUI Area with Homes: the square miles of private forest lands within 500 meters of public forestlands that are occupied by homes.
WUI Area without Homes: the square miles of private forest lands within 500 meters of public forestlands without homes. These lands have the potential to be developed.

Why is it important?

Wildfire directly impacts safety, private and public costs, and landscape health. Today, the rising expense of wildland firefighting that takes place both on public and private lands costs the federal government more than $3 billion per year. A principal reason for the escalating cost of wildland firefighting is the growing number of homes built in the WUI. Many studies have delineated the rising costs of forest and other wildland fires, and all point to the expanding pattern of residential development adjacent to public lands as a significant contributing factor. The costs of fire suppression will continue to grow if residential development trends continue.

Fire plays an important part in most wildland ecosystems. However, many years of fire suppression, much of it undertaken to protect private property, has resulted in fuel buildup, which in turn increases the probability of a large, expensive fire. Warmer temperatures, less snowpack, and drier forests also result in longer and more intense fire seasons across the West. Other factors, such as bug infestations, can exacerbate fire intensities.

Data on this page can be used to quanify whether the selected geographies have significant acreage in the WUI, whether this acreage is currently developed. If there is extensive WUI acreage that is currently undeveloped, it is important to ask whether public land managers and local and state officials are planning for potential development in the WUI and its associated costs.

Methods

The information in this report is based on a study conducted by Headwaters Economics (see Data Sources and Additional Resources) on the 11 contiguous western states. The original study utilized data from the 2000 Census. The study has since been replicated using 2010 Census data. Additional, detailed descriptions of methods are found on the last page of this report. For references on defensible space, see Gude et al, (2008), Data Sources, page 199.

As defined in the National Fire Plan, the WUI includes areas "where structures and other human development meet or intermingle with undeveloped wildland." Other federal documents define the WUI as areas "where humans and their development meet or intermix with wildland fuel" or "the line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuel." In general, the WUI is an area rich in natural amenities, where both population and new housing are on the rise.

Additional Resources

A number of alternative definitions exist for the WUI. For example, the University of Wisconsin's SILVIS lab's definition is not focused on public forests. For more information, see: silvis.forest.wisc.edu/library/WUIDefinitions2.asp *(1)*.
For more discussion of fire policy in general, see: headwaterseconomics.org/wildfire.php *(2)*. This page has a variety of useful links including studies on controlling wildfire costs, the cost of protecting residences from wildland fire, and development in the WUI.
For a White Paper on methods to control future fire suppression costs in the WUI, a literature review of recent reports, and public policy options, see: headwaterseconomics.org/wildfire/HeadwatersFireCosts.pdf *(3)*.
The following report has a useful overview of costs, WUI, and related issues: U.S. Department of Agriculture, Office of Inspector General, Nov. 2006. Audit Report: Forest Service Large Fire Suppression Costs. Report No. 08601-44-SF.
Berry, Alison H., Geoffrey Donovan, and Hayley Hesseln. 2006. The Economic Effects of the Wildland-Urban Interface on Forest Service and BLM Prescribed Burning Costs in the Pacific Northwest. Western Journal of Applied Forestry, 21(2):72-78.
Healthy Forests Restoration Act of 2003, fs.fed.us/biology/wildecology/HFRA.pdf *(4)*.

Data Sources

Gude, P.H., Rasker, R., and van den Noort, J. 2008. Potential for Future Development on Fire-Prone Lands. Journal of Forestry 106(4):198-205; U.S. Department of Commerce. 2011. TIGER/Line 2010 Census Blocks and 2010 Summary File 1, Washington, D.C.

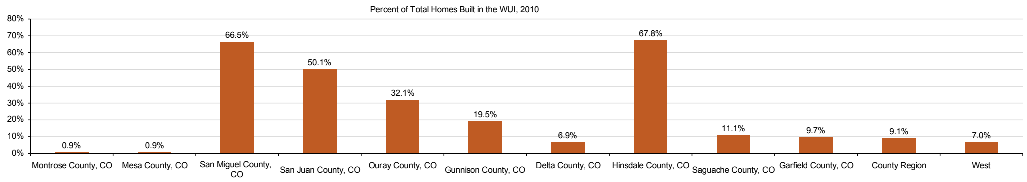
How many homes are in the WUI, and what proportion are permanently versus seasonally occupied?

This page measures the total number of homes compared to the subset of homes in the WUI and how many of those homes are permanent or second homes.

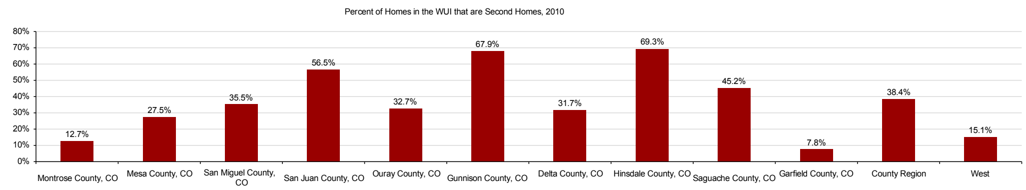
Total Homes and Wildland-Urban Interface Homes, 2010

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	West
Total Number of Homes	18,250	62,644	6,638	756	3,083	11,412	14,572	1,388	3,843	23,309	145,895	27,766,144
WUI Homes	166	539	4,413	379	989	2,221	1,000	941	425	2,250	13,323	1,947,927
Second Homes in WUI	21	148	1,565	214	323	1,509	317	652	192	176	5,117	293,196
Percent of Total												
WUI Homes as % of Total Homes	0.9%	0.9%	66.5%	50.1%	32.1%	19.5%	6.9%	67.8%	11.1%	9.7%	9.1%	7.0%
Second Homes as % of WUI Homes	12.7%	27.5%	35.5%	56.5%	32.7%	67.9%	31.7%	69.3%	45.2%	7.8%	38.4%	15.1%

- In 2010, Hinsdale County, CO had the largest percent of total homes (67.8%) built inside the WUI, and Mesa County, CO had the smallest (0.9%).



- In 2010, Hinsdale County, CO has the largest share of second homes in the WUI (69.3%), and Garfield County, CO has the smallest (7.8%).



Data Sources: Gude, P.H., Rasker, R., and van den Noort, J. 2008. Potential for Future Development on Fire-Prone Lands. Journal of Forestry 106(4):198-205; U.S. Department of Commerce. 2011. TIGER/Line 2010 Census Blocks and 2010 Summary File 1, Washington, D.C.

Study Guide and Supplemental Information

How many homes are in the WUI, and what proportion are permanently versus seasonally occupied?

What do we measure on this page?

This page measures the total number of homes compared to the subset of homes in the WUI and how many of those homes are permanent or second homes.

Second Homes: These are residences used only in certain seasons, for weekends, or other occasional uses throughout the year.

Why is it important?

This page focuses on housing that borders federally managed public forestlands in the West. Roughly 70 percent of western forests are publicly owned. Because wildfire is a natural disturbance in many of these forests, this creates a potential risk to adjacent private lands.

Homes built near forested public lands are much more likely to be second homes compared to homes built on other private western lands. One in five homes near public forests in the West is a second home, compared to one in twenty-five homes on other western private lands. Understanding how many of the homes are second homes is important because it puts the cost and danger of protecting homes into a context: are lives being risked, and billions of dollars being spent, to protect people's vacation homes?

Across the West, only 14 percent of private land adjacent to forests has homes on it. But this relatively small percentage is tremendously expensive. When combining local, state, and federal efforts, the cost to protect homes from forest fires exceeds $1 billion per year. If 50 percent of the forested private lands were developed, firefighting costs could exceed $4 billion.

Methods

The data were calculated using Geographic Information System (GIS) tools. A buffer of 500 meters surrounding forested public lands, including federal, state, and locally managed forests, was mapped, and residential areas that fell within this buffer were identified. The Protected Areas Database was used to map public lands in California, Colorado, Idaho, New Mexico, Nevada, Oregon, Utah, Washington, and Wyoming, and state data sources were used to map public land boundaries in Montana and Arizona.

To identify where housing has occurred adjacent to forested wildlands in the West, maps of housing density were created at the scale of 2010 Census blocks. The threshold of 40-acre lot sizes was used to identify residential development because at this home density, areas are generally considered to be more populated than working agricultural lands, although some high-value agricultural operations, including orchards, can be profitable at this lot size.

Detailed descriptions of methods are provided on the last page of this report and in the references cited under Additional resources.

Additional Resources

For an overview and statistical analysis of WUI development for the eleven western states and their counties, see: headwaterseconomics.org/wildfire *(2)*.

For a peer-reviewed journal article, see: Gude, P.H., R. Rasker, J. van den Noort. 2008. Potential for Future Development on Fire-Prone Lands. Journal of Forestry 106(4): 198-205. Available at headwaterseconomics.org/wildfire/PGude_2008_Forestry.pdf *(5)*.

For a discussion of improving firefighter and homeowner safety, see:
Cohen, J.D. 2000. Preventing Disaster: Home Ignitability in the Wildland-Urban Interface. J. Forestry. 98(3):15-21.

Butler, B.W., and J.D. Cohen. 1998. Firefighter Safety Zones: A Theoretical Model Based on Radiative Heating. Int. J. Wildland Fire. 8(2):73-77.

Nowicki, B. 2002. The Community Protection Zone: Defending Houses and Communities from the Threat of Forest Fire. Available at: biologicaldiversity.org/swcbd/programs/fire/wui1.pdf *(6)*.

Data Sources

Gude, P.H., Rasker, R., and van den Noort, J. 2008. Potential for Future Development on Fire-Prone Lands. Journal of Forestry 106(4):198-205; U.S. Department of Commerce. 2011. TIGER/Line 2010 Census Blocks and 2010 Summary File 1, Washington, D.C.

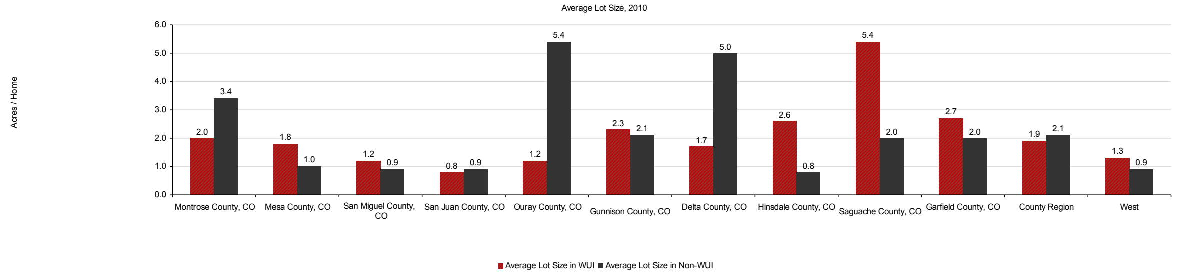
How much land is used inside and outside of the WUI?

This page provides both the total number of residences (homes) as well as the subsets of homes in and outside the WUI. It also shows the average lot size (in acres) of homes within the WUI compared to homes outside of the WUI.

Average Lot Sizes (Acres/Home), 2010

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	West
Average Lot Size	3.4	1.0	1.1	0.9	4.0	2.2	4.8	1.5	2.4	2.1	2.1	0.9
Total Number of Homes	18,250	62,644	6,638	756	3,083	11,412	14,572	1,388	3,843	23,309	145,895	27,766,144
Total Residential Acres	61,591	65,197	7,156	670	12,437	24,560	70,117	2,081	9,305	48,519	301,633	24,584,252
Average Lot Size in WUI	2.0	1.8	1.2	0.8	1.2	2.3	1.7	2.6	5.4	2.7	1.9	1.3
WUI Homes	166	539	4,413	379	989	2,221	1,000	941	425	2,250	13,323	1,947,927
WUI Residential Acres	336	988	5,076	316	1,137	5,011	1,656	2,419	2,303	6,155	25,397	2,455,779
Average Lot Size in Non-WUI	3.4	1.0	0.9	0.9	5.4	2.1	5.0	0.8	2.0	2.0	2.1	0.9
Non-WUI Homes	18,084	62,105	2,225	377	2,094	9,191	13,572	447	3,418	21,059	132,572	25,818,217
Non-WUI Residential Acres	61,255	64,209	2,080	353	11,301	19,549	68,461	338	7,002	42,364	276,912	22,128,473

- In 2010, the largest difference in lot sizes in and outside the WUI occurred in Ouray County, CO. In the WUI, the average lot size was 1.2 acres and outside the WUI the average lot size was 5.4 acres.



Data Sources: Gude, P.H., Rasker, R., and van den Noort, J. 2008. Potential for Future Development on Fire-Prone Lands. Journal of Forestry 106(4):198-205; U.S. Department of Commerce. 2011. TIGER/Line 2010 Census Blocks and 2010 Summary File 1, Washington, D.C.

Study Guide and Supplemental Information

How much land is used inside and outside of the WUI?

What do we measure on this page?

This page provides both the total number of residences (homes) as well as the subsets of homes in and outside the WUI. It also shows the average lot size (in acres) of homes within the WUI compared to homes outside of the WUI.

Why is it important?

Residential lots built in the WUI are much more likely to take up more space than homes built in the non-WUI. This is an important characteristic of the WUI because low-density housing is more costly to protect. In other words, what matters when calculating the costs of protecting homes from wildfires is not just the number of homes, but the per acre use of land per home.

Residential lots near wildlands also take up more than twice the space of homes built in other places. On average across the West, housing near forested land covers 2.3 acres per residence compared to 1.1 acres per residence on other western private lands. This is important because sprawled housing costs more to protect from wildfire.

On behalf of the Montana State Legislature, Headwaters Economics conducted a more detailed analysis of the costs of protecting homes from wildfire in the state of Montana. Headwaters Economics analyzed daily fire suppression costs across 30 large fires that burned in Montana during 2006 and 2007, extracting the portion of total fire suppression costs directly associated with housing. The study discovered that in Montana firefighting costs are highly correlated with the number of homes threatened by a fire.

More importantly, the pattern of development is a significant factor, with dispersed development (i.e. larger lot sizes) contributing more to the cost of fighting fires. For example, one dense subdivision is less costly to protect than the same number of homes spread across a large area of land. This discrepancy in cost between dense vs. sprawled development is important since, in the western U.S., residential lots in the WUI usually take up more space than homes built in other places. Headwaters Economics is replicating the study for California and New Mexico.

Methods

The data were calculated using Geographic Information System (GIS) tools. A buffer of 500 meters surrounding forested public lands, including federal, state, and locally managed forests, was mapped, and residential areas that fell within this buffer were identified. The Protected Areas Database was used to map public lands in California, Colorado, Idaho, New Mexico, Nevada, Oregon, Utah, Washington, and Wyoming, and state data sources were used to map public land boundaries in Montana and Arizona.

To identify where housing has occurred adjacent to forested wildlands in the West, maps of housing density were created at the scale of 2010 Census blocks. The threshold of 40-acre lot sizes was used to identify residential development because at this home density, areas are generally considered to be more populated than working agricultural lands, although some high-value agricultural operations, including orchards, can be profitable at this lot size.

Detailed descriptions of methods are provided on the last page of this report, and in the references cited under Additional Resources.

Additional Resources

Headwaters Economics. August 2008. Montana Wildfire Cost Study, available at: headwaterseconomics.org/wildfire/HeadwatersEconomics_FireCostStudy_TechnicalReport.pdf *(7)*.

For a peer reviewed report, see: Gude, P.H., R. Rasker, J. van den Noort. 2008. Potential for Future Development on Fire-Prone Lands. Journal of Forestry 106(4): 198-205. Available at: headwaterseconomics.org/wildfire/PGude_2008_Forestry.pdf *(5)*.

Two National Academy of Public Administration reports that may be helpful are:

Wildland Fire Costs: Enhancing Hazard Mitigation Capacity. January 2004. See: napawash.org/Pubs/WildfireJan04.htm *(8)*.

Wildfire Suppression: Strategies for Containing Costs. September 2002. See: napawash.org/Pubs/Wildfire9_30_02.pdf *(9)*.

Data Sources

Gude, P.H., Rasker, R., and van den Noort, J. 2008. Potential for Future Development on Fire-Prone Lands. Journal of Forestry 106(4):198-205; U.S. Department of Commerce. 2011. TIGER/Line 2010 Census Blocks and 2010 Summary File 1, Washington, D.C.

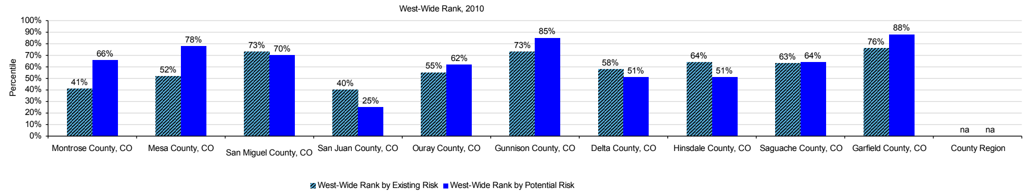
What is the wildfire risk to development?

This page measures the risk of wildfire for lands already developed in the WUI and the potential risk of wildfire should homes be build on undeveloped land in the WUI. The geographies are ordered within the eleven western states in both absolute and percentile rankings.

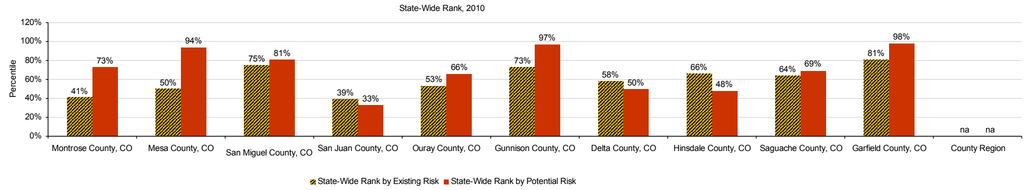
West-Wide and State-Wide County Rankings, 2010

	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	West
West-Wide Rank by Existing Risk	244 of 414	198 of 414	111 of 414	248 of 414	188 of 414	112 of 414	172 of 414	149 of 414	152 of 414	98 of 414	na	na
West-Wide Rank by Potential Risk	139 of 414	91 of 414	125 of 414	311 of 414	158 of 414	62 of 414	201 of 414	202 of 414	150 of 414	48 of 414	na	na
State-Wide Rank by Existing Risk	38 of 64	32 of 64	16 of 64	39 of 64	30 of 64	17 of 64	27 of 64	22 of 64	23 of 64	12 of 64	na	na
State-Wide Rank by Potential Risk	17 of 64	4 of 64	12 of 64	43 of 64	22 of 64	2 of 64	32 of 64	33 of 64	20 of 64	1 of 64	na	na
Percentile												
West-Wide Rank by Existing Risk	41%	52%	73%	40%	55%	73%	58%	64%	63%	76%	na	na
West-Wide Rank by Potential Risk	66%	78%	70%	25%	62%	85%	51%	51%	64%	88%	na	na
State-Wide Rank by Existing Risk	41%	50%	75%	39%	53%	73%	58%	66%	64%	81%	na	na
State-Wide Rank by Potential Risk	73%	94%	81%	33%	66%	97%	50%	48%	69%	98%	na	na

- In 2010, Garfield County, CO was in the 76 percentile in the West when ranked by existing risk (the amount of forested land where homes have already been built next to public lands).
- In 2010, Garfield County, CO was in the 88 percentile in the West when ranked by future potential risk (the area of undeveloped, forested private land bordering fire-prone public lands).



- In 2010, Garfield County, CO was in the 81 percentile in the state when ranked by existing risk (the amount of forested land where homes have already been built next to public lands).
- In 2010, Garfield County, CO was in the 98 percentile in the state when ranked by future potential risk (the area of undeveloped, forested private land bordering fire-prone public lands).



Data Sources: Gude, P.H., Rasker, R., and van den Noort, J. 2008. Potential for Future Development on Fire-Prone Lands. Journal of Forestry 106(4):198-205; U.S. Department of Commerce. 2011. TIGER/Line 2010 Census Blocks and 2010 Summary File 1, Washington, D.C.

What is the wildfire risk to development?

What do we measure on this page?

This page measures the risk of wildfire for lands already developed in the WUI and the potential risk of wildfire should homes be built on undeveloped land in the WUI. The geographies are ordered within the eleven western states in both absolute and percentile rankings.

Existing Risk: Counties are ranked by the number of acres of forested land where homes have already been built next to public lands. For example, the west-wide rank may show that a county ranks 1st among the 413 western counties. This would indicate that the county has the highest "existing risk" (i.e., the 100th percentile). The state-wide rank for another county may show that it ranks 45th among the 50 counties within its state. This would indicate that the county has a low "potential risk" (i.e., the 10th percentile) relative to other counties in the same state.
Potential Risk: Counties are ranked by the number of acres of undeveloped, forested private land bordering fire-prone public lands.

Why is it important?

Defending homes from the risk of wildland fire is a major cost for public land agencies. The National Academy of Public Administration estimates that in the United States 2.2 million homes are expected to exist in the WUI by the year 2030 -- a 40 percent increase over 2001 levels.

While home construction is not the only contributor to the rising cost of fighting fires, it is an important factor and one that is expected to rise with continued development, particularly in the absence of well thought-out land use planning. A warming climate will exacerbate the costs even further.

Data on this page raise important questions about whether the selected geographies have significant acreage in the WUI that is not yet developed, and whether public land managers and local and state officials are planning for this potential development and its associated costs and risks.

Methods

See the last page of this report as well the article by Gude et al. (2008) cited in the data sources for definitions and methods.

Additional Resources

For a study of how an increase in temperatures could impact fire suppression costs, see: Gude, P.H., J.A. Cookson, M.C. Greenwood, M. Haggerty. 2009. Homes in Wildfire-Prone Areas: An Empirical Analysis of Wildfire Suppression Costs and Climate Change. In preparation for submission to journal. Available at headwaterseconomics.org/wildfire/Gude_Manuscript_4-24-09_Color.pdf [10].

Schoennagel T., C.R. Nelson, D.M. Theobald, G.C. Carnwald, and T.B. Chapman. 2009. Implementation of National Fire Plan Treatments Near the Wildland-Urban Interface in the Western United States. Proceedings of the National Academy of Sciences. 106 (23): 10706-10711. This article can be found at: pnas.org/content/early/2009/06/05/0900991106.abstract [11].

Menakis, J.P., J. Cohen, and L. Bradshaw. 2003. Mapping wildland fire risk to flammable structures for the conterminous United States. Pages 41-49 in K.E.M. Galeey, R.C. Klinger, and N.G. Sugihara (eds.).

Theobald. T.D. and W.H. Romme. 2007. Expansion of the U.S. Wildland-Urban Interface. Landscape and Urban Planning. 83: 340-354.

Data Sources

Gude, P.H., Rasker, R., and van den Noort, J. 2008. Potential for Future Development on Fire-Prone Lands. Journal of Forestry 106(4):198-205; U.S. Department of Commerce. 2011. TIGER/Line 2010 Census Blocks and 2010 Summary File 1, Washington, D.C.

Data Sources

The EPS-HDT Development and the Wildland-Urban Interface (WUI) report uses a set of specific West-wide data sources to quantify measures of fire risk related to residential development. In an effort to report more accurate statistics for land ownership, a compilation of state level data was used. All of the spatial data in this report were the result of calculations made in Geographic Information Systems (GIS). The contact information for these databases is:

- **Protected Areas Database 1.3 2012**
  US Geological Survey, Gap Analysis Program (GAP)
  http://gapanalysis.usgs.gov/padus/

- **2010 Decennial Census**
  Census Bureau, U.S. Department of Commerce
  http://wwwcensus.gov
  Tel 303-969-7750

- **MODIS Land Cover Type 2006**
  National Aeronautics and Space Administration
  http://modis-land.gsfc.nasa.gov/landcover.htm

Methods

In this report, we focus on housing that borders federal public forestlands in the West. Roughly 70 percent of western forests are publicly owned. Since wildfire is a natural disturbance in many of these forests, this creates a potential risk to adjacent private lands. Fire risk is extremely difficult to quantify. Since most western forests burn at some point and residential areas are rarely abandoned, for the purpose of this report, all forested public lands were considered susceptible to wildfire.

A buffer of 500 meters surrounding forested public lands, including federal, state, and locally managed forests, was mapped, and residential areas that fell within this buffer were identified. The forested public lands were identified based on the following classes from satellite classified land cover maps: evergreen needleleaf forest, evergreen broadleaf forest, deciduous needleleaf forest, deciduous broadleaf forest, mixed forests, closed shrublands. Although open shrublands and grasslands are also prone to wildfire, defending homes in these habitats tends to be less dangerous and less expensive. Since guidelines for the amount of defensible space necessary to protect homes range from 40 to 500 meters, the threshold of 500 meters was used to identify where residential development occurs adjacent to fire-prone public lands. This is a conservative estimate of the WUI and the associated risk of fire, since it is unknown how many home owners within this zone have followed defensible space guidelines.

In order to identify where housing has occurred adjacent to forested wildlands in the West, maps of housing density were created at the scale of 2000 Census blocks. Forested areas where residential development (census blocks with mean lot sizes less than 40 acre) occurred within 500 meters (0.31 miles) of public lands were identified. The threshold of 40 acre lot sizes was used to identify residential development because at this home density, areas are generally considered to be more populated than working agricultural lands. The mean lot size per Census block was calculated by dividing the number of housing units by the area of private land (public lands and any water bodies were excluded).

For each western state and for the West as a whole, the area of forested wildland interface containing homes, i.e., the WUI, was compared to the area of undeveloped forested wildland interface. Per state, the number of homes in the wildland interface was calculated, as well as the percent of these homes that are second homes. The number of second homes within the WUI was calculated by adding the number of “seasonally occupied” homes, as specified in by the Census SF1 H005005 field, to the number of “other vacant” homes, as specified in the Census SF1 H005007 field. These counts do not include homes that are vacant because they are for rent or sale.

Two measures were used to identify counties with high existing and high potential risk of wildland fire to homes. Existing risk was measured in terms of the total area of WUI per county, and potential risk was represented by the area of undeveloped forested wildland interface, where home construction could occur in the future.

For additional information about methods used to generate metrics in this report, see: Gude, P.H., Rasker, R., and van den Noort, J. 2008. Potential for Future Development on Fire-Prone Lands. Journal of Forestry 106(4):198-205.

Links to Additional Resources

For more information about EPS see:

headwaterseconomics.org/EPS

Web pages listed under Additional Resources include:

Throughout this report, references to on-line resources are indicated with italicized numbers in parentheses. These resources are provided as hyperlinks here.

1 www.silvis.forest.wisc.edu/library/WUIDefinitions2.asp
2 headwaterseconomics.org/wildfire.php
3 headwaterseconomics.org/wildfire/HeadwatersFireCosts.pdf
4 www.fs.fed.us/biology/wildecology/HFRA.pdf
5 headwaterseconomics.org/wildfire/PGude_2008_Forestry.pdf
6 www.biologicaldiversity.org/swcbd/programs/fire/wui1.pdf
7 headwaterseconomics.org/wildfire/HeadwatersEconomics_FireCostStudy_TechnicalReport.pdf
8 www.napawash.org/Pubs/WildfireJan04.htm
9 www.napawash.org/Pubs/Wildfire9_30_02.pdf
10 headwaterseconomics.org/wildfire/Gude_Manuscript_4-24-09_Color.pdf
11 www.pnas.org/content/early/2009/06/05/0900991106.abstract

Transportation Infrastructure and Access on National Forests and Grasslands
A Literature Review

Introduction

The Forest Service transportation system is very large with 374,883 miles (603,316 km) of system roads and 143,346 miles (230,693 km) of system trails. The system extends broadly across every national forest and grasslands and through a variety of habitats, ecosystems and terrains. An impressive body of scientific literature exists addressing the various effects of roads on the physical, biological and cultural environment – so much so, in the last few decades a new field of "road ecology" has emerged. In recent years, the scientific literature has expanded to address the effects of roads on climate change adaptation and conversely the effects of climate change on roads, as well as the effects of restoring lands occupied by roads on the physical, biological and cultural environments.

The following literature review summarizes the most recent thinking related to the environmental impacts of forest roads and motorized routes and ways to address them. The literature review is divided into three sections that address the environmental effects of transportation infrastructure on forests, climate change and infrastructure, and creating sustainable forest transportation systems.

I. Impacts of Transportation Infrastructure and Access to the Ecological Integrity of Terrestrial and Aquatic Ecosystems and Watersheds

It is well understood that transportation infrastructure and access management impact aquatic and terrestrial environments at multiple scales, and, in general, the more roads and motorized routes the greater the impact. In fact, in the past 20 years or so, scientists having realized the magnitude and breadth of ecological issues related to roads; entire books have been written on the topic, e.g., Forman et al. (2003), and a new scientific field called "road ecology" has emerged. Road ecology research centers have been created including the Western

Transportation Institute at Montana State University and the Road Ecology Center at the University of California - Davis.[1]

Below, we provide a summary of the current understanding on the impacts of roads and access allowed by road networks to terrestrial and aquatic ecosystems, drawing heavily on Gucinski et al. (2000). Other notable recent peer-reviewed literature reviews on roads include Trombulak and Frissell (2000), Switalski et al. (2004), Coffin (2007), Fahrig and Rytwinski (2009), and Robinson et al. (2010). Recent reviews on the impact of motorized recreation include Joslin and Youmans (1999), Gaines et al. (2003), Davenport and Switalski (2006), Ouren et al. (2007), and Switalski and Jones (2012). These peer-reviewed summaries provide additional information to help managers develop more sustainable transportation systems

Impact on geomorphology and hydrology

The construction or presence of forest roads can dramatically change the hydrology and geomorphology of a forest system leading to reductions in the quantity and quality of aquatic habitat. While there are several mechanisms that cause these impacts (Wemple et al. 2001 , Figure 1), most fundamentally, compacted roadbeds reduce rainfall infiltration, intercepting and concentrating water, and providing a ready source of sediment for transport (Wemple et al. 1996, Wemple et al. 2001). In fact, roads contribute more sediment to streams than any other land management activity (Gucinski et al. 2000). Surface erosion rates from roads are typically at least an order of magnitude greater than rates from harvested areas, and three orders of magnitude greater than erosion rates from undisturbed forest soils (Endicott 2008).

[1] See http://www.westerntransportationinstitute.org/research/roadecology and http://roadecology.ucdavis.edu/

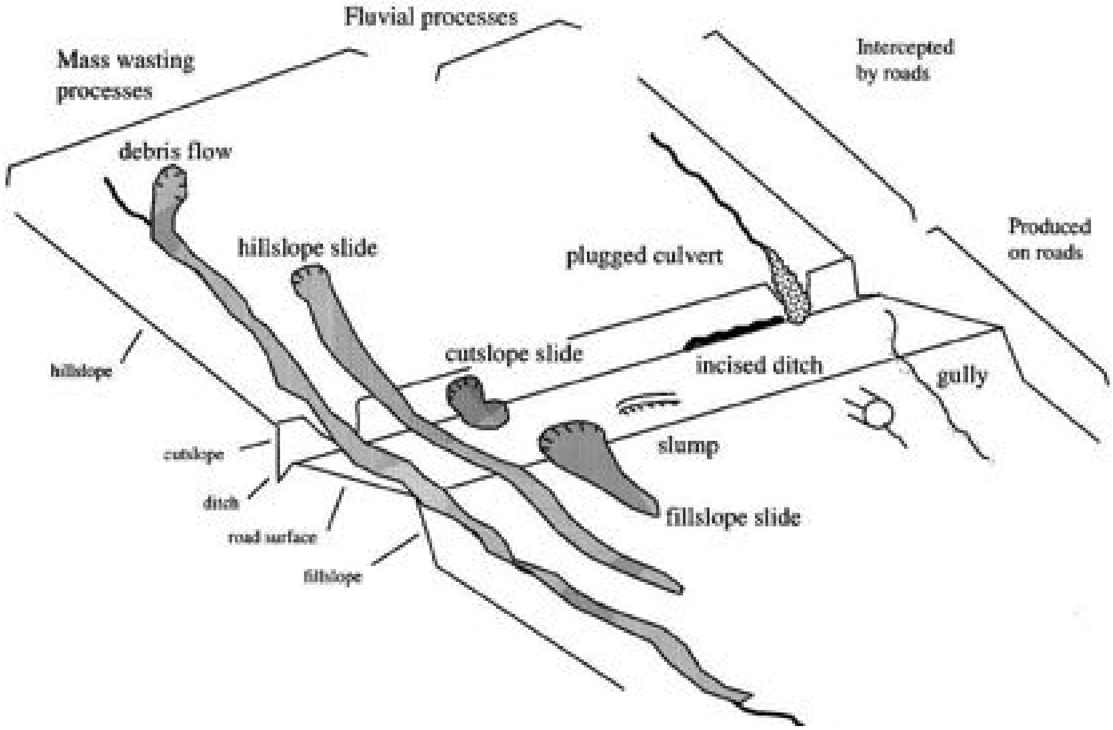


Figure 1: Typology of erosional and depositional features produced by mass-wasting and fluvial processes associate with forest roads (reprinted from Wemple et al. 2001)

Erosion of sediment from roads occurs both chronically and catastrophically. Every time it rains, sediment from the road surface and from cut- and fill-slopes is picked up by rainwater that flows into and on roads (fluvial erosion). The sediment that is entrained in surface flows are often concentrated into road ditches and culverts and directed into streams. The degree of fluvial erosion varies by geology and geography, and increases with increased motorized use (Robichaud et al. 2010). Closed roads produce less sediment, and Foltz et al. (2009) found a significant increase in erosion when closed roads were opened and driven upon. In drier landscapes, wind erosion following vehicle use can be a significant source of soil loss as well (Belnap 2003).

Roads also precipitate catastrophic failures of road beds and fills (mass wasting) during large storm events leading to massive slugs of sediment moving into waterways (Endicott 2008; Gucinski et al. 2000). This typically occurs when culverts are undersized and cannot handle the volume of water, or they simply become plugged with debris. The saturated roadbed can fail entirely and result in a landslide, or the blocked stream crossing can erode the entire fill down to the original stream channel.

The erosion of road- and trail-related sediment and its subsequent movement into stream systems affects the geomorphology of the drainage system in a number of ways. The magnitude of their effects varies by climate, geology, road age, construction / maintenance practices and storm history. It directly alters channel morphology by embedding larger gravels as well as filling pools. It can also have the opposite effect of increasing peak discharges and scouring channels, which can lead to disconnection of the channel and floodplain, and lowered base flows (Furniss et al. 1991; Joslin and Youmans 1999). The width/depth ratio of the stream changes which then can trigger changes in water temperature, sinuosity and other geomorphic factors important for aquatic species survival (Joslin and Youmans 1999; Trombulak and Frissell 2000).

Roads also can modify flowpaths in the larger drainage network. Roads intercept subsurface flow as well as concentrate surface flow, which results in new flowpaths that otherwise would not exist, and the extension of the drainage network into previously unchannelized portions of the hillslope (Gucinski et al. 2000; Joslin and Youmans 1999). Severe aggradation of sediment at stream structures or confluences can force streams to actually go subsurface or make them too shallow for fish passage (Endicott 2008; Furniss et al. 1991).

Impacts on aquatic habitat and fish

Roads can have dramatic and lasting impacts on fish and aquatic habitat. Increased sedimentation in stream beds has been linked to decreased fry emergence, decreased juvenile densities, loss of winter carrying capacity, and increased predation of fishes, and reductions in macro-invertebrate populations that are a food source to many fish species (Rhodes et al. 1994, Joslin and Youmans 1999, Gucinski et al. 2000, Endicott 2008). On a landscape scale, these effects can add up to: changes in the frequency, timing and magnitude of disturbance to aquatic habitat and changes to aquatic habitat structures (e.g., pools, riffles, spawning gravels and in-channel debris), and conditions (food sources, refugi, and water temperature) (Gucinski et al. 2000).

Roads can also act as barriers to migration (Gucinski et al. 2000). Where roads cross streams, road engineers usually place culverts or bridges. Culverts in particular can and often interfere with sediment transport and channel processes such that the road/stream crossing becomes a barrier for fish and aquatic species movement up and down stream. For instance, a culvert may scour on the downstream side of the crossing, actually forming a waterfall up which fish cannot move. Undersized culverts and bridges can infringe upon the channel or floodplain and trap sediment causing the stream to become too shallow and/or warm such that fish will not migrate past the structure. This is problematic for many aquatic species but especially for anadromous species that must migrate upstream to spawn. Well-known native aquatic species affected by roads include Colorado River cutthroat trout (*Oncorhynchus clarki pleuriticus*), the Threatened Greenback cutthroat trout (*O. c. stomias*), and Rio Grande cutthroat trout (*O. c. virginalis)*, as well as other native fishes and amphibians (Endicott 2008).

Impacts on terrestrial habitat and wildlife

Roads and trails impact wildlife through a number of mechanisms including: direct mortality (poaching, hunting/trapping) changes in movement and habitat use patterns (disturbance/avoidance), as well as indirect impacts including alteration of the adjacent habitat and interference with predatory/prey relationships (Wisdom et al. 2000, Trombulak and Frissell 2000). Some of these impacts result from the road itself, and some result from the uses on and around the roads (access). Ultimately, roads have been found to reduce the abundance and distribution of several forest species (Fayrig and Ritwinski 2009, Benítez-López et al. 2010).

Direct mortality and disturbance from road and trail use impacts many different types of species. For example, wide-ranging carnivores can be significantly impacted by a number of factors including trapping, poaching, collisions, negative human interactions, disturbance and displacement (Gaines et al. 2003). Road access has slowed the recovery of the Mexican Wolf (*Canis lupus baileyi*) with more than half of of mortalities due to illegal shootings (USDI FWS 2012). Hunted game species such as elk (*Cervus canadensis*), become more vulnerable from access allowed by roads and motorized trails resulting in a reduction in effective habitat among other impacts (Rowland et al. 2005, Switalski and Jones 2012). Slow-moving migratory animals such as amphibians, and reptiles who use roads to regulate temperature are also vulnerable (Gucinski et al. 2000, Brehme et al. 2013). Several bird species are sensitive to disturbance on roads (Barton and Holmes 2007), and several authors have identified buffer zones (Table 1, Switalski and Jones 2008, Whittington and Allen 2008).

Habitat alteration is a significant consequence of roads as well. At the landscape scale, roads fragment habitat blocks into smaller patches that may not be able to support successfully interior forest species. Smaller habitat patches also results in diminished genetic variability, increased inbreeding, and at times local extinctions (Gucinski et al. 2000; Trombulak and Frissell 2000). Motorized trails and routes can also have cascading effects throughout the ecosystem. For example, on an intensively used ORV route in Idaho, native shrubs, bunch grasses, and microbiotic crust were greatly reduced close to the route and replaced with non-native cheat grass (*Bromus tectorum*) and the native shrub rabbitbrush (*Chrysothamnus* spp.; Munger et al. 2003). Because of these habitat changes, fewer reptiles were found alongside the route than were found 100 m away.

Table 1. A summary of raptor nest buffer zones recommended for areas associated with human disturbance (Reprinted from Switalski and Jones 2008)

Species		Median nest buffer (m) (range in parentheses)	Reference
American kestrel	Falco sparverius	125 (50-200)	Richardson and Miller (1997)
Ferruginous hawk	Buteo regalis	300	Hamann et al. (1999)
Bald eagle	Haliaeetus leucocephalus	400	Hamann et al. (1999)
Northern goshawk	Accipiter gentilis	450 (400-500)	Jones (1979)
Sharp-shinned hawk	Accipiter striatus	450 (400-500)	Jones (1979)
Cooper's hawk	Accipiter cooperii	525 (400-500)	Richardson and Miller (1997)
Prairie falcon	Falco mexicanus	650 (50-800)	Richardson and Miller (1997)
Golden eagle	Aquila chrysaetos	800 (200-1600)	Richardson and Miller (1997)
Peregrine falcon	Falco peregrinus	800 (800-1600)	Richardson and Miller (1997)
Red-tailed hawk	Buteo jamaicensis	800	Call (1979)
Mexican spotted owl	Strix occidentalis lucida	900	US Fish and Wildlife Service (1995)
Osprey	Pandion haliaetus	1000 (400-1500)	Richardson and Miller (1997)

Roads also change the composition and structure of ecosystems along buffer zones, called edge-affected zones. The width of edge-affected zones varies by what metric is being discussed; however, researchers have documented road-avoidance zones a kilometer or more away from a road (Table 2). In heavily roaded landscapes, edge-affected acres can be a significant fraction of total acres. For example, in a landscape area where the road density is 3 mi/mi^2 (not an uncommon road density in national forests) and where the edge-affected zone is estimated to be 500 ft from the center of the road to each side, the edge-affected zone is 56% of the total acreage.

Table 2: A summary of some documented road-avoidance zones for various species (adapted from Robinson et al. 2010).

Species	Avoidance zone m (ft)	Type of disturbance	Reference
Snakes	650 (2133)	Forestry roads	Bowles (1997)
Salamander	35 (115)	Narrow forestry road, light traffic	Semlitsch (2003)
Woodland birds	150 (492)	Unpaved roads	Ortega and Capen (2002)
Spotted owl	400 (1312)	Forestry roads, light traffic	Wasser et al. (1997)
Marten	<100 (<328)	Any forest opening	Hargis et al. (1999)
Elk	500–1000 (1640-3281)	Logging roads, light traffic	Edge and Marcum (1985)
	100–300 (328-984)	Mountain roads depending on traffic volume	Rost and Bailey (1979)
Black bear	274 (899)	Spring, unpaved roads	Kasworm and Manley (1990)
	914 (2999)	Fall, unpaved roads	

Roads and trails also affect ecosystems and habitats because they are also a major vector of non-native plant and animal species. This can have significant ecological and economic impacts when the invading species are aggressive and can overwhelm or significantly alter native species and systems. In addition, roads can increase harassment, poaching and collisions with vehicles, all of which lead to stress or mortality (Wisdom et al. 2000).

Recent reviews have synthesized the impacts of roads on animal abundance and distribution. Fahrig and Rytwinski (2009) did a complete review of the empirical literature on effects of roads and traffic on animal abundance and distribution looking at 79 studies that addressed 131 species and 30 species groups. They found that the number of documented negative effects of roads on animal abundance outnumbered the number of positive effects by a factor of 5. Amphibians, reptiles, most birds tended to show negative effects. Small mammals generally showed either positive effects or no effect, mid-sized mammals showed either negative effects or no effect, and large mammals showed predominantly negative effects. Benítez-López et al. (2010) conducted a meta-analysis on the effects of roads and infrastructure proximity on mammal and bird populations. They found a significant pattern of avoidance and a reduction in bird and mammal populations in the vicinity of infrastructure.

Road density[2] thresholds for fish and wildlife

It is well documented that beyond specific road density thresholds, certain species will be negatively affected, and some will be extirpated. Most studies that look into the relationship between road density and wildlife focus on the impacts to large endangered carnivores or hunted game species, although high road densities certainly affect other species – for instance, reptiles and amphibians. Gray wolves (*Canis lupus*) in the Great Lakes region and elk in Montana and Idaho have undergone the most long-term and in depth analysis. Forman and Hersperger (1996) found that in order to maintain a naturally functioning landscape with sustained populations of large mammals, road density must be below 0.6 km/km^2 (1.0 mi/mi^2). Several studies have since substantiated their claim (Robinson et al. 2010, Table 3).

A number of studies at broad scales have also shown that higher road densities generally lead to greater impacts to aquatic habitats and fish density (Table 3). Carnefix and Frissell (2009) provide a concise review of studies that correlate cold water fish abundance and road density, and from the cited evidence concluded that “1) no truly “safe” threshold road density exists, but rather negative impacts begin to accrue and be expressed with incursion of the very first road segment; and 2) highly significant impacts (e.g., threat of extirpation of sensitive species) are already apparent at road densities on the order of 0.6 km/km^2 (1.0 mi/mi^2) or less” (p. 1).

[2] We intend the term “road density” to refer to the density all roads within national forests, including system roads, closed roads, non-system roads administered by other jurisdictions (private, county, state), temporary roads and motorized trails. Please see Attachment 2 for the relevant existing scientific information supporting this approach.

Table 3: A summary of some road-density thresholds and correlations for terrestrial and aquatic species and ecosystems (reprinted from Robinson et al. 2010).

Species (Location)	Road density (mean, guideline, threshold, correlation)	Reference
Wolf (Minnesota)	0.36 km/km2 (mean road density in primary range); 0.54 km/km^2 (mean road density in peripheral range)	Mech et al. (1988)
Wolf	>0.6 km/km^2 (absent at this density)	Jalkotzy et al. (1997)
Wolf (Northern Great Lakes region)	>0.45 km/km^2 (few packs exist above this threshold); >1.0 km/km^2 (no pack exist above this threshold)	Mladenoff et al. (1995)
Wolf (Wisconsin)	0.63 km/km^2 (increasing due to greater human tolerance	Wydeven et al. (2001)
Wolf, mountain lion (Minnesota, Wisconsin, Michigan)	0.6 km/km^2 (apparent threshold value for a naturally functioning landscape containing sustained populations)	Thiel (1985); van Dyke et al. (1986); Jensen et al. (1986); Mech et al. (1988); Mech (1989)
Elk (Idaho)	1.9 km/km^2 (density standard for habitat effectiveness)	Woodley 2000 cited in Beazley et al. 2004
Elk (Northern US)	1.24 km/km^2 (habitat effectiveness decline by at least 50%)	Lyon (1983)
Elk, bear, wolverine, lynx, and others	0.63 km/km^2 (reduced habitat security and increased mortality)	Wisdom et al. (2000)
Moose (Ontario)	0.2-0.4 km/km2 (threshold for pronounced response)	Beyer et al. (2013)
Black bear (North Carolina)	>1.25 km/km^2 (open roads); >0.5 km/km2 (logging roads); (interference with use of habitat)	Brody and Pelton (1989)
Black bear	0.25 km/km^2 (road density should not exceed)	Jalkotzy et al. (1997)
Bobcat (Wisconsin)	1.5 km/km^2 (density of all road types in home range)	Jalkotzy et al. (1997)
Large mammals	>0.6 km/km^2 (apparent threshold value for a naturally functioning landscape containing sustained populations)	Forman and Hersperger (1996)
Fish populations (Medicine Bow National Forest)	(1) Positive correlation of numbers of culverts and stream crossings and amount of fine sediment in stream channels (2) Negative correlation of fish density and numbers of culverts	Eaglin and Hubert (1993) cited in Gucinski et al. (2001)
Macroinvertebrates	Species richness negatively correlated with an index of road density	McGurk and Fong (1995)
Non-anadromous salmonids (Upper Columbia River basin)	(1) Negative correlation likelihood of spawning and rearing and road density (2) Negative correlation of fish density and road density	Lee et al. (1997)

Where both stream and road densities are high, the incidence of connections between roads and streams can also be expected to be high, resulting in more common and pronounced effects of roads on streams (Gucinski et al. 2000). For example, a study on the Medicine Bow National Forest (WY) found as the number of culverts and stream crossings increased, so did the amount of sediment in stream channels (Eaglin and Hubert 1993). They also found a negative correlation with fish density and the number of culverts. Invertebrate communities can also be impacted. McGurk and Fong (1995) report a negative correlation between an index of road density with macroinvertebrate diversity.

Anderson et al. (2012) also showed that watershed conditions tend to be best in areas protected from road construction and development. Using the US Forest Service's Watershed Condition Framework assessment data, they showed that National Forest lands that are protected under the Wilderness Act, which provides the strongest safeguards, tend to have the healthiest watersheds. Watersheds in Inventoried Roadless Areas – which are protected from road building and logging by the Roadless Area Conservation Rule – tend to be less healthy than watersheds in designated Wilderness, but they are considerably healthier than watersheds in the managed landscape.

Impacts on other resources

Roads and motorized trails also play a role in affecting wildfire occurrence. Research shows that human-ignited wildfires, which account for more than 90% of fires on national lands, is almost five times more likely in areas with roads (USDA Forest Service 1996a; USDA Forest Service 1998). Furthermore, Baxter (2002) found that off-road vehicles (ORVs) can be a significant source of fire ignitions on forestlands. Roads can affect where and how forests burn and, by extension, the vegetative condition of the forest. See Attachment 1 for more information documenting the relationship between roads and wildfire occurrence.

Finally, access allowed by roads and trails can increase of ORV and motorized use in remote areas threatening archaeological and historic sites. Increased visitation has resulted in intentional and unintentional damage to many cultural sites (USDI Bureau of Land Management 2000, Schiffman 2005).

II. Climate Change and Transportation Infrastructure including the value of roadless areas for climate change adaptation

As climate change impacts grow more profound, forest managers must consider the impacts on the transportation system as well as from the transportation system. In terms of the former, changes in precipitation and hydrologic patterns will strain infrastructure at times to the breaking point resulting in damage to streams, fish habitat, and water quality as well as threats to public safety. In terms of the latter, the fragmenting effect of roads on habitat will impede the movement of species which is a fundamental element of adaptation. Through planning, forest managers can proactively address threats to infrastructure, and can actually enhance forest resilience by removing unneeded roads to create larger patches of connected habitat.

Impact of climate change and roads on transportation infrastructure

In addition to a much warmer climate, it is expected that climate change will be responsible for more extreme weather events, leading to increasing flood severity, more frequent landslides, changing hydrographs (peak, annual mean flows, etc.), and changes in erosion and sedimentation rates and delivery processes[3]. Roads and trails in national forests, if designed by an engineering standard at all, were designed for storms and water flows typical of past decades, and hence may not be designed for the storms in future decades. Hence, climate driven changes may cause transportation infrastructure to malfunction or fail (ASHTO 2012, USDA Forest Service 2010). The likelihood is higher for facilities in high-risk settings—such as rain-on-snow zones, coastal areas, and landscapes with unstable geology (USDA Forest Service 2010).

Forests fragmented by roads will likely demonstrate less resistance and resilience to stressors, like those associated with climate change (Noss 2001). First, the more a forest is fragmented (and therefore the higher the edge/interior ratio), the more the forest loses its inertia characteristic, and becoming less resilient and resistant to climate change. Second, the more a forest is fragmented characterized by isolated patches, the more likely the fragmentation will interfere with the ability of species to track shifting climatic conditions over time and space. Noss (2001) predicts that weedy species with effective dispersal mechanisms might benefit from fragmentation at the expense of native species.

Modifying infrastructure to increase resilience

To prevent or reduce road failures, culvert blow-outs, and other associated hazards, forest managers will need to take a series of actions. These include replacing undersized culverts with larger ones, prioritizing maintenance and upgrades (e.g., installing drivable dips and more outflow structures), and obliterating roads that are no longer needed and pose erosion hazards (USDA Forest Service 2010, USDA Forest Service 2012a, USDA Forest Service 2011, Table 4).

Olympic National Forest has developed a number of documents oriented at oriented at protecting watershed health and species in the face of climate change, including a 2003 travel management strategy and a report entitled Adapting to Climate Change in Olympic National Park and National Forest. In the travel management strategy, Olympic National Forest recommended that 1/3rd of its road system be decommissioned and obliterated (USDA Forest Service 2011a). In addition, the plan called for addressing fish migration barriers in a prioritized and strategic way – most of these are associated with roads. The report calls for road decommissioning, relocation of roads away from streams, enlarging culverts as well as replacing culverts with fish-friendly crossings (USDA Forest Service 2011a, Table 4).

[3] http://www.epa.gov/climatechange/impacts-adaptation/southwest.html

Table 4: Current and expected sensitivities of fish to climate change on the Olympic Peninsula, associated adaptation strategies and action for fisheries and fish habitat management and relevant to transportation management at Olympic National Forest and Olympic National Park (excerpt reprinted from USDA Forest Service 2011a).

Current and expected sensitivites	**Adaptation strategies and actions**
Changes in habitat quantity and quality	• Implement habitat restoration projects that focus on re-creating watershed processes and functions and that create diverse, resilient habitat.
Increase in culvert failures, fill-slope failures, stream adjacent road failures, and encroachment from stream-adjacent road segments	• Decommission unneeded roads. • Remove sidecast, improve drainage, and increase culvert sizing on remaining roads. • Relocate stream-adjacent roads.
Greater difficulty disconnecting roads from stream channels	• Design more resilient stream crossing structures.
Major changes in quantity and timing of streamflow in transitional watersheds	• Make road and culvert designs more conservative in transitional watersheds to accommodate expected changes.
Decrease in area of headwater streams	• Continue to correct culvert fish passage barriers. • Consider re-prioritizing culvert fish barrier correction projects.
Decrease in habitat quantity and connectivity for species that use headwater streams	• Restore habitat in degraded headwater streams that are expected to retain adequate summer streamflow (ONF).

In December 2012, the USDA Forest Service published a report entitled “Assessing the Vulnerability of Watersheds to Climate Change.” This document reinforces the concept expressed by Olympic National Forest that forest managers need to be proactive in reducing erosion potential from roads:

> “Road improvements were identified as a key action to improve condition and resilience of watersheds on all the pilot Forests. In addition to treatments that reduce erosion, road improvements can reduce the delivery of runoff from road segments to channels, prevent diversion of flow during large events, and restore aquatic habitat connectivity by providing for passage of aquatic organisms. As stated previously, watershed sensitivity is determined by both inherent and management-related factors. Managers have no control over the inherent factors, so to improve resilience, efforts must be directed at anthropogenic influences such as instream flows, roads, rangeland, and vegetation management….
>
> [Watershed Vulnerability Analysis] results can also help guide implementation of travel management planning by informing priority setting for decommissioning roads and road reconstruction/maintenance. As with the Ouachita NF example, disconnecting roads from the stream network is a key objective of such work. Similarly, WVA analysis could also help prioritize aquatic organism passage projects at road-stream crossings to allow migration by aquatic residents to suitable habitat as streamflow and temperatures change” (USDA Forest Service 2012a, p. 22-23).

Reducing fragmentation to enhance aquatic and terrestrial species adaptation
Decommissioning and upgrading roads and thus reducing the amount of fine sediment deposited on salmonid nests can increase the likelihood of egg survival and spawning success (McCaffery et al. 2007). In addition, this would reconnect stream channels and remove barriers such as culverts. Decommissioning roads in riparian areas may provide further benefits to salmon and other aquatic organisms by permitting reestablishment of streamside vegetation, which provides shade and maintains a cooler, more moderated microclimate over the stream (Battin et al. 2007).

One of the most well documented impacts of climate change on wildlife is a shift in the ranges of species (Parmesan 2006). As animals migrate, landscape connectivity will be increasingly important (Holman et al. 2005). Decommissioning roads in key wildlife corridors will improve connectivity and be an important mitigation measure to increase resiliency of wildlife to climate change. For wildlife, road decommissioning can reduce the many stressors associated with roads. Road decommissioning restores habitat by providing security and food such as grasses and fruiting shrubs for wildlife (Switalski and Nelson 2011).

Forests fragmented by roads and motorized trail networks will likely demonstrate less resistance and resilience to stressors, such as weeds. As a forest is fragmented and there is more edge habitat, Noss (2001) predicts that weedy species with effective dispersal mechanisms will increasingly benefit at the expense of native species. However, decommissioned roads when seeded with native species can reduce the spread of invasive species (Grant et al. 2011), and help restore fragmented forestlands. Off-road vehicles with large knobby tires and large undercarriages are also a key vector for weed spread (e.g., Rooney 2006). Strategically closing and decommissioning motorized routes, especially in roadless areas, will reduce the spread of weeds on forestlands (Gelbard and Harrison 2003).

Transportation infrastructure and carbon sequestration
The topic of the relationship of road restoration and carbon has only recently been explored. There is the potential for large amounts of carbon (C) to be sequestered by reclaiming roads. When roads are decompacted during reclamation, vegetation and soils can develop more rapidly and sequester large amounts of carbon. A recent study estimated total soil C storage increased 6 fold to 6.5 x 107g C/km (to 25 cm depth) in the northwestern US compared to untreated abandoned roads (Lloyd et al. 2013). Another recent study concluded that reclaiming 425 km of logging roads over the last 30 years in Redwood National Park in Northern California resulted in net carbon savings of 49,000 Mg carbon to date (Madej et al. 2013, Table 5).

Kerekvliet et al. (2008) published a Wilderness Society briefing memo on the impact to carbon sequestration from road decommissioning. Using Forest Service estimates of the fraction of road miles that are unneeded, the authors calculated that restoring 126,000 miles of roads to a natural state would be equivalent to revegetating an area larger than Rhode Island. In addition, they calculate that the net economic benefit of road treatments are always positive and range from US$0.925-1.444 billion.

Table 5. Carbon budget implications in road decommissioning projects (reprinted from Madej et al. 2013).

Road Decommissioning Activities and Processes	Carbon Cost	Carbon Savings
Transportation of staff to restoration sites (fuel emissions)	X	
Use of heavy equipment in excavations (fuel emissions)	X	
Cutting trees along road alignment during hillslope recontouring	X	
Excavation of road fill from stream crossings		X
Removal of road fill from unstable locations		X
Reduces risk of mass movement		X
Post-restoration channel erosion at excavation sites	X	
Natural revegetation following road decompaction		X
Replanting trees		X
Soil development following decompaction		X

Benefits of roadless areas and roadless area networks to climate change adaptation
Undeveloped natural lands provide numerous ecological benefits. They contribute to biodiversity, enhance ecosystem representation, and facilitate connectivity (Loucks et al. 2003; Crist and Wilmer 2002, Wilcove 1990, The Wilderness Society 2004, Strittholt and Dellasala 2001, DeVelice and Martin 2001), and provide high quality or undisturbed water, soil and air (Anderson et al. 2012, Dellasalla et al. 2011). They also can serve as ecological baselines to help us better understand our impacts to other landscapes, and contribute to landscape resilience to climate change.

Forest Service roadless lands, in particular, are heralded for the conservation values they provide. These are described at length in the preamble of the Roadless Area Conservation Rule (RACR)[4] as well as in the Final Environmental Impact Statement (FEIS) for the RACR[5], and include: high quality or undisturbed soil, water, and air; sources of public drinking water; diversity of plant and animal communities; habitat for threatened, endangered, proposed, candidate, and sensitive species and for those species dependent on large, undisturbed areas of land; primitive, semi-primitive non- motorized, and semi-primitive motorized classes of dispersed recreation; reference landscapes; natural appearing landscapes with high scenic quality; traditional cultural properties and sacred sites; and other locally identified unique characteristics (e.g., include uncommon geological formations, unique wetland complexes, exceptional hunting and fishing opportunities).

The Forest Service, National Park Service, and US Fish and Wildlife Service recognize that protecting and connecting roadless or lightly roaded areas is an important action agencies can take to enhance climate change adaptation. For example, the Forest Service National Roadmap for Responding to Climate Change (USDA Forest Service 2011b) establishes that increasing connectivity and reducing fragmentation are short and long term actions the Forest Service

[4] Federal Register .Vol. 66, No. 9. January 12, 2001. Pages 3245-3247.
[5] Final Environmental Impact Statement, Vol. 1, 3–3 to 3–7

should take to facilitate adaptation to climate change.[6] The National Park Service also identifies connectivity as a key factor for climate change adaptation along with establishing "blocks of natural landscape large enough to be resilient to large-scale disturbances and long-term changes" and other factors. The agency states that: "The success of adaptation strategies will be enhanced by taking a broad approach that identifies connections and barriers across the landscape. Networks of protected areas within a larger mixed landscape can provide the highest level of resilience to climate change."[7] Similarly, the National Fish, Wildlife and Plants Climate Adaptation Partnership's Adaptation Strategy (2012) calls for creating an ecologically-connected network of conservation areas.[8]

Roadless lands also are responsible for higher quality water and watersheds. Anderson et al. (2012) assessed the relationship of watershed condition and land management status and found a strong spatial association between watershed health and protective designations. Dellasalla et al. (2011) found that undeveloped and roadless watersheds are important for supplying downstream users with high-quality drinking water, and developing these watersheds comes at significant costs associated with declining water quality and availability. The authors recommend a light-touch ecological footprint to sustain the many values that derive from roadless areas including healthy watersheds.

---

[6] Forest Service, 2011. *National Roadmap for Responding to Climate Change*. US Department of Agriculture. FS-957b. Page 26.

[7] National Park Service. *Climate Change Response Program Brief.* http://www.nature.nps.gov/climatechange/adaptationplanning.cfm. Also see: National Park Service, 2010. *Climate Change Response Strategy*. http://www.nature.nps.gov/climatechange/docs/NPS_CCRS.pdf. Objective 6.3 is to "Collaborate to develop cross-jurisdictional conservation plans to protect and restore connectivity and other landscape-scale components of resilience."

[8] See http://www.wildlifeadaptationstrategy.gov/pdf/NFWPCAS-Chapter-3.pdf. Pages 55- 59. The first goal and related strategies are:

> Goal 1: Conserve habitat to support healthy fish, wildlife, and plant populations and ecosystem functions in a changing climate.
>
>> Strategy 1.1: identify areas for an ecologically-connected network of terrestrial, freshwater, coastal, and marine conservation areas that are likely to be resilient to climate change and to support a broad range of fish, wildlife, and plants under changed conditions.
>>
>> Strategy 1.2: Secure appropriate conservation status on areas identified in Strategy 1.1 to complete an ecologically-connected network of public and private conservation areas that will be resilient to climate change and support a broad range of species under changed conditions.
>>
>> Strategy 1.4: Conserve, restore, and as appropriate and practicable, establish new ecological connections among conservation areas to facilitate fish, wildlife, and plant migration, range shifts, and other transitions caused by climate change.

III. Sustainable Transportation Management in National Forests as Part of Ecological Restoration

At 375,000 miles strong, the Forest Service road system is one of the largest in the world – it is eight times the size of the National Highway System. It is also indisputably unsustainable – that is, roads are not designed, located, or maintained according to best management practices, and environmental impacts are not minimized. It is largely recognized that forest roads, especially unpaved ones, are a primary source of sediment pollution to surface waters (Endicott 2008, Gucinski et al. 2000), and that the system has about 1/3rd more miles than it needs (USDA Forest Service 2001). In addition, the majority of the roads were constructed decades ago when road design and management techniques did not meet current standards (Gucinski et al. 2000, Endicott 2008), making them more vulnerable to erosion and decay than if they had been designed today. Road densities in national forests often exceed accepted thresholds for wildlife.

Only a small portion of the road system is regularly used. All but 18% of the road system is inaccessible to passenger vehicles. Fifty-five percent of the roads are accessible only by high clearance vehicles and 27% are closed. The 18% that is accessible to cars is used for about 80% of the trips made within National Forests.[9] Most of the road maintenance funding is directed to the passenger car roads, while the remaining roads suffer from neglect. As a result, the Forest Service currently has a $3.7 billion road maintenance backlog that grows every year. In other words, only about 1/5th of the roads in the national forest system are used most of the time, and the fraction that is used often is the best designed and maintained because they are higher level access roads. The remaining roads sit generally unneeded and under-maintained – arguably a growing ecological and fiscal liability.

Current Forest Service management direction is to identify and implement a sustainable transportation system.[10] The challenge for forest managers is figuring out what is a sustainable road system and how to achieve it – a challenge that is exacerbated by climate change. It is reasonable to define a sustainable transportation system as one where all the routes are constructed, located, and maintained with best management practices, and social and environmental impacts are minimized. This, of course, is easier said than done, since the reality is that even the best roads and trail networks can be problematic simply because they exist and usher in land uses that without the access would not occur (Trombulak and Frissell 2000, Carnefix and Frissell 2009, USDA Forest Service 1996b), and when they are not maintained to the designed level they result in environmental problems (Endicott 2008; Gucinski et al. 2000). Moreover, what was sustainable may no longer be sustainable under climate change since roads designed to meet older climate criteria may no longer hold up under new climate scenarios (USDA Forest Service 2010, USDA Forest Service 2011b, USDA Forest Service 2012a, AASHTO 2012).

Forest Service efforts to move toward a more sustainable transportation system

The Forest Service has made efforts to make its transportation system more sustainable, but still has considerable work to do. In 2001, the Forest Service tried to address the issue by

[9] USDA Forest Service. Road Management Website Q&As. Available online at http://www.fs.fed.us/eng/road_mgt/qanda.shtml.

[10] See Forest Service directive memo dated March 29, 2012 entitled “Travel Management, Implementation of 36 CFR, Part 202, Subpart A (36 CFR 212.5(b))”

promulgating the Roads Rule[11] with the purpose of working toward a sustainable road system (USDA 2001). The Rule directed every national forest to identify a minimum necessary road system and identify unneeded roads for decommissioning. To do this, the Forest Service developed the Roads Analysis Process (RAP), and published Gucinski et al. (2000) to provide the scientific foundation to complement the RAP. In describing the RAP, Gucinski et al. (2000) writes:

> "Roads Analysis is intended to be an integrated, ecological, social, and economic approach to transportation planning. It uses a multiscale approach to ensure that the identified issues are examined in context. Roads Analysis is to be based on science. Analysts are expected to locate, correctly interpret, and use relevant existing scientific literature in the analysis, disclose any assumptions made during the analysis, and reveal the limitations of the information on which the analysis is based. The analysis methods and the report are to be subjected to critical technical review" (p. 10).

Most national forests have completed RAPs, although most only looked at passenger vehicle roads which account for less than 20% of the system's miles. The Forest Service Washington Office in 2010 directed that forests complete a Travel Analysis Process (TAP) by the end of fiscal year 2015, which must address all roads and create a map and list of roads identifying which are likely needed and which are not. Completed TAPs will provide a blueprint for future road decommissioning and management, they will not constitute compliance with the Roads Rule, which clearly requires the identification of the minimum roads system and roads for decommissioning. Almost all forests have yet to comply with subpart A.

The Forest Service in 2005 then tried to address the off-road portion of this issue by promulgating subpart B of the Travel Management Rule,[12] with the purpose of curbing the most serious impacts associated with off-road vehicle use. Without a doubt, securing summer-time travel management plans was an important step to curbing the worst damage. However, much work remains to be done to approach sustainability, especially since many national forests used the travel management planning process to simply freeze the footprint of motorized routes, and did not try to re-design the system to make it more ecologically or socially sustainable. Adams and McCool (2009) considered this question of how to achieve sustainable motorized recreation and concluded that:

> As the agencies move to revise [off-road vehicle] allocations, they need to clearly define how they intend to locate routes so as to minimize impacts to natural resources and other recreationists in accordance with Executive Order 11644....[13]

---

[11] 36 CFR 215 subpart A

[12] 36 CFR 212 subpart B

[13] Recent court decisions have made it clear that the minimization requirements in the Executive Orders are not discretionary and that the Executive Orders are enforceable. See

- *Idaho Conservation League v. Guzman ,* 766 F. Supp. 2d 1056 (D. Idaho 2011) (Salmon-Challis National Forest TMP) .
- *The Wilderness Society v. U.S. Forest Service*, CV 08-363 (D. Idaho 2012) (Sawtooth-Minidoka district National Forest TMP).
- *Central Sierra Environmental Resource Center v. US Forest Service*, CV 10-2172 (E.D. CA 2012) (Stanislaus National Forest TMP).

> …As they proceed with designation, the FS and BLM need to acknowledge that current allocations are the product of agency failure to act, not design. Ideally, ORV routes would be allocated as if the map were currently empty of ORV routes. Reliance on the current baseline will encourage inefficient allocations that likely disproportionately impact natural resources and non-motorized recreationists. While acknowledging existing use, the agencies need to do their best to imagine the best possible arrangement of ORV routes, rather than simply tinkering around the edges of the current allocations.[14]

The Forest Service only now is contemplating addressing the winter portion of the issue, forced by a lawsuit challenging the Forest Service's inadequate management of snowmobiles. The agency is expected to issue a third rule in the fall of 2014 that will trigger winter travel management planning.

Strategies for identifying a minimum road system and prioritizing restoration
Transportation Management plays an integral role in the restoration of Forestlands. Reclaiming and obliterating roads is key to developing a sustainable transportation system. Numerous authors have suggested removing roads 1) to restore water quality and aquatic habitats Gucinski et al. 2000), and 2) to improve habitat security and restore terrestrial habitat (e.g., USDI USFWS 1993, Hebblewhite et al. 2009).

Creating a minimum road system through road removal will increase connectivity and decrease fragmentation across the entire forest system. However, at a landscape scale, certain roads and road segments pose greater risks to terrestrial and aquatic integrity than others. Hence, restoration strategies must focus on identifying and removing/mitigating the higher risk roads. Additionally, areas with the highest ecological values, such as being adjacent to a roadless area, may also be prioritized for restoration efforts. Several methods have been developed to help prioritize road reclamation efforts including GIS-based tools and best management practices (BMPs). It is our hope that even with limited resources, restoration efforts can be prioritized and a more sustainable transportation system created.

GIS-based tools
Girvetz and Shilling (2003) developed a novel and inexpensive way to analyze environmental impacts from road systems using the Ecosystem Management Decision Support program (EMDS). EMDS was originally developed by the United States Forest Service, as a GIS-based decision support tool to conduct ecological analysis and planning (Reynolds 1999). Working in conjunction with Tahoe National Forest managers, Girvetz and Shilling (2003) used spatial data on a number of aquatic and terrestrial variables and modeled the impact of the forest's road network. The network analysis showed that out of 8233 km of road analyzed, only 3483 km (42%) was needed to ensure current and future access to key points. They found that the modified network had improved patch characteristics, such as significantly fewer "cherry stem" roads intruding into patches, and larger roadlessness.

Shilling et al. (2012) later developed a recreational route optimization model using a similar methodology and with the goal of identifying a sustainable motorized transportation system for the Tahoe National Forest (Figure 2). Again using a variety of environmental factors, the model identified routes with high recreational benefits, lower conflict, lower maintenance and

[14] Page 105.

management requirements, and lower potential for environmental impact operating under the presumption that such routes would be more sustainable and preferable in the long term. The authors combined the impact and benefit analyses into a recreation system analysis "that was effectively a cost-benefit accounting, consistent with requirements of both the federal Travel Management Rule (TMR) and the National Environmental Policy Act" (p. 392**).**

The Wilderness Society in 2012 also developed a GIS decision support tool called "RoadRight" that identifies high risk road segments to a variety of forest resources including water, wildlife, and roadlessness (The Wilderness Society 2012, The Wilderness Society 2013). The GIS system is designed to provide information that will help forest planners identify and minimize road related environmental risks. See the summary of and user guide for RoadRight that provides more information including where to access the open source software.

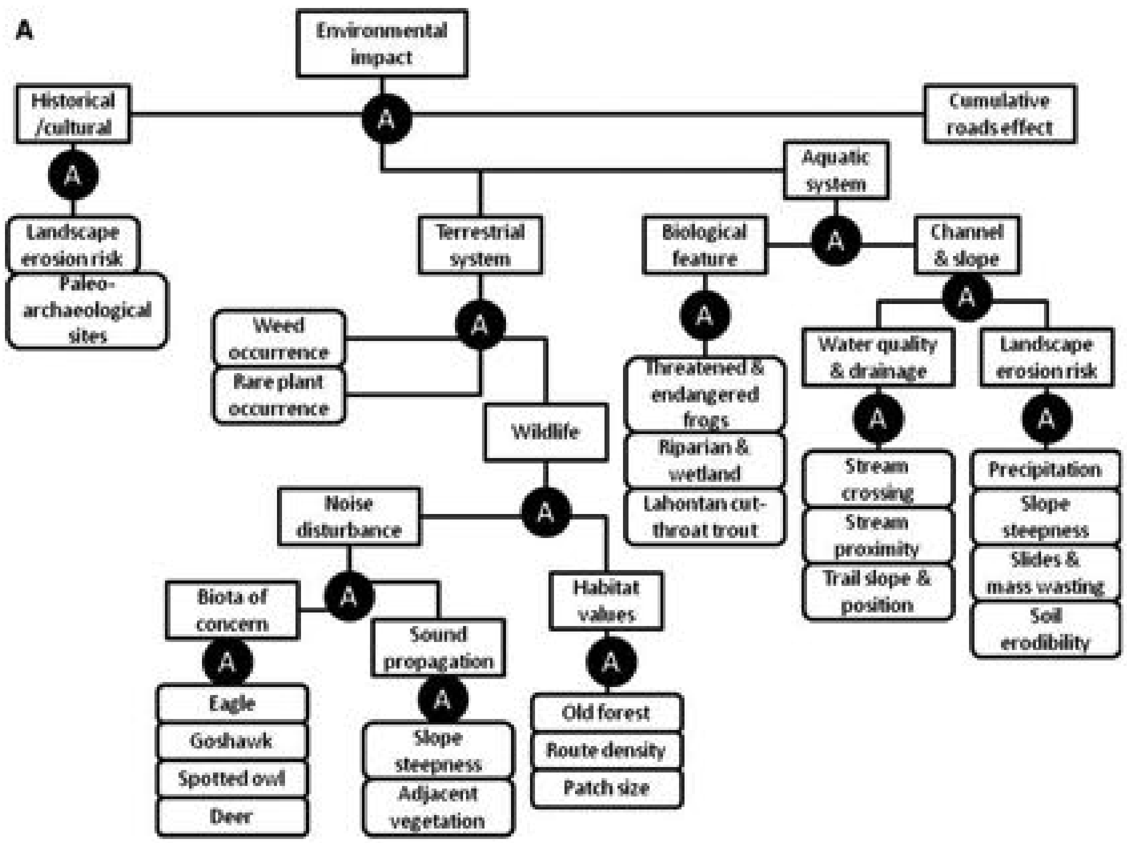


Figure 2: A knowledge base of contributions of various environmental conditions to the concept ''environmental impact'' [of motorized trails]. Rectangles indicate concepts, circles indicate Boolean logic operators, and rounded rectangles indicate sources of environmental data. (Reprinted from Shilling et al. 2012)

Best management practices (BMPs)
BMPs have also been developed to help create more sustainable transportation systems and identify restoration opportunities. BMPs provide science-based criteria and standards that land managers follow in making and implementing decisions about human uses and projects that affect natural resources. Several states have developed BMPs for road construction, maintenance and decommissioning practices (e.g., Logan 2001, Merrill and Cassaday 2003, USDA Forest Service 2012b).

Recently, BMPs have been developed for addressing motorized recreation. Switalski and Jones (2012) published, "*Off-Road Vehicle Best Management Practices for Forestlands: A Review of Scientific Literature and Guidance for Managers*." This document reviews the current literature on the environmental and social impacts of off-road vehicles (ORVs), and establishes a set of Best Management Practices (BMPs) for the planning and management of ORV routes on forestlands. The BMPs were designed to be used by land managers on all forestlands, and is consistent with current forest management policy and regulations. They give guidance to transportation planners on where how to place ORV routes in areas where they will reduce use conflicts and cause as little harm to the environment as possible. These BMPs also help guide managers on how to best remove and restore routes that are redundant or where there is an unacceptable environmental or social cost.

References

AASHTO. 2012. Adapting Infrastructure to Extreme Weather Events: Best Practices and Key Challenges. Background Paper. AASHTO Workshop. Traverse City, Michigan, May 20, 2012. Available at: http://climatechange.transportation.org/pdf/adapt_background5-20-12.pdf.

Adams, J.C., and S.F. McCool. 2009. Finite recreation opportunities: The Forest Service, the Bureau of Land Management, and off-road vehicle management. Natural Areas Journal 49: 45–116.

Anderson, H.M., C. Gaolach, J. Thomson, and G. Aplet. 2012. Watershed Health in Wilderness, Roadless, and Roaded Areas of the National Forest System. Wilderness Society Report. 11 p.

Barton, D.C., A.L. Holmes. 2007. Off-highway vehicle trail impacts on breeding songbirds in northeastern California. The Journal of Wildlife Management 71(5):1817-1620.

Battin J., M.W. Wiley, M.H. Ruckelshaus, R.N. Palmer, E. Korb, K.K. Bartz, and H. Imaki. 2007. Projected impacts of climate change on salmon habitat restoration. Proceedings of the National Academy of Sciences of the United States of America 104: 6720–6725.

Baxter, C.V., C.A. Frissell, and F.R. Hauer. 1999. Geomorphology, logging roads, and the distribution of bull trout spawning in a forested river basin: implications for management and conservation. Transactions of the American Fisheries Society 128: 854–867.

Baxter, G. 2002. All terrain vehicles as a cause of fire ignition in Alberta forests. Advantage (Publication of the Forest Engineering Research Institute of Canada) 3(44): 1-7.

Beazley, K., T. Snaith, F. MacKinnon, and D. Colville. 2004. Road density and the potential impacts on wildlife species such as American moose in mainland Nova Scotia. Proceedings of the Nova Scotia Institute of Science 42: 339-357.

Belnap, J. 2003. The world at your feet: desert biological soil crusts. Frontiers in Ecology and the Environment 1(5):181-189.

Benítez-López , A., R. Alkemade, and P.A. Verweij. 2010. The impacts of roads and other infrastructure on mammal and bird populations: a meta-analysis. Biological Conservation 143: 1307-1316.

Beyer, H.L., R. Ung, D.L. Murray, and M.J. Fortin. 2013 Functional responses, seasonal variation and thresholds in behavioural responses of moose to road density. Journal of Applied Ecology 50: 286–294.

Brehme, C.S., and J.A. Tracey, L.R. McClenaghan, and R.N. Fisher. 2013. Permeability of roads to movement of scrubland lizards and small mammals. Conservation Biology 27(4): 710–720.

Bowles, A.E. 1997. Responses of wildlife to noise. In Wildlife and recreationists: coexistence through management and research. Edited by R.L. Knight and K.J. Gutzwiller. Island Press, Washington, DC. p. 109–156.

Brody, A.J., and M.R. Pelton. 1989. Effects of roads on black bear movements in western North Carolina. Wildlife Society Bulletin 17: 5-10.

Call, M. 1979. Habitat management guides for birds of prey. Bureau of Land Management, Technical Note 338, Denver 70 p. Available at: https://archive.org/download/habitatmanagemen00call/habitatmanagemen00call.pdf

Carnefix, G., and C. A. Frissell. 2009. Aquatic and Other Environmental Impacts of Roads: The Case for Road Density as Indicator of Human Disturbance and Road-Density Reduction as Restoration Target; A Concise Review. Pacific Rivers Council Science Publication 09-001. Pacific Rivers Council, Portland, OR and Polson, MT. Available at: http://www.pacificrivers.org/science-research/resources-publications/road-density-as-indicator/download

Coffin, A. 2006. From roadkill to road ecology: A review of the ecological effects of roads. Journal of Transport Geography 15: 396-406.

Crist, M.R., and B. Wilmer. 2002. Roadless Areas: The Missing Link in Conservation. The Wilderness Society, Washington D.C.

Davenport, J., and T.A. Switalski. 2006. Environmental impacts of transport related to tourism and leisure activities. In: The ecology of transportation: managing mobility for the environment, editors: J Davenport and Julia Davenport. Dordrecht, Netherlands: Kluwer Academic Publishers. 333-360. Available at: http://www.wildlandscpr.org/files/uploads/PDFs/d_Switalski_2006_Enviro_impacts_of_transport.pdf

DellaSala, D., J. Karr, and D. Olson. 2011. Roadless areas and clean water. Journal of Soil and Water Conservation, vol. 66, no. 3. May/June 2011.

DeVelice, R., and J.R. Martin. 2001. Assessing the extent to which roadless areas complement the conservation of biological diversity. Ecological Applications 11(4): 1008-1018.

Endicott, D. 2008. National Level Assessment of Water Quality Impairments Related to Forest Roads and Their Prevention by Best Management Practices. A Report Prepared by the Great Lakes Environmental Center for the Environmental Protection Agency, Office of Water, December 4, 2008. 259 pp.

Edge, W.D., and C.L. Marcum. 1985. Movements of elk in relation to logging disturbances. Journal of Wildlife Management 49(4): 926–930.

Fahrig, L., and T. Rytwinski. 2009. Effects of roads on animal abundance: an empirical review and synthesis. Ecology and Society 14(1): 21. Available at: http://www.ecologyandsociety.org/vol14/iss1/art21/.

Foltz, R.B. N.S. Copeland, and W.J. Elliot. 2009. Reopening abandoned forest roads in northern Idaho, USA: Quantification of runoff, sediment concentration, infiltration, and interrill erosion parameters. Journal of Environmental Management 90: 2542–2550.

Forman, R. T. T., and A.M. Hersperger. 1996. Road ecology and road density in different landscapes, with international planning and mitigation solutions. Pages 1–22. IN: G. L. Evink, P. Garrett, D. Zeigler, and J. Berry (eds.), Trends in Addressing Transportation Related Wildlife Mortality. No. FLER- 58-96, Florida Department of Transportation, Tallahassee, Florida.

Foreman, R.T.T., D. Sperling, J.A. Bissonette et al. 2003. Road Ecology – Science and Solutions. Island Press. Washington, D.C. 504 p.

Furniss, M.J., T.D. Roelofs, and C.S. Yee. 1991. Road construction and maintenance. In: Meehan, W.R., ed. Influences of forest and rangeland management on salmonid fishes and their habitats. Spec. Publ. 19. Bethesda, MD: American Fisheries Society. p. 297-323.

Gaines, W.L., P. Singleton, and R.C. Ross. 2003. Assessing the cumulative effects of linear recreation routes on wildlife habitats on the Okanogan and Wenatchee National Forests. Gen. Tech. Rep. PNW-GTR-586. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 79 p. Available at: http://www.montanawildlife.com/projectsissues/Assessingthecumulativeeffectsoflinearrecreationroutesonwildlifehabitats.pdf

Gelbard, J.L., and S. Harrison. 2003. Roadless habitats as refuges for native grasslands: interactions with soil, aspect, and grazing. Ecological Applications 13(2): 404-415.

Girvetz, E., and F. Shilling. 2003. Decision Support for Road System Analysis and Modification on the Tahoe National Forest. Environmental Management 32(2): 218–233

Grant, A., C.R. Nelson, T.A. Switalski, and S.M. Rinehart. 2011. Restoration of native plant communities after road decommissioning in the Rocky Mountains: effect of seed mix composition & soil properties on vegetatative establishment. Restoration Ecology 19: 160-169.

Gucinski, M., J. Furniss, R. Ziemer, and M.H. Brookes. 2000. Forest Roads: A Synthesis of Scientific Information. Gen. Tech. Rep. PNWGTR-509. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 103 p. Available at: http://www.fs.fed.us/pnw/pubs/gtr509.pdf.

Hamann, B., H. Johnston, P. McClelland, S. Johnson, L. Kelly, and J. Gobielle. 1999. Birds. In: G. Joslin, and H. Youmans (ed), Effects of Recreation on Rocky Mountain Wildlife: A Review for Montana Committee on Effects of Recreation on Wildlife, Montana Chapter of the Wildlife Society. P. 3.1-3.3.

Hargis, C.D., J.A. Bissonette, and D.T. Turner. 1999. The influence of forest fragmentation and landscape pattern on American martens. Journal of Applied Ecology 36(1): 157–172.

Hebblewhite, M., R.H. Munro, E.H Merrill. 2009. Trophic consequences of postfire logging in a wolf-ungulate system. Forest Ecology and Management 257(3): 1053-1062.

Holman, I.P., R.J. Nicholls, P.M. Berry, P.A. Harrison, E. Audsley, S. Shackley, and M.D.A. Rounsevell. 2005. A regional, multi-sectoral and integrated assessment of the impacts of climate and socio-economic change in the UK. Part II. Results. Climatic Change 71: 43-73.

Jalkotzy, M.G., P.I. Ross, and M.D. Nasserden. 1997. The effects of linear developments on wildlife: a review of selected scientific literature. Prepared for Canadian Association of Petroleum Producers. Arc Wildlife Services, Ltd., Calgary, AB. 115 p.

Jensen W.F., T.K. Fuller, and W.L. Robinson. 1986. Wolf (*Canis lupus*) distribution on the Onterio-Michigan border near Sault Ste. Marie. Canadian Field-Naturalist 100: 363-366.

Jones, S. 1979. The accipiters: goshawk, Cooper's hawk, sharp-shinned hawk. Habitat Management Series for Unique or Endangered Species Report Number 17. Technical Note 335, USDI Bureau of Land Management, 55 p.

Joslin, G., and H. Youmans, coordinators. 1999. Effects of recreation on Rocky Mountain wildlife: A Review for Montana. Committee on Effects of Recreation on Wildlife, Montana Chapter of The Wildlife Society. 307 p. Available at: http://joomla.wildlife.org/Montana/index

Kasworm, W.F., and T.L. Manley. 1990. Road and trail influences on grizzly bears and black bears in northwest Montana. International Conference on Bear Research and Management 8: 79-84.

Kerkvliet, J., J. Hicks, and B. Wilmer. 2008. Carbon Sequestered when Unneeded National Forest Roads are Revegetated. The Wilderness Society Briefing Memo. Available at: http://wilderness.org/sites/default/files/legacy/brief_carbonandroads.pdf.

Lee, D., J. Sedell, B.E. Rieman, R. Thurow, and J. Williams. 1997. Broad-scale assessment of aquatic species and habitats. In: An assessment of ecosystem components in the interior Columbia basin and portions of the Klamath and Great Basins. Edited by T.M. Quigley and S.J. Arbelbide. General Technical ReportPNW-GTR-405. USDA Forest Service, Pacific Northwest Research Station, Portland, OR. Vol III. p. 183–196.

Lloyd, R., K. Lohse, and T.P.A. Ferre. 2013. Influence of road reclamation techniques on forest ecosystem recovery. Frontiers in Ecology and the Environment 11(2): 75-81.

Loucks, C., N. Brown, A. Loucks, and K. 2003. USDA Forest Service roadless areas: potential biodiversity conservation reserves. Conservation Ecology 7(2): 5.
Available at: http://www.ecologyandsociety.org/vol7/iss2/art5/

Logan, R. 2001. Water Quality BMPs for Montana Forests. Montana Department of Environmental Quality. Missoula, MT. 60p. Available at: https://dnrc.mt.gov/Forestry/Assistance/Practices/Documents/2001WaterQualityBMPGuide.pdf

Lyon, L.J. 1983. Road density models describing habitat effectiveness for elk. Journal of Forestry 81: 592-595.

Madej, M., J. Seney, and P. van Mantgem. 2013. Effects of road decommissioning on carbon stocks, losses, and emissions in north coastal California. Restoration Ecology 21(4): 439–446.

McCaffery M., T.A. Switalski, and L. Eby. 2007. Effects of road decommissioning on stream habitat characteristics in the South Fork Flathead River, Montana. Transactions of the American Fisheries Society 136: 553-561.

McGurk, B.J., and D.R. Fong, 1995. Equivalent roaded area as a measure of cumulative effect of logging. Environmental Management 19: 609-621.

Mech, L D. 1989. Wolf population survival in an area of high road density. American Midland Naturalist 121: 387-389.

Mech, L. D., S.H. Fritts, G.L. Radde, and W.J. Paul. 1988. Wolf distribution and road density in Minnesota. Wildlife Society Bulletin 16: 85-87.

Merrilll, B.R., and E. Cassaday. 2003. Best Management Practices for Road Rehabilitation – Road – Stream Crossing Manual. California State Parks. Eureka, CA. 25p. Available at: http://www.parks.ca.gov/pages/23071/files/streamcrossingremovalbmp5_03.pdf

Mladenoff, D.J., T.A. Sickley, R.G. Haight, and A.P. Wydeven. 1995. A regional landscape analysis and prediction of favorable gray wolf habitat in the Northern Great Lakes region. Conservation Biology 9: 279-294.

Munger J.C., B.R. Barnett, S.J. Novak, A.A. Ames. 2003. Impacts of off-highway motorized vehicle trails on the reptiles and vegetation of the Owyhee Front. Idaho Bureau of Land Management Technical Bulletin 03-3:1-23.

Moore, T. 2007. [unpublished draft]. National Forest System Road Trends, Trends Analysis Submitted to Office of Management and Budget. United States Department of Agriculture, Forest Service, Engineering Staff, Washington Office, Washington, DC.

National Fish, Wildlife and Plants Climate Adaptation Partnership (NFWPCAP). 2012. National Fish, Wildlife and Plants Climate Adaptation Strategy. Association of Fish and Wildlife Agencies, Council on environmental Quality, Great Lakes Indian Fish and Wildlife Commission, National Oceanic and Atmospheric Administration, and U.S. Fish and Wildlife Service. Washington, DC.

Noss, R.F. 2001. Beyond Kyoto: forest management in a time of rapid climate change. Conservation Biology 15(3): 578-590.

Ortega, Y.K., and D.E. Capen. 2002. Roads as edges: effects on birds in forested landscapes. Forest Science 48(2): 381–396.

Ouren, D.S., C. Haas, C.P. Melcher, S.C. Stewart, P.D. Ponds, N.R. Sexton, L. Burris, T. Fancher, and Z.H. Bowen. 2007. Environmental effects of off-highway vehicles on Bureau of Land Management lands: A literature synthesis, annotated bibliographies, extensive bibliographies, and internet resources: U.S. Geological Survey, Open-File Report 2007-1353, 225 p.

Parmesan, C. 2006. Ecological and evolutionary responses to recent climate change. Annual Review of Ecology, Evolution, and Systematics 37: 637-669.

Quigley, T.M., and S.J. Arbelbide, tech. eds. 1997. An assessment of ecosystem components in the interior Columbia basin and portions of the Klamath and Great Basins: volume 1 and volume 3. Gen. Tech. Rep. PNW-GTR-405. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.
Available at: http://www.fs.fed.us/pnw/publications/pnw_gtr405/.

Reynolds, K. 1999. Netweaver for EMDS user guide (version1.1); a knowledge base development system. General technical Report PNW-GTR-471. USDA Forest Service, Pacific Northwest Research Station, Portland, OR.

Rhodes, J.J., McCullough, D.A., and F.A. Espinosa. 1994. A coarse screening process for evaluation of the effects of land management activities on salmon spawning and rearing habitat in ESA consultations. Tech. Rep. 94-4. Portland, OR: Columbia River Intertribal Fish Commission. 127 p.

Richardson, C.T., and C.K. Miller. 1997. Recommendations for protecting raptors from human disturbance: a review. Wildlife Society Bulletin 25: 634-638.

Rieman, B., D. Lee, G. Chandler, and D. Myers. 1997. Does wildfire threaten extinction for salmonids? Responses of Redband Trout and Bull Trout Following Recent Large Fires on the Boise National Forest, in Greenlee, J. M., Proceedings: First Conference on Fire Effects on Rare and Endangered Species and Habitats. Coeur d'Alene, Idaho. International Association of Wildland Fire. Fairfield, WA. p. 47-57.

Robichaud, P.R., L.H. MacDonald, and R.B. Foltz. 2010. Fuel management and Erosion. In: Cumulative Watershed Effects of Fuels Management in the Western United States. USDA Forest Service RMRS-GTR-231. P. 79-100. Available at: http://www.fs.fed.us/rm/pubs/rmrs_gtr231/rmrs_gtr231_079_100.pdf

Robinson, C., P.N. Duinker, and K.F. Beazley. 2010. A conceptual framework for understanding, assessing, and mitigation effects for forest roads. Environmental Review 18: 61-86.

Rooney, T.P. 2006. Distribution of ecologically-invasive plants along off-road vehicle trails in the Chequamegon National Forest, Wisconsin. The Michigan Botanist 44:178-182

Rost, G.R., and J.A. Bailey. 1979. Distribution of mule deer and elk in relation to roads. Journal of Wildlife Management 43(3): 634–641.

Rowland, M.M., M.J. Wisdom, B.K. Johnson, and M.A. Penninger. 2005. Effects of roads on elk: implications for management in forested ecosystems. Pages 42-52. IN: Wisdom, M.J., technical editor, The Starkey Project: a Synthesis of Long-term Studies of Elk and Mule Deer.

Reprinted from the 2004 Transactions of the North American Wildlife and Natural Resources Conference, Alliance Communications Group, Lawrence, KS.

Schiffman, L. 2005. Archaeology, Off-Road Vehicles, and the BLM. Published online April 20, 2005. Archeaology.
Available at: http://www.archaeology.org/online/features/southwest/

Semlitsch, R.D., T.J. Ryan, K. Hamed, M. Chatfield, B. Brehman, N. Pekarek, M. Spath, and A. Watland. 2007. Salamander abundance along road edges and within abandoned logging roads in Appalachian forests. Conservation Biology 21: 159-167.

Shilling, F., J. Boggs, and S. Reed. 2012. Recreational System Optimization to Reduce Conflict on Public Lands. Environmental Management 50: 381–395.

Strittholt, J., and D. Dellasala. 2001. Importance of Roadless Area Conservation in Forested Ecosystems: Case Study of the Klamath-Siskiyou Region of the United States. In Conservation Biology 15(6): 1742-1754.

Switalski, T.A., J.A. Bissonette, T.H. DeLuca, C.H. Luce, and M.A. Madej. 2004. Benefits and impacts of road removal. Frontiers in Ecology and the Environment. 2(1): 21-28. Available at: http://www.fs.fed.us/rm/pubs_other/rmrs_2004_switalski_t001.pdf

Switalski, A., and A. Jones, editors. 2008. Best Management Practices for Off-Road Vehicle Use on Forestlands: a Guide for Designating & Managing Off-Road Vehicle Routes. Wildlands CPR and the Wild Utah Project. Missoula, MT. 51 p.

Switalski, T.A., and C.R. Nelson. 2011. Efficacy of road removal for restoring wildlife habitat: black bear in the Northern Rocky Mountains, USA. Biological Conservation 144: 2666-2673.

Switalski, T.A., and A. Jones. 2012. Off-road vehicle best management practices for forestlands: A review of scientific literature and guidance for managers. Journal of Conservation Planning 8: 12-24.

The Wilderness Society. 2004. Landscape Connectivity: An Essential Element of Land Management. Policy Brief. Number 1.

The Wilderness Society. 2012. Rightsizing the National Forest Road System: A Decision Support Tool. Available at: http://www.landscapecollaborative.org/download/attachments/12747016/Road+decommissioning+model+-overview+2012-02-29.pdf?version=1&modificationDate=1331595972330.

The Wilderness Society. 2013. RoadRight: A Spatial Decision Support System to Prioritize Decommissioning and Repairing Roads in National Forests User Guide. RoadRight version: 2.2, User Guide version: February, 2013.
Available at: http://www.landscapecollaborative.org/download/attachments/18415665/RoadRight%20User%20Guide%20v22.pdf?api=v2

Thiel, R.P. 1985. The relationships between road densities and wolf habitat in Wisconsin. American Midland Naturalist 113: 404-407.

Trombulak S., and C. Frissell. 2000. Review of Ecological Effects of Roads on Terrestrial and Aquatic Communities. Conservation Biology 14(1): 18-30.

USDA Forest Service. 1996a. National Forest Fire Report, 1994. Washington DC.

USDA Forest Service. 1996b. Status of the interior Columbia basin: summary of scientific findings. Gen. Tech. Rep. PNW-GTR-385. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station; U.S. Department of the Interior, Bureau of Land Management. 144 p.

USDA Forest Service. 1998. 1991-1997 Wildland Fire Statistics. Fire and Aviation Management, Washington, D.C.

USDA Forest Service. 1999. Roads Analysis: Informing Decisions about Managing the National Forest Transportation System. Misc. Rep. FS-643. Washington, D.C.: USDA Forest Service. 222 p. Available at: http://www.fs.fed.us/eng/road_mgt/DOCSroad-analysis.shtml

USDA Forest Service. 2001a. Final National Forest System Road Management Strategy Environmental Assessment and Civil Rights Impact Analysis. U.S. Department of Agriculture Forest Service Washington Office, January 2001.

USDA Forest Service. 2010. Water, Climate Change, and Forests: Watershed Stewardship for a Changing Climate, PNW-GTR-812, June 2010, 72 p.
Available at: http://www.fs.fed.us/pnw/pubs/pnw_gtr812.pdf.

USDA Forest Service. 2011a. Adapting to Climate Change at Olympic National Forest and Olympic National Park. Forest Service Pacific Northwest Research Station General Technical Report, PNW-GTR-844, August 2011.
Available at: http://www.fs.fed.us/pnw/pubs/pnw_gtr844.pdf

USDA Forest Service. 2011b. National Roadmap for Responding to Climate Change. US Department of Agriculture. FS-957b. 26 p.
Available at: http://www.fs.fed.us/climatechange/pdf/Roadmap_pub.pdf.

USDA Forest Service. 2012a. Assessing the Vulnerability of Watersheds to Climate Change: Results of National Forest Watershed Vulnerability Pilot Assessments. Climate Change Resource Center.

USDA Forest Service. 2012b. National Best Management Practices for Water Quality Management on National Forest System Lands. Report# FS-990. 177p. Available at: http://www.fs.fed.us/biology/resources/pubs/watershed/FS_National_Core_BMPs_April2012.pdf

USDI Fish and Wildlife Service. 1993. Grizzly bear recovery plan. Missoula, MT. 181p.

USDI Fish and Wildlife Service. 1995. Recovery Plan for the Mexican Spotted Owl (*Strix occidentalis lucida*). US Fish and Wildlife Service, Albuquerque, NM. Available at: http://warnercnr.colostate.edu/~alanf/reprints/mso_rec_plan.pdf

USDI Fish and Wildlife Service. 1999. Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for Bull Trout in the Coterminous United States; Final Rule. Federal Register Volume 64, Number 210 (Monday, November 1, 1999). p. 58922.

USDI Fish and Wildlife Service. 2012. Mexican Wolf Recovery Program: Progress Report #15, U.S. Fish and Wildlife Service, Albuquerque, NM. 60 p.

USDI Bureau of Land Management. 2000. Strategic paper on cultural resources at risk. Bureau of Land Management, Washington, D.C. 18 p.

USDI National Park Service. 2010. Climate Change Response Strategy. National Park Service Climate Change Response Program, Fort Collins, Colorado. Available at: http://www.nature.nps.gov/climatechange/docs/NPS_CCRS.pdf.

van Dyke, F.G., R.H. Brocke, H.G. Shaw, B.B Ackerman, T.P. Hemker, and F.G. Lindzey. 1986. Reactions of mountain lions to logging and human activity. Journal of Wildlife Management. 50(1): 95–102.

Wasser, S.K., K. Bevis, G. King, and E. Hanson. 1997. Noninvasive physiological measures of disturbance in the northern spotted owl. Conservation Biology 11(4): 1019–1022.

Wemple, B.C., J.A. Jones, and G.E. Grant. 1996. Channel network extension by logging roads in two basins, western Cascades, OR. Water Resources Bulletin 32: 1195-1207.

Wemple, B.C., F.J. Swanson, and J.A. Jones. 2001. Forest Roads and geomorphic process interactions, Cascade Range, Oregon. Earth Surface Process and Landforms 26: 191-204. Available at: http://andrewsforest.oregonstate.edu/pubs/pdf/pub2731.pdf

Whittington, D.M., and G.T. Allen. 2008. Guidelines for Raptor Conservation in the Western United States. U.S. Fish and Wildlife Service, Region 9. Division of Migratory Bird Management, Washington D.C. 142 p.

Wilcove, D.S. 1990. The role of wilderness in protecting biodiversity. Natural Resources and Environmental Issues: Vol. 0, Article 7.

Wisdom, M.J., R.S. Holthausen, B.C. Wales, C.D. Hargis, V.A. Saab, D.C. Lee, W.J. Hann, T.D. Rich, M.M. Rowland, W.J. Murphy, and M.R. Eames. 2000. Source habitats for terrestrial vertebrates of focus in the interior Columbia basin: Broad-scale trends and management implications. Volume 1 – Overview. Gen. Tech. Rep. PNW-GTR-485. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

Wydeven, A.P, D.J. Mladenoff, T.A. Sickley, B.E. Kohn, R.P. Thiel, and J.L. Hansen. 2001. Road density as a factor in habitat selection by wolves and other carnivores in the Great Lakes Region. Endangered Species Update 18(4): 110-114.

Attachments

Attachment 1: Wildfire and Roads Fact Sheet

Attachment 2: Using Road Density as a Metric for Ecological Health in National Forests: What Roads and Routes should be Included? Summary of Scientific Information

Roads and Fire: A Proven Relationship

Photo: Lou Anegli Digital

Roaded Forests Are at a Greater Risk of Experiencing Wildfires than Unroaded Forests

- A wildland fire ignition is almost twice as likely to occur in a roaded area than in a roadless area. (USDA 2000, Table 3-18)
- The location of large wildfires is often correlated with proximity to busy roads. (Sierra Nevada Ecosystem Project, 1996)
- High road density increases the probability of fire occurrence due to human-caused ignitions. (Hann, W.J., et al. 1997)
- Unroaded areas have lower potential for high-intensity fires than roaded areas because they are less prone to human-caused ignitions. (DellaSala, et al. 1995)
- The median size of large fires on national forests is greater outside of roadless areas. (USDA 2000, Table 3-22)
- A positive correlation exists between lightning fire frequency and road density due to increased availability of flammable fine fuels near roads. (Arienti, M. Cecilia, et al. 2009)
- Human caused wildfires are strongly associated with access to natural landscapes, with the proximity to urban areas and roads being the most important factor (Romero-Calcerrada, et al. 2008)

For more information, contact Gregory H. Aplet, Ph.D., Senior Forest Scientist, at greg_aplet@tws.org or 303-650-5818 x104.

Human Activity and Wildfire

- Sparks from cars, off-road vehicles, and neglected campfires caused nearly 50,000 wildfire ignitions in 2000. (USDA 2000, Fuel Management and Fire Suppression Specialist Report, Table 4.)
- More than 90% of fires on national lands are caused by humans (USDA 1996 and 1998)
- Human-ignited wildfire is almost 5 times more likely to occur in a roaded area than in a roadless area (USDA 2000, Table 3-19).

There are 375,000 miles of roads in our national forests.

Roads and Fire: A Proven Relationship

Photo: USDA Forest Service, Coconino National Forest

References

Arienti, M. Cecilia; Cumming, Steven G., et al. 2009. Road network density correlated with increased lightning fire incidence in the Canadian western boreal forest. International Journal of Wildland Fire 2009, 18, 970–982

DellaSala, D.A., D.M. Olson and S.L. Crane. 1995. Ecosystem management and biodiversity conservation: Applications to in-landPacific Northwest forests. Pp. 139-160 in: R.L. Everett and D.M. Baumgartner, eds. Symposium Proceedings: Ecosystem Management inWestern Interior Forests. May 3-5, 1994, Spokane, WA. Washington State University Cooperative Extension, Pullman, WA.

Hann, W.J., et al. 1997. An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins: Volume II, Ch. 3, p. 882

Romer-Calcerrada, Raul. 2008. GIS analysis of spatial patterns of human-caused wildfire ignoition risk in the SW of Madrid (Central Spain). Landscape Ecol. 23:341-354.

Sierra Nevada Ecosystem Project. 1996. Status of the Sierra Nevada: Sierra Nevada Ecosystem Project, Final Report to Congress Volume I: Assessment summaries and management strategies. Wildland Resources Center Report No. 37. Center for Water and Wildland Resources, Unversity of California, Davis, CA.

USDA Forest Service. 1996. National Forest Fire Report 1994.Washington, D.C.

USDA Forest Service. 1998. 1991-1997 Wildland fire statistics. Fire and Aviation Management, Washington, D.C.

USDA. 2000. Forest Service Roadless Area Conservation Rule Final Environmental Impact Statement, Ch. 3,.

Attachment 2: Using Road Density as a Metric for Ecological Health in National Forests: What Roads and Routes should be Included?
Summary of Scientific Information
Last Updated, November 22, 2012

I. Density analysis should include closed roads, non-system roads administered by other jurisdictions (private, county, state), temporary roads and motorized trails.

Typically, the Forest Service has calculated road density by looking only at open system road density. From an ecological standpoint, this approach may be flawed since it leaves out of the density calculations a significant percent of the total motorized routes on the landscape. For instance, the motorized route system in the entire National Forest System measures well over 549,000 miles.[1] By our calculation, a density analysis limited to open system roads would consider less than 260,000 miles of road, which accounts for less than half of the entire motorized transportation system estimated to exist on our national forests.[2] These additional roads and motorized trails impact fish, wildlife, and water quality, just as open system roads do. In this section, we provide justification for why a road density analysis used for the purposes of assessing ecological health and the effects of proposed alternatives in a planning document should include closed system roads, non-system roads administered by other jurisdictions, temporary roads, and motorized trails.

Impacts of closed roads

It is crucial to distinguish the density of roads physically present on the landscape, whether closed to vehicle use or not, from "open-road density" (Pacific Rivers Council, 2010). An open-road density of 1.5 mi/mi² has been established as a standard in some national forests as protective of some terrestrial wildlife species. However, many areas with an open road density of 1.5 mi/mi² have a much higher inventoried or extant hydrologically effective road density, which may be several-fold as high with significant aquatic impacts. This higher density occurs because many road "closures" block vehicle access, but do nothing to mitigate the hydrologic alterations that the road causes. The problem is

[1] The National Forest System has about 372,000 miles of system roads. The forest service also has an estimated 47,000 miles of motorized trails. As of 1998, there were approximately 130,000 miles of non-system roads in our forests. Non-system roads include public roads such as state, county, and local jurisdiction and private roads. (USFS, 1998) The Forest Service does not track temporary roads but is reasonable to assume that there are likely several thousand miles located on National Forest System lands.

[2] About 30% of system roads, or 116,108 miles, are in Maintenance Level 1 status, meaning they are closed to all motorized use. (372,000 miles of NFS roads - 116,108 miles of ML 1 roads = 255,892). This number is likely conservative given that thousands of more miles of system roads are closed to public motorized use but categorized in other Maintenance Levels.

further compounded in many places by the existence of "ghost" roads that are not captured in agency inventories, but that are nevertheless physically present and causing hydrologic alteration (Pacific Watershed Associates, 2005).

Closing a road to public motorized use can mitigate the impacts on water, wildlife, and soils only if proper closure and storage technique is followed. Flow diversions, sediment runoff, and illegal incursions will continue unabated if necessary measures are not taken. The Forest Service's National Best Management Practices for non-point source pollution recommends the following management techniques for minimizing the aquatic impacts from closed system roads: eliminate flow diversion onto the road surface, reshape the channel and streambanks at the crossing-site to pass expected flows without scouring or ponding, maintain continuation of channel dimensions and longitudinal profile through the crossing site, and remove culverts, fill material, and other structures that present a risk of failure or diversion. Despite good intentions, it is unlikely given our current fiscal situation and past history that the Forest Service is able to apply best management practices to all stored roads,[3] and that these roads continue to have impacts. This reality argues for assuming that roads closed to the public continue to have some level of impact on water quality, and therefore, should be included in road density calculations.

As noted above, many species benefit when roads are closed to public use. However, the fact remains that closed system roads are often breached resulting in impacts to wildlife. Research shows that a significant portion of off-road vehicle (ORV) users violates rules even when they know what they are (Lewis, M.S., and R. Paige, 2006; Frueh, LM, 2001; Fischer, A.L., et. al, 2002; USFWS, 2007.). For instance, the Rio Grande National Forest's Roads Analysis Report notes that a common travel management violation occurs when people drive around road closures on Level 1 roads (USDA Forest Service, 1994). Similarly, in a recent legal decision from the Utah District Court , *Sierra Club v. USFS*, Case No. 1:09-cv-131 CW (D. Utah March 7, 2012), the court found that, as part of analyzing alternatives in a proposed travel management plan, the Forest Service failed to take a hard look at the impact of continued illegal use. In part, the court based its decision on the Forest Service's acknowledgement that illegal motorized use is a significant problem and that the mere presence of roads is likely to result in illegal use.

In addition to the disturbance to wildlife from ORVs, incursions and the accompanying human access can also result in illegal hunting and trapping of animals. The Tongass National Forest refers to this in its EIS to amend the Land and Resources Management Plan. Specifically, the Forest Service notes in the EIS that Alexander Archipelego wolf mortality due to legal and illegal hunting and trapping is related not only to roads open to motorized access, but to all roads, and that *total road densities* of 0.7-1.0 mi/mi^2 or less may be necessary (USDA Forest Service, 2008).

As described below, a number of scientific studies have found that ORV use on roads and trails can have serious impacts on water, soil and wildlife resources. It should be expected that ORV use will continue to

[3] The Forest Service generally reports that it can maintain 20-30% of its open road system to standard.

some degree to occur illegally on closed routes and that this use will affect forest resources. Given this, roads closed to the general public should be considered in the density analysis.

Impacts of non-system roads administered by other jurisdictions (private, county, state)

As of 1998, there were approximately 130,000 miles of non-system roads in national forests (USDA Forest Service, 1998). These roads contribute to the environmental impacts of the transportation system on forest resources, just as forest system roads do. Because the purpose of a road density analysis is to measure the impacts of roads at a landscape level, the Forest Service should include all roads, including non-system, when measuring impacts on water and wildlife. An all-inclusive analysis will provide a more accurate representation of the environmental impacts of the road network within the analysis area.

Impacts of temporary roads

Temporary roads are not considered system roads. Most often they are constructed in conjunction with timber sales. Temporary roads have the same types environmental impacts as system roads, although at times the impacts can be worse if the road persists on the landscape because they are not built to last.

It is important to note that although they are termed temporary roads, their impacts are not temporary. According to Forest Service Manual (FSM) 7703.1, the agency is required to "Reestablish vegetative cover on any unnecessary roadway or area disturbed by road construction on National Forest System lands within 10 years after the termination of the activity that required its use and construction." Regardless of the FSM 10-year rule, temporary roads can remain for much longer. For example, timber sales typically last 3-5 years or more. If a temporary road is built in the first year of a six year timber sale, its intended use does not end until the sale is complete. The timber contract often requires the purchaser to close and obliterate the road a few years after the Forest Service completes revegetation work. The temporary road, therefore, could remain open 8-9 years before the ten year clock starts ticking per the FSM. Therefore, temporary roads can legally remain on the ground for up to 20 years or more, yet they are constructed with less environmental safeguards than modern system roads.

Impacts of motorized trails

Scientific research and agency publications generally do not decipher between the impacts from motorized trails and roads, often collapsing the assessment of impacts from unmanaged ORV use with those of the designated system of roads and trails. The following section summarizes potential impacts resulting from roads and motorized trails and the ORV use that occurs on them.

Aquatic Resources

While driving on roads has long been identified as a major contributor to stream sedimentation (for review, see Gucinski, 2001), recent studies have identified ORV routes as a significant cause of stream sedimentation as well (Sack and da Luz, 2004; Chin et al.; 2004, Ayala et al.; 2005, Welsh et al;. 2006). It has been demonstrated that sediment loss increases with increased ORV traffic (Foltz, 2006). A study by

Sack and da Luz (2004) found that ORV use resulted in a loss of more than 200 pounds of soil off of every 100 feet of trail each year. Another study (Welsh et al., 2006) found that ORV trails produced five times more sediment than unpaved roads. Chin et al. (2004) found that watersheds with ORV use as opposed to those without exhibited higher percentages of channel sands and fines, lower depths, and lower volume – all characteristics of degraded stream habitat.

Soil Resources [4]

Ouren, et al. (2007), in an extensive literature review, suggests ORV use causes soil compaction and accelerated erosion rates, and may cause compaction with very few passes. Weighing several hundred pounds, ORVs can compress and compact soil (Nakata et al., 1976; Snyder et al., 1976; Vollmer et al., 1976; Wilshire and Nakata, 1976), reducing its ability to absorb and retain water (Dregne, 1983), and decreasing soil fertility by harming the microscopic organisms that would otherwise break down the soil and produce nutrients important for plant growth (Wilshire et al., 1977). An increase in compaction decreases soil permeability, resulting in increased flow of water across the ground and reduced absorption of water into the soil. This increase in surface flow concentrates water and increases erosion of soils (Wilshire, 1980; Webb, 1983; Misak et al., 2002).

Erosion of soil is accelerated in ORV-use areas directly by the vehicles, and indirectly by increased runoff of precipitation and the creation of conditions favorable to wind erosion (Wilshire, 1980). Knobby and cup-shaped protrusions from ORV tires that aid the vehicles in traversing steep slopes are responsible for major direct erosional losses of soil. As the tire protrusions dig into the soil, forces far exceeding the strength of the soil are exerted to allow the vehicles to climb slopes. The result is that the soil and small plants are thrown downslope in a "rooster tail" behind the vehicle. This is known as mechanical erosion, which on steep slopes (about 15° or more) with soft soils may erode as much as 40 tons/mi (Wilshire, 1992). The rates of erosion measured on ORV trails on moderate slopes exceed natural rates by factors of 10 to 20 (Iverson et al., 1981; Hinckley et al., 1983), whereas use on steep slopes has commonly removed the entire soil mantle exposing bedrock. Measured erosional losses in high use ORV areas range from 1.4-242 lbs/ft^2 (Wilshire et al., 1978) and 102-614 lbs/ft^2 (Webb et al., 1978). A more recent study by Sack and da Luz (2003) found that ORV use resulted in a loss of more than 200 lbs of soil off of every 100 feet of trail each year.

Furthermore, the destruction of cryptobiotic soils by ORVs can reduce nitrogen fixation by cyanobacteria, and set the nitrogen economy of nitrogen-limited arid ecosystems back decades. Even small reductions in crust can lead to diminished productivity and health of the associated plant community, with cascading effects on plant consumers (Davidson et al., 1996). In general, the deleterious effects of ORV use on cryptobiotic crusts is not easily repaired or regenerated. The recovery time for the lichen component of crusts has been estimated at about 45 years (Belnap, 1993). After this time the crusts may appear to have regenerated to the untrained eye. However, careful observation will reveal that the 45 year-old crusts will not have recovered their moss component, which will take an additional 200 years to fully come back (Belnap and Gillette, 1997).

[4] For a full review see Switalski, T. A. and A. Jones (2012).

Wildlife Resources [5]

Studies have shown a variety of possible wildlife disturbance vectors from ORVs. While these impacts are difficult to measure, repeated harassment of wildlife can result in increased energy expenditure and reduced reproduction. Noise and disturbance from ORVs can result in a range of impacts including increased stress (Nash et al., 1970; Millspaugh et al., 2001), loss of hearing (Brattstrom and Bondello, 1979), altered movement patterns (e.g., Wisdom et al. 2004; Preisler et al. 2006), avoidance of high-use areas or routes (Janis and Clark 2002; Wisdom 2007), and disrupted nesting activities (e.g., Strauss 1990).

Wisdom et al. (2004) found that elk moved when ORVs passed within 2,000 yards but tolerated hikers within 500 ft. Wisdom (2007) reported preliminary results suggesting that ORVs are causing a shift in the spatial distribution of elk that could increase energy expenditures and decrease foraging opportunities for the herd. Elk have been found to readily avoid and be displaced from roaded areas (Irwin and Peek, 1979; Hershey and Leege, 1982; Millspaugh, 1995). Additional concomitant effects can occur, such as major declines in survival of elk calves due to repeated displacement of elk during the calving season (Phillips, 1998). Alternatively, closing or decommissioning roads has been found to decrease elk disturbance (Millspaugh et al., 2000; Rowland et al., 2005).

Disruption of breeding and nesting birds is particularly well-documented. Several species are sensitive to human disturbance with the potential disruption of courtship activities, over-exposure of eggs or young birds to weather, and premature fledging of juveniles (Hamann et al., 1999). Repeated disturbance can eventually lead to nest abandonment. These short-term disturbances can lead to long-term bird community changes (Anderson et al., 1990). However when road densities decrease, there is an observable benefit. For example, on the Loa Ranger District of the Fishlake National Forest in southern Utah, successful goshawk nests occur in areas where the localized road density is at or below 2-3 mi/mi^2 (USDA, 2005).

Examples of Forest Service planning documents that use total motorized route density or a variant

Below, we offer examples of where total motorized route density or a variant has been used by the Forest Service in planning documents.

- The Mt. Taylor RD of the Cibola NF analyzed open and closed system roads and motorized trails together in a single motorized *route* density analysis. Cibola NF: Mt. Taylor RD Environmental Assessment for Travel Management Planning, Ch.3, p 55. http://prdp2fs.ess.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5282504.pdf.

- The Grizzly Bear Record of Decision (ROD) for the Forest Plan Amendments for Motorized Access

[5] For a full review see:Switalski, T. A. and A. Jones (2012).

Management within the Selkirk and Cabinet-Yaak Grizzly Bear Recovery Zones (Kootenai, Lolo, and Idaho Panhandle National Forests) assigned route densities for the designated recovery zones. One of the three densities was for Total Motorized Route Density (TMRD) which includes open roads, restricted roads, roads not meeting all reclaimed criteria, and open motorized trails. The agency's decision to use TMRD was based on the Endangered Species Act's requirement to use best available science, and monitoring showed that both open and closed roads and motorized trails were impacting grizzly. Grizzly Bear Plan Amendment ROD. Online at cache.ecosystem-management.org/48536_FSPLT1_009720.pdf.

- The Chequamegon-Nicolet National Forest set forest-wide goals in its forest plan for both open road density and total road density to improve water quality and wildlife habitat.

> *I decided to continue reducing the amount of total roads and the amount of open road to resolve conflict with quieter forms of recreation, impacts on streams, and effects on some wildlife species.* ROD, p 13.

Chequamegon-Nicolet National Forest Land and Resource Management Plan Record of Decision. Online at http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5117609.pdf.

- The Tongass National Forest's EIS to amend the forest plan notes that Alexander Archipelago wolf mortality due to legal and illegal hunting and trapping is related not only to roads open to motorized access, but to all roads, and that *total road densities* of 0.7-1.0 mi/mi^2 or less may be necessary.

> *Another concern in some areas is the potentially unsustainable level of hunting and trapping of wolves, when both legal and illegal harvest is considered. The 1997 Forest Plan EIS acknowledged that open road access contributes to excessive mortality by facilitating access for hunters and trappers. Landscapes with open-road densities of 0.7 to 1.0 mile of road per square mile were identified as places where human-induced mortality may pose risks to wolf conservation. The amended Forest Plan requires participation in cooperative interagency monitoring and analysis to identify areas where wolf mortality is excessive, determine whether the mortality is unsustainable, and identify the probable causes of the excessive mortality.*
>
> *More recent information indicates that wolf mortality is related not only to roads open to motorized access, but to all roads, because hunters and trappers use all roads to access wolf habitat, by vehicle or on foot. Consequently, this decision amends the pertinent standard and guideline contained in Alternative 6 as displayed in the Final EIS in areas where road access and associated human caused mortality has been determined to be the significant contributing factor to unsustainable wolf mortality. The standard and guideline has been modified to ensure that a range of options to reduce mortality risk will be considered in these areas, and to specify that total road densities of 0.7 to 1.0 mile per square mile or less may be necessary.* ROD, p 24.

Tongass National Forest Amendment to the Land and Resource Management Plan Record of Decision and Final EIS. January 2008. http://tongass-fpadjust.net/Documents/Record_of_Decision.pdf

References

Anderson, D.E., O.J. Rongstad, and W.R. Mytton. 1990. Home range changes in raptors exposed to increased human activity levels in southeastern Colorado. Wildlife Bulletin 18:134-142.

Ayala, R.D., P. Srivastava, C.J. Brodbeck, E.A. Carter, and T.P. McDonald. 2005. Modeling Sediment Transport from an Off-Road Vehicle Trail Stream Crossing Using WEPP Model. American Society of Agricultural and Biological Engineers, 2005 ASAE Annual International Meeting, Paper No: 052017.

Belnap, J. 1993. Recovery rates of cryptobiotic crusts: inoculant use and assessment methods. Great Basin Naturalist 53:89-95.

Belnap, J. and D.A. Gillette. 1997. Disturbance of biological soil crusts: impacts on potential wind erodibility of sandy desert soils in SE Utah. Land Degradation and Development 8: 355-362.

Brattstrom, B.H., and M.C. Bondello. 1979. The effects of dune buggy sounds on the telencephalic auditory evoke response in the Mojave fringe-toed lizard, Uma scoparia. Unpublished report to the U.S. Bureau of Land Management, California Desert Program, Riverside, CA. 31p.

Chin, A., D.M. Rohrer, D.A. Marion, and J.A. Clingenpeel. 2004. Effects of all terrain vehicles on stream dynamics. Pages:292-296 in Guldin, J.M. technical compiler, Ovachita and Ozark Mountains Symposium: ecosystem management research. General technical report SRS-74. Ashville, NC: USDA, FS, Southern Research Station.

Davidson, D.W, W.D. Newmark, J.W. Sites, D.K. Shiozawa, E.A. Rickart, K.T. Harper, and R.B. Keiter. 1996. Selecting Wilderness areas to conserve Utah's biological diversity. Great Basin Naturalist 56: 95-118.

Dregne, H.E. 1983. Physical effects of off-road vehicle use. Pages 15-30 in R.H. Webb and H.G. Wilshire. Environmental Effects of Off-Road Vehicles: Impacts and Management in Arid Regions. Springer-Verlag, New York.

Foltz, R.B. 2006. Erosion from all terrain vehicle (ATV) trails on National Forest lands. The American Society of Agricultural and Biological engineers (ASABE). Paper# 068012. St. Joseph, MI.

Frueh, LM. 2001. Status and Summary Report on OHV Responsible Riding Campaign. Prepared by Monaghan and Associates for the Colorado Coalition for Responsible OHV Riding. Available at http://www.wildlandscpr.org/files/CO%20OHV%20Focus%20Group%20StatusSummaryReport_1.pdf.

Gucinski, H., M. J. Furniss, R. R. Ziemer, and M. H. Brookes. 2001. Forest roads: a synthesis of scientific information. Gen. Tech. Rep. PNWGTR-509. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland, OR. http://www.fs.fed.us/pnw/pubs/gtr509.pdf

Hamann, B., H. Johnston, P. McClelland, S. Johnson, L. Kelly, and J. Gobielle. 1999. Birds. Pages 3.1-3.34 in Joslin, G. and H. Youmans, coordinators Effects of Recreation on Rocky Mountain Wildlife: A Review for Montana.

Hershey, T.J., and T.A. Leege. 1982. Elk movements and habitat use on a managed forest in north-central Idaho. Idaho Department of Fish and Game. 32p.

Hinckley, B.S., Iverson, R.M. and B. Hallet. 1983. Accelerated water erosion in ORV-use areas. Pages 81-96 in Webb, R.H. and H.G. Wilshire, editors, Environmental Effects of Off-Road Vehicles. Springer-Verlag, New York.

Irwin, L.L., and J.M. Peek. 1979. Relationship between road closure and elk behavior in northern Idaho. Pages 199-205 in Boyce, M.S. and L.D. Hayden-Wing, editors, North American Elk: Ecology, Behavior, and Management. Laramie, WY: University of Wyoming.

Iverson, R.M., Hinckley, B.S., and R.H. Webb. 1981. Physical effects of vehicular disturbance on arid landscapes. Science 212: 915-917.

Janis, M.W., and J.D. Clark. 2002. Responses of Florida panthers to recreational deer and hog hunting. Journal of Wildlife Management 66(3): 839-848.

Lewis, M.S., and R. Paige. 2006. Selected Results From a 2006 Survey of Registered Off-Highway Vehicle (OHV) Owners in Montana. Responsive Management Unit Research Summary No. 21. Prepared for Montana Fish, Wildlife and Parks. http://fwp.mt.gov/content/getItem.aspx?id=19238

Millspaugh, J.J. 1995. Seasonal movements, habitat use patterns and the effects of human disturbances on elk in Custer State Park, South Dakota. M.S. Thesis. Brookings, SD: South Dakota State University.

Millspaugh, J.J., G.C. Brundige, R.A. Gitzen, and K.J. Raedeke. 2000. Elk and hunter space-use sharing in South Dakota. Journal of Wildlife Management 64(4): 994-1003.

Millspaugh, J.J., Woods, R.J. and K.E. Hunt. 2001. Fecal glucocorticoid assays and the physiological stress response in elk. Wildlife Society Bulletin 29: 899-907.

Misak, R.F., J.M. Al Awadhi, S.A. Omar, and S.A. Shahid. 2002. Soil degradation in Kabad area, southwestern Kuwait City. Land Degradation & Development. 13(5): 403-415.

Nakata, J.K., H.G. Wilshire, and G.G. Barnes. 1976. Origin of Mojave Desert dust plumes photographed from space. Geology 4(11): 644-648.

Nash, R.F., G.G. Gallup, jr., and M.K. McClure. 1970. The immobility reaction in leopard frogs (Rana pipiens) as a function of noise induced fear. Psychonometric Science 21(3): 155-156.

Ouren, D.S., Haas, Christopher, Melcher, C.P., Stewart, S.C., Ponds, P.D., Sexton, N.R., Burris, Lucy, Fancher, Tammy, and Bowen, Z.H., 2007, Environmental effects of off-highway vehicles on Bureau of Land Management lands: A literature synthesis, annotated bibliographies, extensive bibliographies, and internet resources: U.S. Geological Survey, Open-File Report 2007-1353, 225 p.

Pacific Rivers Council. 2010. Roads and Rivers 2: An Assessment of National Forest Roads Analyses. Portland, OR http://pacificrivers.org/science-research/resources-publications/roads-and-rivers-ii/download

Pacific Watershed Associates. 2005. Erosion Assessment and Erosion Prevention Planning Project for Forest Roads in the Biscuit Fire Area, Southern Oregon. Prepared for Pacific Rivers Council and The Siskiyou Project. Pacific Watershed Associates, Arcata, California. http://pacificrivers.org/files/post-fire-management-and-sound-science/Final%20Biscuit%20PWA%20Report.pdf

Phillips, G.E. 1998. Effects of human-induced disturbance during calving season on reproductive success of elk in the upper Eagle River Valley. Dissertation. Fort Collins, CO: Colorado State University.

Preisler, H.K., A.A. Ager, and M.J. Wisdom. 2006. Statistical methods for analyzing responses of wildlife to human disturbance. Journal of Applied Ecology 43: 164-172.

Rowland, M.M., M.J. Wisdom, B.K. Johnson, and M.A. Penninger. 2005. Effects of roads on elk: implications for management in forested ecosystems. Pages 42-52. IN: Wisdom, M.J., technical editor, The Starkey Project: a Synthesis of Long-term Studies of Elk and Mule Deer. Reprinted from the 2004 Transactions of the North American Wildlife and Natural Resources Conference, Alliance Communications Group, Lawrence, KS.

Sack, D., and S. da Luz, Jr. 2003. Sediment Flux and Compaction Trends on Off-Road Vehicle (ORV) and other Trails in an Appalachian Forest Setting. Physical Geography 24 (6): 536-554.

Snyder, C.T., D.G. Frickel, R.E. Hadley, and R.F. Miller. 1976. Effects of off-road vehicle use on the hydrology and landscape of arid environments in central and southern California. U.S. Geological Survey Water-Resources Investigations Report #76-99. 45p.

Switalski, T. A. and A. Jones. 2012. Off-road Vehicle Best Management Practices for Forestlands: A Review of Scientific Literature and Guidance for Managers. Journal of Conservation Planning. Vol. 8 (2014). Pages 12 – 24.

USFWS, Nevada Fish and Wildlife Office. 2007. 12-Month Finding on a Petition to List the Sand Mountain Blue Butterfly (Euphilotes pallescens ssp. arenamontana) as Threatened or Endangered with Critical Habitat. Federal Register, Vol. 72, No. 84. See pages 24260-61. http://www.wildlandscpr.org/denial-petition-list-sand-mountain-blue-butt....

USDA Forest Service (USFS) 1994. Rio Grande National Forest Roads Analysis Process Report. See pages 76-77 and 118.

USDA Forest Service. (USFS) 1998. National Forest System Roads and Use. Available online at http://www.fs.fed.us/eng/road_mgt/roadsummary.pdf.

USDA Forest Service. (USFS) 2008. Tongass National Forest Amendment to the Land and Resource Management Plan Record of Decision and Final EIS. http://tongass-fpadjust.net/Documents/Record_of_Decision.pdf

Vollmer, A.T., B.G. Maza, P.A. Medica, F.B. Turner, and S.A. Bamberg. 1976. The impact of off-road vehicles on a desert ecosystem. Environmental Management 1(2):115-129.

Webb, R.H., Ragland, H.C., Godwin, W.H., and D. Jenkins. 1978. Environmental effects of soil property changes with off-road vehicle use. Environmental Management 2: 219-233.

Webb, R.H.. 1983. Compaction of desert soils by off-road vehicles. Pages 51-79 in: Webb, R.H. and Wilshire, H.G., editors, Environmental Effects of Off-Road Vehicles. Springer-Verlag, New York.

Welsh, M.J., L.H. MacDonald, and E. Brown, and Z. Libohova. 2006. Erosion and sediment delivery from unpaved roads and off-highway vehicles (OHV). Presented at AGU fall meeting. San Francisco, CA.

Wilshire, H.G., G.B. Bodman, D. Broberg, W.J. Kockelman, J. Major, H.E. Malde, C.T. Snyder, and R.C. Stebbins. 1977. Impacts and management of off-road vehicles. The Geological Society of America. Report of the Committee on Environment and Public Policy.

Wilshire, H.G., Nakata, J.K., Shipley, S., and K. Prestegaard. 1978. Impacts of vehicles on natural terrain at seven sites in the San Francisco Bay area. Environmental Geology 2: 295-319.

Wilshire, H.G. 1980. Human causes of accelerated wind erosion in California's deserts. Pages 415-433 in D.R. Coates and J.B. Vitek, editors, Thresholds in Geomorphology. George Allen & Unwin, Ltd., London.

Wilshire, H.G. 1992. The wheeled locusts. Wild Earth 2: 27-31.

Wisdom, M.J., R.S. Holthausen, B.C. Wales, C.D. Hargis, V.A. Saab, D.C. Lee, W.J. Hann, T.D. Rich, M.M. Rowland, W.J. Murphy, and M.R. Eames. 2000. Source habitats for terrestrial vertebrates of focus in the interior Columbia basin: Broad-scale trends and management implications. Volume 1 – Overview. Gen. Tech. Rep. PNW-GTR-485. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. http://www.fs.fed.us/pnw/pubs/gtr485/gtr485vl.pdf

Wisdom, M.J., H.K. Preisler, N.J. Cimon, and B.K. Johnson. 2004. Effects of off-road recreation on mule deer and elk. Transactions of the North American Wildlife and Natural Resource Conference 69.

Wisdom, M.J. 2007. Shift in Spatial Distribution of Elk Away from Trails Used by All-Terrain Vehicles. Report 1, May 2007, USDA Forest Service, Pacific Northwest Research Station, La Grande, OR.

WILDERNESS WORKSHOP

COLORADO ENVIRONMENTAL COALITION

THE WILDERNESS SOCIETY

Coloradans Express Strong Support for Wilderness Protection

A May 2007 poll conducted by Talmey-Drake found that a solid majority of Colorado voters favor additional wilderness designation of federal public lands in Colorado. This support is shared widely among Coloradans across geographic, political party affiliation and gender categories, and is nearly identical whether respondents hunt, fish or recreate in other ways. Specific results are highlighted below.

● **Nearly Three-Quarters of Coloradans Statewide Agree Wilderness Quality Lands Are More Important for Recreation, Tourism and Wildlife than for Energy Development and Motorized Recreation.** When read pro-wilderness and anti-wilderness statements, nearly three-quarters (71%) of those surveyed agree with the pro-wilderness argument, versus 24% who align themselves with the anti-wilderness argument. This support was consistent across all geographic regions of the state (ranging from 59% to 76%, with both Denver and West Slope at 76%). There is also majority support for the pro-wilderness statement across all political parties; although support is higher among Democrats (85%) and Independents (76%), Republicans also favor BLM wilderness (52% supporting versus 43% opposed).

> Supporters of more wilderness protection say Colorado's population has grown 20 percent in the past eight years and new development uses up about 250 acres every day. They also point out that tourism, recreation and hunting are some of the largest contributors to Colorado's economy, and that this rapid growth, as well as increased drilling of oil and gas on our public lands, is putting intense pressure on Colorado's national parks, wilderness areas and forests. Therefore more of the state's remaining wild places should be protected for recreation, wildlife, and our children before it's too late. Further, they say that we can never drill our way to energy independence and we ought to implement sustainable energy alternatives before we damage these last best wild places.
>
> Opponents of more wilderness protection say there are already enough protected areas in Colorado. They say the state has more than 30 million acres designated as national parks and forests, state parks, and open space, and more than ten percent of this 30 million acres is already locked up as wilderness, where off-road vehicles users and mountain bikers are prohibited. Further, they say that locking up more wilderness areas goes too far by banning oil and gas exploration at a time we need more domestic oil and gas production to provide greater energy independence from the Middle East countries like Saudi Arabia, Iraq and Iran.
>
> Now, with which do you tend to agree more – the statement in support of more wilderness protection, or the statement opposed to more wilderness protection?

● **Voters Favor Protection of Wilderness-Quality Bureau of Land Management (BLM) Lands.** About one million out of the eight million acres of public lands managed in Colorado by the BLM meet the criteria for wilderness designation. Nearly two-thirds of Coloradans statewide (64%) support wilderness designation of these BLM lands -- 70% strongly so -- versus 27% who oppose this proposal (55% strongly so). Again, there is majority support for this wilderness proposal across all geographic regions of the state and political parties.

- **West Slopers Strongly Support Additional Wilderness near their Communities.**

Seventy percent of West Slope respondents favor designation of wilderness-quality Forest Service or BLM lands in or near the county where they live, 84% strongly so. Only 23% of those surveyed on the West Slope are in opposition (75% strongly opposed). This support is particularly high among Democrats (78%) and Independents (77%), but less so among Republicans (48% supportive versus 41% in opposition).

- **Coloradans Believe Wilderness is Important to the Economy and their Quality of Life.**

When read statements about wilderness, more than 90% agree that wilderness areas are important economically for the hunting, fishing and tourism they support, versus 9% who disagree. This result is very consistent across political party and geographic region.

Strong support (80%) is also found for the statement that "[t]he presence of nearby wilderness helps define Colorado and is an important reason why I choose to live here." While high across all geographic regions, this sentiment is highest on the West Slope (89%, with 67% feeling strongly) and lowest on the Eastern Plains at 68%.

- **Coloradans Are Not Swayed by Energy and Motorized Recreation Arguments Against Wilderness.** Only 33% of respondents agree with a statement that wilderness-quality lands are needed for domestic energy development, while 71% support an alternative statement that wilderness-quality lands should not be sacrificed for energy development but clean energy alternatives pursued instead.

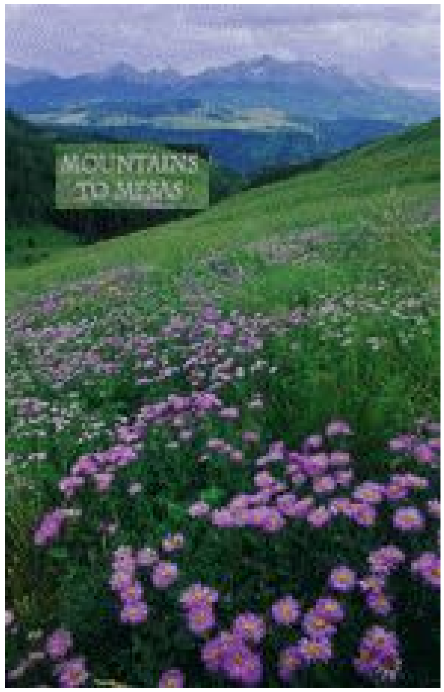
Similarly, a statement suggesting that wilderness unfairly restricts off-road vehicles users and mountain bikers from recreation opportunities receives much less support (37%) than an alternative statement arguing that these uses have ample access to the majority of public lands while additional wilderness is necessary for quiet uses (78%). Notably support for this statement is highest on the West Slope and North Corridor (Boulder, Larimer and Weld counties) at 83%.

Methodology

The survey was conducted by Talmey-Drake Research & Strategy, Inc., a public opinion and market research firm in Boulder, Colorado. The results of this survey are based on 617 random telephone interviews with Colorado residents, conducted from May 1st to 14th, 2007. Quotas were established to obtain equal representation for men and women, and an appropriate representation from among certain counties[1]. The West Slope was then oversampled to obtain approximately 100 completed interviews on the West Slope. Results were then weighted to reflect the actual population of the West Slope. A random sample of 617 has a worst-case 95% confidence interval of plus or minus 3.9% about any one reported percentage.

The poll was commissioned by Colorado Environmental Coalition, The Wilderness Society and Wilderness Workshop.

[1] Quotas were established for Adams, Arapahoe, Boulder, Denver, Douglas, El Paso, Jefferson, Larimer, Mesa, Pueblo and Weld.



MOUNTAINS TO MESAS

Conservation Management Alternative
For Protecting Biological Diversity and Ecosystem Health
on the Grand Mesa, Uncompahgre, and Gunnison National Forest (GMUG)

Proposed for the
GMUG Forest Plan Revision
June 2005

Developed by citizens & scientists in Western Colorado
in collaboration with:

High Country Citizens' Alliance
Sheep Mountain Alliance
Southern Rockies Ecosystem Project
Western Colorado Congress
Western Slope Environmental Resource Council

For more information, visit www.mtns2mesas.org

MOUNTAINS TO MESAS (M2m)
CONSERVATION MANAGEMENT ALTERNATIVE FOR THE GMUG
June 2005

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The **Grand Mesa, Uncompahgre and Gunnison National Forest (GMUG)** hosts some of the most spectacular natural features in the Rockies, such as Grand Mesa, the largest flat-topped mountain in the world; Dry Mesa Dinosaur quarry, where the world's largest dinosaur bone fossils were found; and Bridal Veil Falls, the tallest waterfall in Colorado.

Spanning an 8,500-foot elevation range between the Continental Divide mountains in the east and Colorado Plateau mesas in the west, the GMUG also encompasses great ecological diversity and species richness. The GMUG includes the Uncompahgre Plateau and Grand Mesa, which flank the confluence of the Gunnison and Colorado Rivers. The three Forests include ten designated Wilderness areas (nineteen percent of the combined Forest)—large areas of land vital to landscape-scale wildlife connectivity in the southern Rocky Mountains.

Recently, the GMUG National Forest Service has begun Forest Plan revision, a process that every fifteen years establishes management direction and limitations. Forest Plan revision will affect important aspects of these public lands: the future of roadless areas, recreation, species viability, forest health, logging, livestock grazing, and water quality, among others.

Given the significance of this revised Forest Plan, **Mountains to Mesas (M2m)**, a coalition of conservation organizations within the GMUG area consulted with citizens and regional scientists via interviews and surveys to formulate this conservation management alternative (CMA). M2m's CMA is based on current conservation-biology approaches, with the goal of restoring and preserving the natural character of the GMUG Forest, as well as promoting sustainable resource use. This CMA provides for multiple uses on the Forest lands, including recreational activities, motor vehicle use, ecologically-sensitive grazing, silviculture, and other resource extraction, recognizing that these uses are subordinate to the primary objective of this alternative, which is sustainable ecological management.

Conservation planning on the GMUG is critical to ecosystem health and function, both of which are intrinsically valuable, but are also essential for multiple human needs, from clean water to recreation. Of particular concern is the increasing fragmentation of the forests due to roadbuilding and timber cutting;

degradation of ecosystems through the suppression of natural processes, such as wildfires; and loss of biodiversity, evidenced by the drastically-declined populations of Canada lynx, Gunnison sage grouse, Colorado River cutthroat trout, and boreal toad. These concerns are interrelated, as overexploitation, habitat destruction, and impacts of exotic species are the most significant causes of modern extinctions (Langner and Flather 1994).

M2m presents a comprehensive plan that combines sustainable local resource use with the necessary tools to implement a management system that will prevent and reverse the above-mentioned negative impacts to the GMUG Forest. These management recommendations are based on the most current scientific research and species data. As ecosystem information and conservation methods and opportunities change, GMUG Forest management will need to be appropriately modified.

M2m's alternative follows conservation principles endorsed by environmental organizations and scientists of neighboring National Forests areas, including the San Juan, the White River, and the Rio Grande National Forests, with the intent to promote "a vast, connected landscape where native species thrive and natural ecological processes maintain a healthy balance," an intact Southern Rocky Mountain ecoregion (Southern Rockies Ecosystem Project 2004). Adhering to these established principles of conservation biology, M2m's plan recognizes the importance of large core wild areas, functional connectivity across the landscape, and the vital role of keystone species and processes, especially large carnivores (Soulé and Noss 1998, Soulé and Terborgh 1999). Hence, this alternative is a prescription specifically for the GMUG region within the larger ecological context.

I. PURPOSE AND RESERVE DESIGN

A. GOALS AND OBJECTIVES OF THE M2m CONSERVATION MANAGEMENT ALTERNATIVE

The primary goal of this alternative is to protect and restore the native biological diversity of the GMUG. A secondary goal is to promote sustainable interactions between the human society and the natural environment of the GMUG. In circumstances in which there is insufficient information available to gauge the impacts of an action, deference must be given to protecting native biological diversity. The following fundamental objectives lend themselves toward these goals (Noss and Cooperrider 1994) and form the basis from which this alternative was developed:

- Represent, in a system of protected areas, all native ecosystem types and successional stages across the natural range of variation.
- Protect and restore viable populations of all native species in natural patterns of abundance and distribution.
- Protect and restore ecological and evolutionary processes, such as disturbance regimes, hydrological processes, nutrient cycles, and biotic interactions.
- Manage landscapes and communities to be responsive to short-term and long-term environmental change and to maintain the evolutionary potential of the biota.

- Prevent further landscape fragmentation and restore connectivity between core reserves.
- Control and eradicate exotic species.
- Encourage human uses that are consistent with conservation of native biodiversity, and eliminate those that are not.

B. PHYSICAL AND SOCIO-ECONOMIC LANDSCAPE

The GMUG forests were administratively combined in the 1970's, and occupy over 3.1 million acres in western Colorado's Gunnison, San Miguel and Colorado River Basins. President Benjamin Harrison created the oldest of these three National Forests, the Grand Mesa, on December 24, 1892, making it the third such reserve to be created in the nation. President Theodore Roosevelt created Gunnison National Forest on June 13, 1905, and the Uncompahgre National Forest on June 14, 1905.

Grand Mesa National Forest covers 351,705 acres and features the largest flat-topped mountain in the world. Created by basalt flows, Grand Mesa (about 10,500 ft.) bounds the Gunnison River Basin to the northwest. Grand Mesa is a valuable water resource because of its perched water table, and provides water for municipalities including Grand Junction. More than 300 lakes dot the surface of the Grand Mesa, sustaining wildlife, hundreds of valley farms and ranches, and several towns. Below timberline, the mesa's range supports several thousand deer and elk in the summer. This Forest has no designated Wilderness lands.

Uncompahgre National Forest covers more than one million acres of Uncompahgre Plateau tableland and four mountains over 14,000 feet. The Uncompahgre Plateau consists of sedimentary shales and sandstones, and bounds the Gunnison River Basin to the southwest. With elevations that average about 9000 ft., the Uncompahgre Plateau is below timberline and forested. Wilderness Areas include the 99,000-acre Uncompahgre Wilderness, the 16,500-acre Mt. Sneffels Wilderness Area, and the Lizard Head Wilderness Area of 41,193 acres.

The 1.76 million acre **Gunnison National Forest** is bounded by the Continental Divide on three sides and serves as headwaters for much of Gunnison River Basin, which lies in the southwest quadrant of the Southern Rocky Mountain Geologic Province. The Elk Mountains bound the basin to the north; the Sawatch Range and San Juan Mountains form the Continental Divide to east and south. All three ranges boast some of the most spectacular mountains in Colorado with peaks over 14,000 ft. in altitude. Wilderness Areas include 48,986 acres of Collegiate Peaks Wilderness, 32,000 acres of Fossil Ridge Wilderness, 128,859 acres of La Garita Wilderness, 64,992 acres in Raggeds Wilderness, 176,000 acres in the West Elk Wilderness Area, and about 20,000 acres in Maroon Bells-Snowmass Wilderness Area.

The San Juan Mountains are the result of volcanic activity; their volcanic layers and soils are highly erodable, and Pleistocene glaciations carved them into rugged spires and fluted peaks. The Elk Mountains to the north are largely sedimentary rock; Paleozoic sediments were raised thousands of feet when the Rocky Mountains were uplifted. In roughly the center of the Basin, the West Elk Mountains are volcanic flows, tuffs and breccias surrounding intrusive laccoliths and stocks. Much of Gunnison Basin lies in the middle of Colorado's Transverse Mineral Belt, a zone rich in economic ore and other mineral occurrences. The San Juans are also in the Mineral Belt and had one of the richest depositories of silver in the state.

The Gunnison River is created at Almont by the confluence of the East and Taylor Rivers, and flows west out of the upper basin. The river joins Tomichi Creek at the city of Gunnison; west of Gunnison, it encounters the Gunnison Uplift, where millions of years ago, over 1,500 feet of rock were uplifted. The river responded by carving spectacular canyons, some of which are now protected by Black Canyon National Park. Blue Mesa, Morrow Point and Crystal Reservoirs inundate other sections of canyon, and are all components of the Aspinall hydropower unit. Blue Mesa Reservoir is the largest body of water in Colorado. Below the canyons of the Gunnison River, the Uncompahgre River joins the Gunnison west of Montrose, and the North Fork joins at Delta. The Gunnison River flows into the Colorado River at Grand Junction.

Water in the Gunnison Basin is scarce—the mean annual precipitation is a little over 17 inches. Most of the basin's water is derived from snowpack in the eastern half of the basin, where the mean annual temperature is about 37 degrees and average annual snowfall is over 116 in. In the upper basin (eastern half), the least amount of precipitation falls around Blue Mesa Lake (less than 10 inches per year). The greatest amount of precipitation falls in the Elk Mountains north of Crested Butte (more than 50 inches per year). A significant feature of the climate of the upper Gunnison Basin is the so-called "rainshadow" effect. A topographic barrier, mountain ridges extending north from the San Juan Mountains and south from the West Elk Mountains, separates the western Gunnison Basin from the eastern, upper basin. The ridges effectively form precipitation barriers at Cerro Summit and Cimarron Summit (Johnston 1997).

Given the size (3.2 million acres) and altitudinal range of the GMUG, it is not surprising that diversity of scenic values, wildlife and flora is perhaps its most distinctive feature and most valuable resource. The diversity of the GMUG is underscored by floral differences from low-altitude semi-desert shrublands to high-altitude alpine tundra, and is reflected in significant socio-economic diversity in the human landscape. GMUG National Forest recorded 4,293,300 recreation-visitor days in 1995.

Resource extraction on the GMUG in the past century has often exceeded the carrying capacity of the land with numerous damaging effects, from soil instability and erosion, to polluted aquatic systems and unhealthy forest stand structures. Given that the GMUG Forest is inherently limited biologically by how many natural resources it can provide in the long-term, the Forest Service, today, must carefully evaluate proposed activities and allow only those that will sustain and stabilize the local economic base.

The long-term economic health of communities adjacent to the GMUG Forest depends on a diverse economy. While oil and gas development constitutes today's boom, these activities will eventually fall off, causing an economic contraction. When this occurs, communities that neighbor the GMUG will need to have in place other sources of strong economic activity.

Protected public lands, according to the Sonoran Institute, especially mountain lands, in regions that are rural but connected to larger population centers, and near ski areas, have provided the greatest economic growth in the West for the last 30 years.[1] Having a clean environment, spectacular scenery, and fully protected public lands is the key to the long-term future of nearby human populations (Powers 1996). People choose a location to live based on quality of life considerations such as natural scenery, outdoor recreation opportunities, clean air and water, and the presence of wildlife and wilderness. Economic activity arises with the migration of people to these high-quality environments.[2] These new arrivals foster

[1] <www.sonoran.org >.
[2] Many other studies share this conclusion:

a diverse economic mix, promoting tourism, hunting, fishing, and dispersed recreation. Many rely on non-labor sources of income such as retirement and investment income, which fuel construction and other businesses.

It is important that the Forest Service recognize the "ecological services" that healthy ecosystems provide, e.g. "air we breathe is filtered and oxygenated by plants; water we drink is purified by wetlands; food we eat is grown in soils fertilized and renewed by ecosystem processes; …floods, droughts, and fires are mitigated by intact ecosystems; …carbon is stored in healthy forests, which is increasingly important as rising atmospheric carbon dioxide levels, due largely to fossil fuel burning and deforestation, cause global overheating" (SREP 2003). In the past, human populations have discounted these benefits as free and inevitable, but today they have gained enormous economic value. The National Science Foundation lists 17 categories of these services with an estimated value worldwide of between $16 and $54 trillion per year (Constanza *et al*. 1997). As their dollar value becomes further documented, these ecological services will have a larger role in economic decisions.

C. ECOSYSTEM TYPES AND CONCERNS[3]

Semi-desert and sagebrush shrublands

Description

Semi-desert shrublands are generally found below 7,500 feet in elevation, occurring where summers are hot, winters are cold and precipitation is sparse, often less than 10 inches per year. Their characteristic flora includes greasewood and four-winged saltbush. Sagebrush shrublands, dominated by sagebrush, range from 7,000 to 10,000 feet in elevation and experience climatic conditions similar to semi-desert shrublands except for a slight increase in precipitation and cooler temperatures year-round.

Fires have historically played an important role in shrubland ecology, which support a diverse array of plant and animal communities due to their broad ranges in environmental conditions.

Conservation Concerns

Livestock overgrazing and fire suppression have decreased palatable forbs and grasses favored by wildlife and increased unpalatable woody plants in many shrubland areas. Other causes of habitat destruction are removal of sagebrush to increase forage for livestock, conversion to cropland, oil and gas exploration, and invasion of exotic species, such as cheatgrass. These perturbations have caused population declines of shrubland-dependent species, such as sage grouse.

Rasker, R. 1994. A New Look at Old Vistas: The Economic Role of Environmental Quality in Western Public Lands. University of Colorado Law Review. Vol. 65(2): 369-399.

Rudzitis, G. and H.E. Johansen. 1991. How Important Is Wilderness? Results from a United States Survey. Environmental Management. Vol. 15: 227-233.

Rudzitis, G. and H.E. Johansen. 1989. Migration into Western Wilderness Counties: Causes and Consequences. Western Wildlands. Spring: 19-23.

[3] Information in this section comes from the following two sources:
Southern Rockies Ecosystem Project, The Denver Zoological Foundation and The Wildlands Project 2003. Southern Rockies Wildlands Network Vision. Colorado Mountain Club: Golden, Colorado.
Southern Rockies Ecosystem Project 2004. Appendix B. The State of the Southern Rockies Ecoregion. Colorado Mountain Club: Golden, Colorado.

Montane Shrublands

Description

Montane shrublands are typically found below montane forests and above grasslands, semi-desert shrublands, or piñon-juniper woodlands, in the semi-arid sites between 5,500 and 8,500 feet, although they may occur higher on south-facing slopes. In the GMUG region, montane shrublands consist mainly of gambel oak, Utah serviceberry, and mountain mahogany plant communities. Due to their mid-elevation position, these shrublands contain a mix of species from different elevation ecosystems and provide winter forage and habitat for species such as deer and elk. Fire encourages the establishment and spread of montane shrublands as an early seral stage.

Conservation Concerns

Development in montane shrubland ecosystems is degrading and fragmenting thousands of acres of valuable wildlife habitat in many GMUG areas, especially in portions of the San Juan Mountains. Fire suppression may cause other tree and shrub species to replace these montane shrubland ecosystems and result in a decline of vital wildlife food sources, such as gambel oak acorns.

Piñon-Juniper Woodlands

Description

Piñon-juniper woodlands occur primarily on warm, dry sites in the foothills and on mesa tops, between 5,500 to 8,000 feet, but sometimes higher on south-facing slopes. At hotter and drier lower elevations, these woodlands often occur in relatively sparse, savanna conditions, but as elevation increases, they grow in dense stands, interspersed with ponderosa pine and gambel oak. They are dominated by piñon pine and juniper species, have biological soil crusts, and provide habitat for 181 vertebrate species. Piñon nuts are an important food source for both wildlife and native peoples.

Conservation Concerns

Overgrazing by livestock in these woodlands has led to reduced forage for wildlife, destruction of biological soil crusts, soil erosion and an influx of invasive flora. In addition, heavy historic grazing pressure in some areas has led to unnatural increases in piñon-juniper as native forbs and grasses have declined. Besides grazing, housing development, seeding with exotic/non-local native species, and mechanical removal of piñon-juniper to provide for domestic livestock or firewood have greatly altered and fragmented these woodlands in some areas.

Ponderosa Pine Forests and Woodlands

Description

Generally found in the foothills and montane zones between 5,000 and 9,000 feet, ponderosa pine forests are typically dry and warm, and snowfall does not accumulate for long periods during the winter. Depending on elevation, these forests may comprise open or dense woodlands and become interspersed with other trees. Ponderosa pine forests support a rich diversity of animals, such as the Abert's squirrel and Mexican spotted owl. Historically, these forests have mainly supported frequent, low-intensity fires, but in some places also experienced stand-replacing fires.

Conservation Concerns

Historical and current logging has resulted in a substantial loss of ponderosa pine old-growth habitat. Fire suppression and overgrazing have contributed to unnaturally large, catastrophic fires and insect outbreaks. In addition, in many areas, heavy recreation, extensive road-networks, and exploding residential development have fragmented these forest habitats. Ponderosa pine forests are poorly represented among protected lands.

Douglas-Fir Forests

Description

Found between 5,500 and 9,000 feet, Douglas-fir prefers the cooler and more moist conditions of high elevations and north-facing slopes, where it grows in pure stands or interspersed with blue spruce, aspen, white fir, and Englemann spruce. On exposed or drier south-facing slopes, it occurs in park-like stands with limber and bristlecone pine. Douglas-fir ecosystems may include numerous shrub species, herbaceous understories, and humidity- or moisture-dependent species such as lichens and mosses. They provide habitat for approximately 80 vertebrate species, including the Northern goshawk. Low-intensity fires historically maintained large, old trees, while occasional stand-replacing fires occurred in denser stands. Western Spruce budworm, Douglas-fir bark beetles, and Tussock moths also kill or defoliate Douglas-fir trees.

Conservation Concerns

Fire suppression, logging, loss of old-growth habitat, heavy recreation, and residential development have degraded and fragmented Douglas-fir forests. Douglas-fir forests are poorly represented among protected lands.

Montane Mixed-Conifer Forests

Description

Mixed-conifer forests are comprised of various pine, fir and spruce tree species. They occur in dense stands in mesic and cool middle-elevation (7,300-9,300 ft) zones. Because of its variety of conifers, the montane mixed-conifer ecosystem provides habitat for diverse understory plant species and animals, such as the Mexican spotted owl, black bear, and one of the highest concentrations of Lepidopteran species on the continent. Historically, these forests experienced a mixed fire regime including occasional stand-replacing fires. Other disturbance agents are Western Spruce budworm and Douglas-fir bark beetle.

Conservation Concerns

Though slightly more protected than ponderosa pine and Douglas-fir ecosystems, mixed-conifer forests suffer from the same impacts: fire suppression, logging, loss of old-growth habitat, heavy recreation, and residential development.

Lodgepole Pine Forests

Description

Lodgepole pine forests occur only in scattered patches in southern and western Colorado, usually on cool, dry sites between 8,500 and 10,000 feet. These forests are tolerant of heavy snowfall and warm summers with periods of drought. Often a pioneer species that is later replaced by other forest ecosystems, lodgepole pine can dominate other conifer species after a stand-replacing fire, resulting in an even-aged, dense forest. Because they create a closed-canopy habitat, lodgepole pine forests harbor less understory, but they serve 83 vertebrate species, including elk, black bear, and American marten.

Conservation Concerns

Logging—especially clear-cutting—and road building have severely fragmented lodgepole pine forests, while encroaching residential development has led to increased fire suppression. Existing protected tracts of this forest are not sufficient to allow for natural disturbance regimes and native species movement.

Aspen Forests

Description
Commonly occurring between 8,000-10,000 feet, aspen can be found in various sites, but large trees usually exist in cool, moist conditions. These forests are generally small groves, but some extensive stands occur in southwestern Colorado (the largest continuous tracts are believed to occur near Dunton and Rico, and are managed by the San Juan and Uncompahgre National Forests). While they usually precede conifers as a successional stage, some aspen forests can become stable, mature forests. They support a rich diversity of vertebrates and insects, and are especially important to beaver for providing food and dam-building material, as well as nesting songbirds, hawks, and owls, which use cavities in old aspen forests for nesting.

Conservation Concerns
Increased logging of old aspen forests, livestock grazing, over-browsing by elk, fire suppression, and residential development threaten to eliminate stands of mature trees, reduce initiation of new stands, and fragment and reduce these forests. The presence of large carnivores may help to restore aspen communities by culling elk numbers and modifying elk movement and browsing patterns to lessen impacts on aspen forests.

Limber Pine and Bristlecone Pine Forests
Description
These unique forests are found between 7,500 feet and treeline in rugged, exposed, and dry terrain with short growing seasons, conditions that contribute to their sparse, open-canopy stands. Limber pine and bristlecone pine forests grow as individual pure stands and codominants, or with other conifers. More common in the southern half of Colorado, bristlecone pine can live over 2,000 years. Limber pine seeds are a major food source for Clark's nutcracker and gray jays. Both forests support approximately 60 vertebrates. Mammals, such as black bears, feed on the nuts of these pine trees.

Conservation Concerns
Because of their inhospitable location and twisted wood grain, these pines have remained relatively unthreatened by development and timber harvest. However, overgrazing has negatively impacted some areas, causing soil and understory plant depletion in an ecosystem where these are already scarce.

Engelmann Spruce-Subalpine Fir Forests
Description
Occurring between 9,000 and 12,000 feet on cool, moist sites where most precipitation falls as snow, these forests will grow in individual pure stands, but generally are co-dominant with each other or interspersed with pine, aspen, and alpine tundra. Old-growth forest stands have complex structures and include large-canopy trees up to 500 years old. Natural disturbance agents are rare stand-replacing crown fires, spruce bark beetle, Western Spruce budworm, wood-rotting fungi, and windthrow. Spruce-fir forests support approximately 90 vertebrates, such as boreal owl, Northern goshawk, elk, black bear, American marten, and snowshoe hare, and, historically, lynx and wolverine.

Conservation Concerns
Logging and related road building have fragmented old-growth spruce-fir forests with negative impacts on their structure and composition as well as the species dependent on forest-interior and old-growth habitat such as lynx, boreal owl, and American marten. Recreation—i.e. year-round ORV-use, ski area development and expansions—has also damaged these forests' ecological integrity.

Alpine Tundra

Description
A cold, wind-swept terrain found above 11,000-12,000 feet, alpine tundra includes a mosaic of ecosystems, such as alpine wetlands, talus and scree slopes, snowfields, and krummholz forests. Alpine tundra maintains generally stable natural conditions, but recovery from disturbances can take hundreds of years because of the brief growing season and shallow soils. Low-growing shrubs, perennial herbs, lichens and mosses dominate alpine tundra, which supports approximately 50 vertebrates, including white-tailed ptarmigan, white-crowned sparrow, horned lark, bighorn sheep, elk, and yellow-bellied marmot.

Conservation Concerns
Domestic sheep grazing and dramatic increases in recreation (especially ORV use and “peakbagging”) have destroyed native alpine vegetation and biological soil crusts, and have caused soil erosion in some areas. The absence of grizzly bears is also a concern as grizzly bears play an important role in top-down ecosystem regulation, and their presence is indicative of large expanses of wilderness quality habitat.

Aquatic, Riparian and Wetland Ecosystems
Description
Aquatic ecosystems comprise a small percentage of the GMUG, but they are among the most valuable to native species and they are rich in species diversity, supporting a host of amphibians (tiger salamander, boreal toad), resident and migrating birds (Wilson’s warbler, American dipper), native fish (Colorado cutthroat trout), mammals (river otter, beaver), insects (butterflies and dragonflies), and vegetation (willow and cottonwood species).

Riparian ecosystems consist of the upland margins of streams, rivers and lakes. In the GMUG, these ecosystems occur throughout the region, wherever high-mountain streams, low-elevation rivers, natural lakes, and ponds meet terrestrial ecosystems, and range from narrow linear communities in deep canyons to extensive areas in broad floodplains.

Wetlands are areas that are covered by water annually, with plants and animals adapted to living in water and moist soils (Cowardin *et al.* 1979). These include forested wetlands, willow carrs, fens, marshes, alpine snow glades, wet meadows, salt meadows, bottomland shrublands, shallow ponds, and playa lakes.

Concerns
Human development; water storage and diversion projects; pollution from power plants, pesticides, herbicides, and mine drainage; excess nutrients from septic and livestock waste; sedimentation from logging, road-building and recreation; overgrazing in riparian habitat; and the introduction of exotic species, such as non-native fish species, are the main conservation concerns for aquatic ecosystems. Roughly one-third to one-half of Colorado’s wetlands has been permanently destroyed due to human development and conversion to croplands (Dahl 1990, Wilen 1995). Only 0.1% of Colorado’s land area is occupied by fens (Cooper and Andrus 1994; Cooper 1996; Cooper *et al*. 1998, Cooper and MacDonald 2000). The dramatic loss of wetlands and riparian areas on private lands over the past century makes the mission of conserving them on the GMUG even more critical.

D. COMPONENTS OF THE RESERVE SYSTEM

Introduction

Mountains to Mesas proposes implementation of a reserve design system (Noss and Cooperrider 1994) comprised of protected **core reserves** or large core wild areas that are interconnected by **linkages**—habitat that allows for species dispersal and migration—and surrounded by **compatible use areas**, which accommodate medium- and high-impact recreation, extraction and other uses that are managed according to the conservation goals prescribed above (Section I.A.), with an aim to move the GMUG Forest as close to these benchmarks of ecological integrity as possible.

To aid the implementation of the reserve design system, M2m has adapted Noss' core reserve terminology used in this CMA to the existing, standard Forest Service menu of management area prescriptions, drawing from the USFS Region 2 list of available prescriptions.

1. CORE RESERVES

Core reserves are a primary component of the proposed reserve design system (Noss and Cooperrider 1994). In terms of GMUG Forest management, core reserves include wilderness and research natural areas. As large blocks of relatively intact ecosystems, core reserves provide habitat for wide-ranging animals, and promote natural processes, including nutrient cycling, predation, and the reestablishment of natural fire regimes. Because human disturbance within core reserves must be minimal in order for many species to survive, wilderness areas are the heart of core reserves (Mattson 1997).

As the term "wilderness" denotes, core reserves must be to the greatest extent "self-willed" or allowed to function in their natural state, in order to be ecologically viable. Conservation biology points to the need for core reserves that are large in size and diverse in habitat (Soulé and Simberloff 1986, Wilcox and Murphy 1985, Noss 1992). A larger core reserve area is likely to sustain more habitats and species than a smaller one. Also, natural fluctuations or stochastic factors, such as disease, impact small populations more than large ones (Frankel and Soulé 1981). "Edge effects"—natural or human impacts on the perimeter of core reserves, such as logging, tree blow-down or human poaching—disturb small reserves more than large ones because small reserves have a larger perimeter-to-area ratio. Edge effects result in reduced species viability (Noss 1983, Harris 1984, Franklin and Forman 1987, Wilcove *et al.* 1986, Janzen 1986, Noss and Cooperrider 1994).

Large, protected areas that include the full range of habitats are more capable of sustaining natural disturbance regimes and of perpetuating diverse and successional ecosystems (Aplet and Keeton 1999). Studies show that more mammal species are lost from small national parks than large ones (Newmark 1987, 1995). Designating wilderness areas for preservation, in accordance with 1964 Wilderness Act, has proven to be the most effective means of preserving large areas in the United States (Foreman 1995).

Although the main tenet of core reserve management is minimal human disturbance or intervention, wilderness areas need not be "human exclusion zones" (SREP 2003). Non-motorized recreational activities, such as backpacking or hunting, are permitted and compatible with ecological values. Further, areas selected for wilderness need not be pristine[4]: "…one of the most important criteria for large

---

[4] Senator Frank Church (1973), the floor manager of the Wilderness Act, said that the Forest Service: "…would have us believe that no lands ever subject to past human impact can qualify as wilderness, now or ever. Nothing could be more contrary to the meaning and intent of the Wilderness Act. The effect of such an interpretation would be to automatically disqualify

carnivores in the U.S. is not necessarily pristine habitat, but large areas of protected space" (SREP 2003). While ecological and experiential justifications are necessary to include them, areas with primitive roads, light historical logging and other unnatural disturbances can be designated for wilderness (SREP 2003). However, no new roads and no motorized or mechanized equipment are permitted in wilderness areas, once they have been designated, except in emergency restorative circumstances (Foreman 1998), and existing roads in designated Wilderness areas should be closed and then obliterated or turned into single-track trails.

These areas are to be managed in accordance with the 1964 Wilderness Act, specifically with no commercial logging, no mineral exploration or production, and no new mining claims. Livestock grazing should be phased out, as allotments are vacated, and eventually terminated. Wilderness areas should be managed to restore and protect their ecological integrity (SREP 2003). Therefore, activities such as reintroduction of native flora or fauna, and extirpation of exotic species are not precluded in wilderness areas.

2. LINKAGES

A primary tenet of the reserve design is connectivity between core reserves. Isolating core reserves diminishes the possibility for genetic exchange and re-colonization of species (MacArthur and Wilson 1967, Frankel and Soulé 1981). Large animals depend on biologically-linked landscapes for survival (Frankel and Soulé 1981, Noss and Harris 1986, Noss and Cooperrider 1994). "…[N]o single core area would be large enough to support large carnivores in the Southern Rockies, so carnivores must be able to move throughout the region (not just within a given Wilderness Area)…" (SREP 2003). Canada lynx, for example, might require 500,000 to 1.2 million acres of undeveloped habitat to maintain a viable population (Hoover and Willis 1987), an area greater than any existing Wilderness in the GMUG Forest. **Linkages**, which connect core reserves, are therefore essential to accommodate natural dispersal of individuals, seasonal migration, genetic exchange between populations, and possible relocation in response to climate change (Noss and Cooperrider 1994, Miller *et al.* 1998). A linkage is defined as the intervening area between larger blocks of suitable habitat that facilitates daily and seasonal movements or dispersal from natal sites by providing animals with the security, food and shelter they need to meet their life history requirements (Dobson *et al.* 1999, Servheen *et al.* 2003).

In the GMUG, linkages are particularly crucial for the reestablishment of viable populations of the endangered Canada lynx (Koehler 1990, cited in Aubry *et al.* 1999, Aubry *et al.* 1999). Since 1999, the Colorado Division of Wildlife has released 129 lynx on state National Forests. Most of these lynx are living in the San Juan Mountains, including areas of the GMUG. Canada lynx dispersal distances—movement from a place of residence to a breeding location (Shields 1987, cited in Aubry *et al.* 1999)—are typically in excess of 100 km, and successful dispersal depends partially on the distance between habitat patches, diminishing as the distance between habitat patches increases (McKelvey *et al.* 1999). When snowshoe hares, their primary food source, are scarce, lynx will travel distances that exceed 1,000 km (Koehler and Aubry 1994). However, lynx will not usually cross openings of more than 100 m in width and they do not hunt in open areas. Lynx traveling for dispersal or food-source purposes, therefore, require specific linkage habitat "…characterized by woody vegetation greater than 2 m in height with a closed canopy and close proximity to foraging habitat" (Koehler and Aubry 1994).

---

almost everything, for few if any lands on this continent—or any other—have escaped man's imprint to some degree" (cited in SREP 2003).

Linkages for GMUG forests must be selected for protection based on the habitat needs of native species specific to the GMUG. Of particular concern are focal species—those that "serve an important ecological function or indicate healthy, functioning systems" and special element species—those that are rare, endangered or endemic (SREP 2003). Focal species for the GMUG include the black bear, gray wolf, bighorn sheep, and goshawk. GMUG special element species include the Canada lynx, Gunnison sage grouse, and boreal toad. Linkages must facilitate the movement of focal and special element species. In addition, far-ranging species, such as the wolf and lynx, will require linkages with habitat of sufficient width in order to minimize detrimental edge effects (Miller *et al.* 1997).

3. COMPATIBLE USE AREAS

Compatible use areas serve multiple purposes that are ecologically and conservationally important: "They ameliorate edge effects on core wild areas by insulating core wild areas from intensive land use; they provide a suitable habitat matrix for animals to move between core wild areas (i.e., enhance connectivity); they provide supplemental habitat for populations of many native species inhabiting core wild areas, and stabilize population dynamics; they protect adjacent developed areas from any adverse impacts by large mammals that reach relatively high densities in core wild areas" (Groom *et al.* 1999).

Low Use Compatible areas may surround core reserves to insulate them from human impacts and the intrusion of exotic species, and thereby reduce edge effects. Low Use Compatible areas support light human uses that are compatible with effectively-functioning habitat and are practiced according to the conservation goals of this reserve design. They are areas of low road density (less than 0.5 miles/square mile), with vehicle use limited to designated roads and mountain bikes allowed on designated trails. Some compatible uses for buffer zones include: backpacking, camping, hunting, fishing, ecologically-sensitive and predator-friendly livestock grazing, and limited low-intensity silviculture (Groom *et al.* 1999).

Medium and High Use Compatible areas can provide temporary habitat for a dispersing individual, while accommodating some carefully-managed medium- and high-impact human activities such as grazing, timber harvest, mineral extraction, and dispersed camping and hunter camping in ecologically-appropriate sites.

Medium and High Use Compatible areas provide for heavily-managed wildlife and ecological restoration that temporarily requires habitat manipulation to favor focal species. They may have a higher road density than buffer zones. Vehicular and mountain bike use is restricted to designated routes.

E. GUIDELINES FOR SELECTION OF CORE RESERVES AND LINKAGES

In designing the key biological components of this alternative, M2m applied the following guidelines compiled from many scientific sources (Noss and Cooperrider 1994):

- Species well distributed across their native range are less susceptible to extinction than species confined to small portions of their range.
- Dispersing individuals travel more easily through habitat most closely resembling that of their preferred home ranges.
- Large blocks of habitat, containing large populations of ecologically important species are superior to small blocks of habitat containing small populations.
- Blocks of habitat close together are better than blocks far apart.
- Habitat in contiguous or connected blocks is better than fragmented habitat.
- Blocks of habitat that are roadless or otherwise less accessible to humans are superior to roaded and accessible habitat blocks.

To determine the location and size of core reserves, linkages, and compatible use lands, M2m proposes the **three-track approach** (Noss and Cooperrider 1994): (1) represent habitats and vegetation types; (2) identify and protect special elements (locations of threatened species), biodiversity "hotspots," and important places such as roadless areas; and 3) identify and protect key habitat for focal species that indicate healthy, functioning systems. Combined, these three tracks offer a comprehensive approach toward conservation planning (SREP 2003). This Alternative should be evaluated and adjusted accordingly by monitoring the Management Indicator Species listed in Section II.D.

1. ECOSYSTEM REPRESENTATION

Approximately, 70% of the protected lands in parks and Wilderness Areas of the Southern Rockies are above 10,000 feet, while low- and mid-elevation ecosystem types, such as grasslands and shrublands that support a high number of vertebrate species, are not sufficiently represented in protected areas (SREP 2004). Species that depend on low- and mid-elevation habitats like the flammulated owl, which occurs in ponderosa pine and mixed-conifer forests, commonly have little protected habitat (SREP 2004).

Ecosystem representation or selecting areas for protection that represent a full range of habitats and vegetation types is a way of ensuring protection of the species that rely on various ecosystems for survival (Pressy *et al.* 1993). The Nature Conservancy, which practices this "coarse filter" method, estimates that 85% to 90% of all species in a region can be protected via ecosystem representation (Noss and Cooperrider 1994). In addition, this approach is economically efficient when it comes to collecting data: "Broader vegetation schemes serve as a surrogate for data on each individual species within a given scheme, and these vegetation patterns are easier to map. In many cases such data already exist…" (SREP 2004).

The present configuration of the GMUG Forest protected areas does not adequately represent all ecosystem types, particularly **ponderosa pine forest**, **piñon-juniper forest**, **fens**, and **sagebrush lands**.

3. SPECIAL ELEMENTS

Protecting areas based solely on ecosystem representation may not sufficiently ensure protection of rare species and unique ecosystems, also known as **special elements**. Therefore, a "fine filter" approach is necessary, targeting specifically-identified special element locations for protection. Examples of special elements in the GMUG include:

• rare, threatened, or endemic species (e.g. lynx, sage grouse)
• biodiversity "hotspots" (e.g. areas with high species richness or endemism)
• rare and/or important natural communities (e.g. wetland and riparian ecosystems)
• communities within important seral stages (e.g. old-growth forests)
• sites historically important to native species (e.g. elk calving and wintering grounds)
• wildlife linkages
• roadless areas

Roadless Areas
"Habitat fragmentation is the most serious threat to biological diversity and is the primary cause of the present extinction crisis" (Wilcox and Murphy 1985).

Because roads severely fragment habitat (Fahrig *et al.* 1995, Forman *et al.* 1995), protecting remaining roadless areas is a major component in the M2m reserve design. Roadless areas are less accessible to humans and offer some of the best opportunities for conservation and restoration on the GMUG Forest.

Large roadless areas are capable of "perpetuating important natural processes, such as fire, flooding, or intact nutrient cycling" (Baker 1992), and, thus, are more likely to be "sustainable and self-regulating" (SREP 2004). They support many native, wide-ranging and "interior" species that require remote habitat (Noss 1991) and provide habitats that are more likely to be free of exotic species, and sources of pollution and degradation.

Given the restoration and conservation potential and value of roadless areas, M2m proposes the following: (1) add contiguous roadless areas to existing Wilderness areas in the GMUG Forest to protect larger blocks of habitat; (2) recommend for Wilderness those roadless areas between existing Wilderness to minimize distances between blocks of protected habitat; and (3) designate lower-elevation roadless areas for Wilderness to protect additional and more productive native ecosystem types and to be responsive to possible climate change.

Of the 10 largest roadless areas in the Southern Rockies, 3 are partially located within the GMUG Forest: Collegiate Peaks Roadless Area, which is 145,300 ha and 46% protected; West Elk Roadless Area, which is 129,400 ha and 55% protected; and La Garita Roadless Area, which is 103,600 ha and 49% protected (SREP 2003). Thus, the GMUG Forest have a unique potential to return to and maintain ecological integrity through protection of these roadless areas.

Other special elements on the GMUG Forest of particular significance are as follows:

Canada lynx (*Lynx canadensis*): ranked by the Colorado Natural Heritage Program (CNHP) as critically imperiled or extremely rare in Colorado; determined by the Colorado Wildlife Commission to be endangered in Colorado; and identified by the U.S. Fish & Wildlife Service (USFWS) as threatened nationally. Data are not yet available to determine the reintroduced lynx's ecological interactions on the GMUG.

Gunnison sage grouse (*Centrocercus minimus*): a CNHP imperiled or very rare species in Colorado; a Colorado Wildlife Commission "special concern" species; and a BLM "sensitive species"; endemic to the Gunnison Basin in Western Colorado

Boreal toad (*Bufo boreas boreas*): a CNHP critically imperiled or extremely rare species in Colorado; a Colorado Wildlife Commission endangered species; and a USFS "sensitive species"

Fens: Although fens only occupy a minor portion of the landscape, they perform important hydrological and water quality functions, as well as providing habitat for species like the carnivorous roundleaf sundew (*Drosera rotundifolia*) and lesser bladderwort (*Utricularia minor*), both USFS "sensitive species," and "local concern" species like the mud sedge (*Carex limosa*) and bog buckbean (*Menyanthes trifoliata*). The Mountain-Prairie Region of the U.S. Fish and Wildlife Service has determined that all functioning fens fall within their Resource Category 1, meaning that the goal is no loss of existing habitat value, and that every reasonable effort should be made to avoid impacting these habitats. Mitigation for loss of fens is problematic, as there are no known methods to create new functional fens. For these reasons, this alternative recommends that the protection of all fens be a priority in the GMUG.

4. FOCAL SPECIES

The third component of the three-track approach addresses the needs of **focal species**. A focal species approach assumes that the conservation of viable populations of focal species captures the ecological factors needed to maintain healthy populations of other species and functioning natural processes (Lambeck 1997, Miller *et al.* 1998, Watson *et al.* 2001). This approach identifies additional high-value habitats for particular focal species that represent important ecological functions or are indicators of healthy, functioning systems (e.g. old-growth forest, intact riparian areas).

Top-level carnivores are particularly important to use as focal species for conservation because their far-ranging and diverse habitat needs often encompass those of numerous other species, and they are often excellent indicators of certain habitat conditions. In addition, large predators have fundamental roles in sustaining the natural balance of ecoregions via "top-down regulation" (Terborgh *et al.* 2001, Miller *et al.* 2001). Many peer-reviewed studies have shown that ecosystems are incomplete in both form and function without large predators (Soulé and Noss 1998, Terborgh *et al.* 1999, Oksanen and Oksanen 2000, Estes *et al.* 2001, Miller *et al.* 2001). For example, without natural predators like the wolf, ungulate numbers have increased sometimes by a factor of five to seven times (Crête and Manseau 1996, Crête 1999, Berger *et al.* 2001), beyond the carrying capacity of the land. This imbalance often results in negative impacts on other species; for example, an overabundance of elk is detrimental to aspen growth (Kay 1990, Kay and Wagner 1994, White *et al.* 1998, Ripple and Larson 2000), and over-browsing by both deer and elk has dramatically impacted lower elevation grassland/sage/shrub ecosystems of the Gunnison Basin, which in turn has impacted species like the Gunnison sage grouse and American pronghorn.

The M2m Alternative has selected large carnivores such as the **gray wolf** as focal species because of their potential role in maintaining ecological integrity in the GMUG, as well as representing the requirements of numerous species for survival. While the gray wolf is not currently present in the GMUG, it is likely to return in the future, and portions of the GMUG have been identified as having some of the best potential habitat for wolves in the Southern Rockies (Carroll *et al*. 2003). As has been previously emphasized, big, interconnected wilderness areas that support large native predators like the gray wolf are critical to preserving and restoring self-regulating natural communities (MacArthur and Wilson 1967).

Focal species may include "keystone" species, which enrich ecosystem function in various interactions, such as predation, competition, mutualism, and habitat modification (Power *et al.* 1996, Jeo *et al.* 2000, Soulé *et al.* in press). Besides top predators, some keystone species, such as the **beaver**, shape ecosystems into a mosaic of habitats that provide for greater diversity (Naiman *et al.* 1988) or have other important functions, such as seed dispersal.

Focal species that are known as “umbrella” species are those whose diverse habitat needs represent the needs of many other species. An example of an umbrella species on the GMUG is the **black bear** whose necessary terrain includes subalpine coniferous forests, subalpine aspen forests, upper montane coniferous forests, lower montane coniferous forests, Rocky Mountain closed coniferous forests and adjacent shrublands and grasslands (SREP 2003).

Focal species that are known as “indicator” species “are tightly linked to specific biological elements, processes, or qualities, and are sensitive to ecological changes” (SREP 2003). Thus, they serve as indicators of ecosystem health and early warning systems of environmental shifts (Noss and Cooperrider 1994). An example of an indicator species of the GMUG Forest is the **Northern goshawk**, a raptor that is most commonly associated with mature and old-growth coniferous forests, and mixed conifer-aspen stands or aspen stands abutting conifers. Because the Northern goshawk depends on this specific habitat, its status indicates the quality of this habitat.

On the GMUG, focal species include:

Northern goshawk (*Acipiter gentilis*): a USFS/BLM “sensitive species”; and an indicator of mature and old-growth forest coniferous forests and contiguous mixed conifer-aspen and aspen stands

Black bear (*Ursus americanus*): an indicator of large, roadless, contiguous and connected areas with closed forest and woodland habitat, predominantly aspen and Gambel oak; and an umbrella species because its large-area habitat requirements include those of many other species

Bighorn sheep (*Ovis canadensis*): an indicator of steep-sloped, rugged terrain dominated by grass and shrubs; open space; and Wilderness quality because it is intolerant of human disturbances

Rocky Mountain elk (*Cervidae*): an umbrella indicator for many species in forested and non-forested landscapes. Healthy elk herds are an indicator of high forest landscape integrity (low road densities), secure, low-elevation wintering areas, and a variety of ecological zones and vegetation types.

Gray wolf (*Canis lupus*): a CNHP presumed extinct/apparently extirpated from the state species, a USFWS endangered species, and a Colorado Wildlife Commission endangered species; a keystone species because it is a top-down ecosystem regulator; an umbrella species because the large areas that wolves require for population persistence include habitats necessary to many other species

Gunnison sage grouse (*Centrocercus minimus*): a CNHP imperiled or very rare species; a Colorado Wildlife Commission “special concern” species; and a BLM “sensitive species”; an indicator of healthy sagebrush ecosystems in both upland and riparian areas

Canada lynx (*Lynx canadensis*): a CNHP critically imperiled or extremely rare species prior to its recent reintroduction; an umbrella indicator of mature forests displaying a good mosaic of small openings and dense forest cover. An ecosystem top predator, lynx is a prime indicator of Wilderness quality because of its dependence on old-growth forests subject to dynamic natural disturbance regimes.

Colorado River cutthroat trout (*Oncorhynchus clarki pleuriticus*): a CNHP vulnerable, very rare, or found in restricted range species; a Colorado Wildlife Commission "special concern" species; a USFS/BLM "sensitive species"; an indicator of high water quality (temperature, chemical constituency, turbidity) and water quantity (streams exhibit natural flow regimes throughout the year), also an indicator of lack of competition from non-native species, and lack of fishing pressure from public use

Beaver (*Castor canadensis*): a keystone species because its ability to physically alter aquatic systems provides and enhances habitats for numerous other species (Naiman *et al*. 1988); an indicator for high-quality riparian ecosystems where aspens, willows, cottonwoods and/or alders occur (Allen 1983)

Biological soil crusts: Lichens and mosses are indicators of intact alpine plant communities and lack of disturbance. Mosses are also indicators of intact fen communities that have sustained little hydrological or soil disturbance.

F. DATA USED IN DESIGNING THE M2m ALTERNATIVE

Data Sources

Information from a variety of sources was used to shape the M2m CMA. Primary information came from citizen surveys and expert interviews (see Appendix I for the survey form). Nearly 40 surveys were collected from local residents and 26 expert interviews were conducted with biologists representing several different agencies, organizations and universities. Approximately 50 people reviewed drafts of the prescriptions map. These interviews and surveys provided essential field knowledge in the development of this CMA.

In addition to the information compiled from these experts and citizens, Table 1. lists each of these data sources as they relate to the three-track approach for identifying core reserves, linkages, and compatible-use lands. Table 2. lists these data sources relative to each of the M2m management prescriptions. Together, these data sources, in conjunction with the citizen and expert input, defined the need for the various forest uses and activities, and guided the M2m team in determining where each is appropriate and in defining the boundaries for the management prescription.

Table 1. Data Sources Used to Map Prescriptions and Define Boundaries, with Respect to the Three-track Approach for Identifying Core Reserves, Linkages and Compatible-Use Lands

Track	Data Layer	Source
Ecosystem Representation	Roadless Areas	Citizens Roadless Area Inventory (SRCA)
	Ecosystem types	COGAP vegetation
Special Elements	Biodiversity hotspots	Potential Conservation Areas (CNHP)
	Rare, threatened and endangered species and communities	CDOW, CNHP, Forest Service and BLM specialists
	Wildlife linkages	SREP
	Historically important sites for wildlife	CDOW, local experts
	Lynx habitat	USFS
	Gunnison sage grouse habitat	CDOW
	Boreal toad habitat	CDOW (incorporate data when available)
	Fens	CNHP and Dr. David Cooper (CSU)
Focal Species	Canada lynx	USFS
	Grey wolf	SREP
	Gunnison sage grouse	CDOW
	Colorado River cutthroat trout	CDOW
	Northern goshawk	CDOW, USFS
	Black bear	SREP
	Bighorn sheep	CDOW
	Elk	CDOW

Table 2: Data Sources Used to Map Prescriptions and Define Boundaries, with Respect to Each Management Prescription

M2M Prescription	Data Layer	Source
Recommended for Wilderness	Roadless Areas	Citizens Roadless Area Inventory (SRCA)
Research Natural Area	Existing USFS; others based on citizens' recommendations	Digitized
Special Interest Area	Existing USFS; others based on citizens' recommendations	Digitized
Gunnison Sage Grouse Habitat Area	Gunnison Sage Grouse – NDIS data (use 'overall range')	CDOW
Lynx Habitat Area	Lynx – USFS mapped denning habitat and linkages	USFS
Colorado River Cutthroat Trout	Identified stream reaches (not yet mapped)	CDOW
Wildlife Linkage Area	Identified wildlife linkages	SREP
Forested Wildlife Habitat	Existing forested habitat; NDIS data	CDOW
Ecological Restoration	Existing intensive timber management w/ roads; potential wildlife habitat (lynx and others)	USFS GMUG Activity layer, Aerial photos, GMUG Roads & trails data; CDOW
Dispersed Non-Motorized Recreation	Roadless/Quiet zones near Crested Butte, Wildlife security zones	Gunnison Travel Group CDOW
Big Game Winter Range	NDIS data – mule deer, elk, bighorn sheep (use 'winter concentration')	CDOW
Bighorn Sheep Habitat	Big horn sheep NDIS data ('overall range')	CDOW
Municipal Watershed Protection Area	Municipal watersheds	Local municipalities
Scenic Byways	Not mapped	CDOT
Ski-Based Resorts	Existing ski area developments	USFS
Dispersed Motorized Recreation	Existing roaded areas, citizens' recommendations	GMUG Roads & trails data
High Use Motorized Recreation	Existing high use motorized recreation sites	Aerial photos; existing management prescriptions
Timber Compatible	Former cut areas	Aerial photos; suitable timber base (USFS)

G. RELATIONSHIP TO ADJACENT NON-GMUG LANDS

Nestled between the high peaks of the Continental Divide and the Colorado Plateau, the GMUG encircles the Gunnison Basin. This expansive area encompasses numerous additional public lands including four National Forests (Pike San Isabel, White River, Rio Grande and San Juan); The Black Canyon of the Gunnison National Park; Curecanti National Recreation Area; numerous state parks, state wildlife areas and fish hatcheries; and large expanses of BLM lands. To ensure that Forest management considers the greater ecosystem, protection of biodiversity must be the highest priority on these adjacent public lands.

National Forest Roadless Areas Contiguous/Adjacent to Gunnison National Forest

Pike San Isabel

Several important connections should be highlighted between the Pike San Isabel and the Gunnison, notably, Romley East (Pike San Isabel) and Romley West (Gunnison) join to form an area that is over 20,000 acres. Also, Kreutzer-Princeton is adjacent to an area by the same name on the Gunnison. Joined together these four areas equal 70,000 acres, and recent CDOW data suggest they are part of an important new lynx concentration area in the northeastern Gunnison Basin. Additionally, three large roadless areas along the Continental Divide south of Monarch Pass are contiguous with Gunnison roadless areas. Both Chipeta and Starvation Creek are recommended for Wilderness, while Antora Peak is a proposed Research Natural Area. Together these areas are important wildlife habitat comprising a major portion of the Monarch Pass to Poncha Pass wildlife corridor identified by the Southern Rockies Ecosystem Project.

Antora Peak, 3,800 acres
Antora Peak lies at the juncture of the Gunnison, San Isabel and Rio Grande Forests. The barren slopes and tundra of Sheep Mountain give way to spruce-fir stands, with pockets of lodgepole, limber pine and aspen, providing diverse wildlife habitat. The Upper Arkansas and South Platte Project recommends the majority of 3,800-acre area for a Research Natural Area, with the balance as non-motorized backcountry recreation.

Starvation Creek, 7,600 acres
Encompassing the Continental Divide south of Marshall Pass. Poncha, Starvation and Silver Creeks, the 7,600-acre Starvation Creek area provides lush riparian vegetation and stands of Englemann spruce, subalpine fir, lodgepole pine, Douglas-fir and aspen. The Upper Arkansas and South Platte Project recommends Starvation Creek for Wilderness designation.

Chipeta, 34,026 acres
Chipeta lies north of Marshall Pass and east of the Continental Divide. The west side is dominated by Mount Ouray, Devils Armchair, Chipeta Mountain and Pahlone Peak, all well above 12,000’, and on the east by stands of spruce-fir, lodgepole pine and aspen as

the elevations fall off to 9.500 feet. The Upper Arkansas and South Platte Project recommends Chipeta for Wilderness designation.

Mt Antero, 67,400 acres

At more than 67,000 acres, Mt. Antero—with its 14,269-foot summit—is the largest of the adjacent six areas on the San Isabel. It is predominantly barren rock, alpine tundra and alpine wetlands, with several species of *Draba* and boreal toads, thus indicating its biological diversity. There are many historical prospects, and some access to the high peaks and lakes via cherry-stemmed roads. The Upper Arkansas and South Platte Project proposes Mt. Antero for Wilderness

Kreutzer-Princeton, 50,200 acres

This proposed Wilderness of more than 50,000 acres lies along the Continental Divide between Tin Cup Pass and Cottonwood Pass. Collegiate Peaks Wilderness is immediately to the north, separated only by the Cottonwood Pass road. It features the high peaks of Mt Princeton on the east and Emma Burr and Kreutzer Peak on the west. Mineral Basin lies at more moderate elevations through the central part of the area, providing extensive riparian zones and wildlife habitat for many species, including a large bighorn sheep herd. Within the Wilderness, there are four proposed Research Natural Areas, which is a strong indication of its relatively pristine condition and ecological importance.

Romley, 8,600 acres

Romley, at 8,600 acres lies along the Continental Divide south of Kreutzer-Princeton and west of Mt. Antero. Its high elevations have significant wetlands, and spruce-fir forests are found in several of the stream headwaters on the east side. Romley is proposed for Wilderness to maintain connectivity along the Divide complex of Wildernesses.

San Juan National Forest

San Miguel, 59,738 acres

The 59,738-acre roadless area offers outstanding opportunities for primitive recreation and solitude in one of the most stunningly spectacular settings in all of Colorado. The San Miguel range consists of craggy and difficult summits between Molas and Lizard Head Passes. A generous network of trails laces the area, including a 20-mile segment of the Colorado Trail, offering hikers abundant opportunities for exploration. San Miguel occupies a key link in the landscape of intact spruce-fir forest ecosystems in the San Juans. The area's old-growth and mature spruce-fir forests fill the gap between similar forests in the Weminuche Wilderness to the southeast and the Lizard Head Wilderness directly northwest across Lizard Head Pass.

Grizzly Peak RNA, 5,672 acres

Grizzly Peak is a high elevation RNA containing high quality tufted hairgrass meadows along with sedge and willow dominated wetlands. A wet spruce-fir forest with some old-growth stands blankets the lower slopes. The alpine vegetation occurs on large areas of Mancos shale interspersed with volcanic intrusions and provides good examples of patterned ground in an alpine setting. The area is deemed unsuitable for timber harvest, has not experienced any mining activity, and is closed to motorized recreation. The grazing allotment is vacant and would be permanently closed. The Grizzly Peak RNA is within the San Miguel Roadless Area, partially sharing a border with the GMUG.

Middle Peak RNA, 2,729 acres
Middle Peak contains a spruce-fir forest in a mosaic of stands of widely-varying age. Sedge dominated wetlands occur where landslides create benches and swales. Thurber fescue meadows are also common. Exotic species are rare other than lodgepole pine, which was planted near the area's southwest boundary. The RNA is largely within the Lizard Head Wilderness and is thus mostly unavailable for logging, mining, or motorized recreation. The grazing allotment is vacant and would be permanently closed.

White River National Forest

Housetop Mountain and Mamm Peak
Housetop Mountain and Mamm Peak are two large, adjacent roadless areas on the WRNF that lie in the highlands above and south of the communities of Battlement Mesa and Parachute. Combined, these total a 54,634 roadless area.

Housetop Mountain is a RARE II area that ranges from 5,200-9,289 ft. with many steep slopes over 60%. It contains piñon-juniper, sagebrush, and gambel oak, with small pockets of aspen and Douglas fir. It contains a remnant bighorn sheep herd, several sensitive and endangered plant and animal species and habitats, and was designated a Research Natural Area in the revised Forest Plan. Citizens inventoried it at 16,944 acres, significantly larger than the 12,654 acres claimed by the WRNF. It is at the western extremity of WRNF and is contiguous with an 11,115-acre roadless area on Gunnison NF. Its current WRNF Management Prescriptions are Research Natural Area, Bighorn Sheep Habitat, and Elk Habitat all noted for their habitat and ecological value, demonstrating that the WRNF acknowledges its ecological importance.

Mamm Peak has been inventoried by citizens at 26,575 acres, somewhat larger than the WRNF's RARE II 25,326 acreage. It spans from 7,100-11,123 ft. containing piñon-juniper, sagebrush, gambel oak, large areas of aspen, and spruce-fir. It is flat to rolling terrain with some oil shale cliffs. It contains important elk habitat, deer and elk winter range and some of the best black bear habitat in the state. It is adjacent to Housetop Mt. Roadless Area (RA) and the same 11,115 RA on the GMUG mentioned above.

Thompson Creek/East Willow/Hayes Creek/McClure Pass

This roadless complex spans across two National Forests, comprising a wild area larger than either the Hunter-Frying Pan or Holy Cross Wilderness Areas. East Willow is contiguous with the 41,360-acre Clear Fork roadless area on the Gunnison NF, which connects it with the 29,680-acre Thompson Creek roadless area back on the White River. Thompson Creek, in turn, connects to another 9,470-acre roadless area on the Gunnison and the 7,784-acre Hayes Creek RA and the 25,285-acre Assignation Ridge/Thompson Creek BLM area on the WR, for a total wild area of 121,600 acres.

Thompson Creek spans from 8,000-11,000 ft. across mainly rolling terrain with a few deeply incised creeks, three containing cutthroat trout populations. Vegetation is varied and diverse with open meadows, piñon-juniper and sagebrush, aspen, and spruce-fir. There are pockets of gambel oak and Douglas fir. It is summer range and calving grounds for elk, and has documented goshawk usage. Citizens inventoried that area at 29,680 acres, significantly larger than the WRNF's inventory of 18,500 acres.

Thompson Creek contains the Lake Ridge Lakes, a unique feature in that they are found on top of a ridge. This area includes Colorado Natural Heritage Program's Middle Thompson Creek Potential Conservation Area, rated "very high significance" for biodiversity, including a Class A Colorado River Cutthroat Trout stream, Boreal Owl habitat and a riparian willow carr. The largest stands of old growth and potential old growth spruce-fir on the White River are in the Thompson Creek Roadless Area.

East Willow spans from 7,800-10,200 ft. with rolling terrain varying from relatively flat to over 40%. It contains sagebrush, gambel oak, aspen, spruce-fir and is part of the great aspen forest that spreads from the West Elks to Divide Creek, what some consider the largest aspen forest in the world. It contains prime elk habitat, including a large calving area in aspen on the south side of West Divide Creek. Citizen inventories found it to be 7,891 acres, somewhat larger than the WRNF inventory at 7,122 acres.

Hayes Creek forms the essential wildlife link on the White River National Forest from the Raggeds and Maroon Bells-Snowmass Wilderness Areas to the Thompson Creek and Clear Fork (Gunnison NF) roadless areas and ultimately to Grand Mesa. It ranges from 7,400' to 11,200' with vegetation composed of primarily aspen with lower elevation gambel oak and sparse spruce-fir on ridgetops. Citizens have inventoried that area as containing 7,784 acres. It contains elk calving and bighorn sheep habitat.

Reno Mountain is a RARE II area that spans from 7,000-9,700 ft. and is 12,368 acres in size. It is comprised of rolling terrain varying from flat to 40% slope with sagebrush and piñon-juniper, gambel oak, aspen, and spruce-fir. A black bear fall concentration area, wild turkey range, elk resident population and calving area, and mule deer summer range, Reno Mountain is the only WRNF IRA with land cover dominated by a mix of aspen and shrub—a vegetation type poorly represented in WRNF roadless areas. The area from Battlement Mesa (Housetop Mountain and Mamm Peak IRAs) east to the Divide Creek watershed (including Reno Mountain) is the finest black bear habitat in the state of Colorado, according to WRNF Forest Ecologist Keith Giezentanner. Reno Mountain is also the best bear migration route from Divide Creek to the Grand Mesa, and the only route between the Battlement and Grand Mesa areas that does not go through human settlements.

Star Peak has been inventoried by citizens at 5,165 acres, though the WRNF does not recognize it as a roadless area. It is contiguous with a 35,120-acre roadless area on the

GMUG, and primarily lies above tree line. Most of it is identified as a Special Interest Area MA 2.1 due to CNHP identification of the site as a Potential Conservation Area containing ten rare plant species with G2/G3 and S1/S2 rankings. It contains the only known location of alpine arnica in the State of Colorado. It also may contain Uncompahgre fritillary butterfly.

BLM Lands

Dominguez Canyons
Encompassing more than 70,000 acres, Dominguez Canyons straddle the Mesa-Delta county line, approximately 20 miles southeast of Grand Junction. Spanning an elevation range from 4,800 feet along the Gunnison River to 9,000 feet on the Uncompahgre Plateau, Dominguez Canyons encompasses ecosystems as varied as upper Sonoran desert to Douglas fir-aspen forest. Perennial streams throughout this important watershed flow into Big and Little Dominguez Canyons. The Grand Junction and Uncompahgre (Montrose) BLM Field Offices are cooperatively developing a Dominguez-Escalante Community Stewardship Plan that would address Dominguez Canyons. Support for Dominguez Wilderness is abundant and diverse, from hunters, hikers, equestrians, and other outdoor enthusiasts, to businesses and surrounding county commissions.

Gunnison River Bluffs
The Gunnison River Bluffs area covers 12,400 acres contiguous to Dominguez WSA. The proposed wilderness encompasses an intricate system of mesas and canyons, and hosts numerous species across three distinct ecosystems. Piñon-juniper woodlands punctuate the rolling hills of the western portion of the unit, giving way to sagebrush and prickly pear as the terrain becomes rockier and more rugged. At the eastern boundary, sheer cliffs plunge hundreds of feet down to the waters of the Gunnison River, providing a scenic backdrop and shelter for a variety of bird species. Exploring the tight canyons, visitors can encounter the very definition of solitude in close proximity to two growing population centers (Grand Junction and Delta).

Roubideau Canyon
Encompassing 14,476 acres, the Roubideau Canyon Citizens Wilderness Proposal includes the 10,562-acre Camelback WSA, which is managed by the BLM's Uncompahgre Field Office. The upper reaches of the canyon also include 19,650 acres of Forest Service land in the Uncompahgre National Forest, which Congress designated as the Roubideau Area in 1993. Roubideau Canyon spans life zones from upper Sonoran desert at 5,000 feet to sub-alpine at 9,500 feet. Roubideau's perennial streams flow into the Gunnison River. Based on its contribution to the lower Gunnison watershed as well as its proximity to Escalante Canyon, citizens have asked the BLM to consider Roubideau Canyon in the Dominguez-Escalante Community Stewardship Plan. Roubideau is located near the city of Delta.

I. BIODIVERSITY AND MULTIPLE USE—REGULATORY FRAMEWORK

The 1964 Wilderness Act is a mandate "…to secure for the American people of present and future generations the benefits of an enduring resource of wilderness." Congress deemed this action necessary "…to assure that an increasing population, accompanied by expanding settlement and growing mechanization, does not occupy and modify all areas within the United States and its possessions, leaving no lands designated for preservation and protection in their natural condition…."

Protected areas, such as designated wilderness areas, are central to conservation efforts worldwide to safeguard species and habitat (Soulé and Wilcox 1980: 4, Hendee *et al.* 1990, Foreman and Wolke 1992, Foreman 1999, Nash 2001). Yet, as early as the 1920s and 1930s, ecologists such as Victor Shelford noted that species and habitats within existing protected areas were still being lost (Shelford 1926, Shelford 1933, Leopold 1937). The problems inherent in Shelford's era persist today; namely, protected areas are spatially inadequate to maintain native biodiversity, taking into account even the largest protected Wilderness Areas (Newmark 1995, Noss and Cooperrider 1994). Also, protected areas generally have not been selected based on biological or ecological criteria, so that many ecosystems are not well represented (SREP 2003). In the Southern Rockies, for example, protected areas have often been chosen for their scenic and recreational values, while some of the most "productive" ecosystems, such as low-elevation riparian areas and shrub lands, remain largely outside the existing system of publicly-owned nature reserves (SREP 2003). In 2000, Shinneman *et al.* determined that "only 3 out of 12 major terrestrial ecosystem types in the Southern Rockies had more than 10% of their total area within strictly protected lands such as National Parks, Wilderness Areas, and Research Natural Areas" (SREP 2003).

Species extinctions or extirpations on public lands, such as the grizzly bear, gray wolf, wolverine and Canada lynx in the GMUG, are contributing to the collapse of whole ecosystems (Grumbine 1992), and despite the National Forest Management Act (NMFA) requirement that "Population trends of the management indicator species will be monitored and relationships to habitat changes determined" (36 C.F.R. § 219.19 (a)(2) and (a)(6)), data to guide the preservation of viable populations of remaining species is still limited. In his analysis of the National Forest System, resource policy expert Edward Grumbine (1990) states, "…on the evidence of conservation biology models and accounting only for existing habitat fragmentation, the Forest Service cannot justifiably claim to be maintaining minimum viable populations."

Unless these serious concerns are addressed and efforts are taken to halt damages to public lands and to restore them on a larger temporal and geographic scale, the continent is destined to be "wiped clean of old-growth forests and large carnivores," and to become "a continent of weeds" (Soulé and Terborgh 1999). We will solely be perpetuating "ecological museum pieces—single representatives of communities that, although present because of unusually large restoration and maintenance investments, do not exist in any ecologically meaningful way" (Simberloff *et al.* 1999: 71). Hence, under present National Forest management practices, the intent of Congress "to secure…an enduring resource of wilderness" is not, according to scientific evidence, being fulfilled.

Forestry management recommendations based on the most current scientific research and species data, then, call for a major change in philosophy, one that shifts away from anthropocentric needs to biocentric ones, with a commitment to restoring and protecting biota of the GMUG, as well as the air, water, soil, and the natural processes necessary for their survival. Moreover, such an approach is mandated by existing laws and regulations, as for example, the Planning Regulations at Title 36 of the Code of Federal Regulations concerning wildlife:

> "219.19 Fish and Wildlife Resource
>
> Fish and wildlife habitat shall be managed to maintain viable populations of existing native and desired non- native vertebrate species in the planning area. For planning purposes, a viable population shall be regarded as one which has the estimated numbers and distribution of reproductive individuals to insure its continued existence is well distributed in the planning area. In order to insure that viable populations will be maintained, habitat must be provided to support, at least, a minimum number of reproductive individuals and that habitat must be well distributed so that those individuals can interact with others in the planning area...
>
> (1) In order to estimate the effects of each alternative on fish and wildlife populations, certain vertebrate and/or invertebrate species shall be identified and selected as management indicator species.... In the selection of management indicator species, the following categories shall be represented where appropriate: Endangered and threatened plant and animal species identified on State and federal lists for the planning area; species with special habitat needs that may be influenced significantly by planned management programs ; ... and additional plant or animal species selected because their population changes are believed to indicate the effects of management activities on other species of selected major biological communities or on water quality.
>
> (2) Planning alternatives shall be stated and evaluated in terms of both amount and quality of habitat and of animal population trends of the management indicator species" [emphasis ours].

This regulatory language mandates much of what the M2m Alternative proposes to do in the plan revision, and is strongly supported by recent research indicating the importance of ecologically effective densities of strongly interacting species (Soule et al. 2005)

In addition, direction for sensitive species, or those declining in population or distribution, is found at Forest Service Manual 2672.41:

> "Objectives of the Biological Evaluation.

> 1. To ensure that Forest Service actions do not contribute to loss of viability of any native or desired non-native plant or animal species.
> 2. To ensure that activities do not cause any species to move toward federal listing.
> 3. <u>To incorporate concerns for sensitive species throughout the planning process</u>, reducing negative impacts to species and enhancing opportunities for mitigation" [emphasis ours].

There is further direction on diversity in the Planning Regulations:

> "Forest Planning shall provide for diversity of plant and animal communities.... Such diversity shall be considered throughout the planning process. Inventories shall include quantitative data making possible the evaluation of diversity in terms of its prior and present condition" (36 CFR 219.26).

> "Management prescriptions ... shall preserve and enhance the diversity of plant and animal communities ... <u>so that it is at least as great as would be expected in a natural forest</u> ..." (36 CFR 219.27 g) [underline added for emphasis].

Finally, Planning Regulations created in 1982 require that forest planning be based on a:

> "…recognition that the national forests are ecosystems and their management for goods and services requires an awareness and consideration of the interrelationships among plants, animals, soil, water, air and other environmental factors within such ecosystems" (36 CFR 219.1 (b) 3).

Existing law, regulation and policy require the Forest Service to carefully consider the needs of native plant and animal species in deciding how to manage the national forests.

M2m's management alternative is also consistent with the philosophy and legal mandate of "multiple use." The Multiple Use Sustained Yield Act (MUSY) of 1960 (16 USC 528-531) requires the national forests be "administered for outdoor recreation, range, timber, watershed and wildlife and fish purposes" (sec 1). Congress defined "multiple use" as "making the most judicious use of the land…over areas large enough to provide sufficient latitude for periodic adjustments in use to conform to changing needs and conditions" (P.L. 86-517; 74 Stat. 215; 16 U.S.C. 528-531). Renewable resources, Congress further clarified, are to be managed in a "harmonious and coordinated [way], each with the other, without impairment of the productivity of the land." A conservation-biology ethic towards management of the GMUG Forest is the best approach to "judicious use of the land," because it ensures our forests' ecological and commercial "productivity" in perpetuity.

Indeed, failure to follow the approach outlined in the M2m Alternative or some similar approach would not ensure the perpetuation of viable populations of all native wildlife species, and thus would not fulfill the GMUG Forest's legal and moral responsibility to maintain wildlife and fish populations for multiple use.

In conclusion, the National Environmental Policy Act requires that the GMUG Forest Service consider all reasonable alternatives. Given the science-driven and, thus, reasonable content of M2m's CMA, we expect the Forest Service to fairly and thoroughly review this alternative and at minimum to include elements of it in each alternative within the Forest Plan Environmental Impact Statement for public review and comment.

II. IMPLEMENTATION

A. LAND MANAGEMENT PRESCRIPTIONS

Table 3. Crosswalk between Core Reserve Model/M2m Prescriptions and Forest Service Management Prescriptions

Reserve Design Unit	**M2m Prescription**	**Former USFS Prescription (from 1983 GMUG Forest Plan)**	**Current USFS Prescription (from 2004)**
Cores and Linkages	Wilderness	8A: Pristine wilderness recreation 8B: Primitive wilderness recreation 8C: Semi-primitive wilderness recreation	1.1: Wilderness 1.11: Pristine Wilderness 1.12: Primitive 1.13: Semi-Primitive
	Recommended for Wilderness	N/A	1.2: Recommended for Wilderness
	Research Natural Area	10A: Research natural area	2.2: Research Natural Areas
	Wildlife Linkage	N/A	3.55: Corridors Connecting Core Areas 5.5: Forested Key Landscape Linkages
Low Use Compatible	Ecological Restoration	N/A	1.42: Core Restoration Areas
	Special Interest Area	10C: Special interest area	2.1: Special Interest Areas Minimal Use and Interpretation
	Forested Wildlife Habitat	4B: Wildlife habitat for one or more management indicator species 4C: Wildlife habitat in hardwood and areas of woody vegetation on rangelands 4D: Wildlife habitat in aspen	3.5: Forested Flora or Fauna Habitats Limited Management
	Dispersed Non-Motorized Recreation	3A: Semi-primitive non-motorized recreation opportunities	1.31: Backcountry Recreation Non-Motorized
	Gunnison Sage Grouse Habitat	N/A	3.64: Special Plant and Wildlife Habitat

	Lynx Habitat	N/A	3.64: Special Plant and Wildlife Habitat
	Colorado River Cutthroat Trout	N/A	3.64: Special Plant and Wildlife Habitat
	Bighorn Sheep Habitat	N/A	3.51: Bighorn Sheep 5.42: Bighorn Sheep Habitat
	Big Game Winter Range	5A: Big game winter range in non-forest areas. 5B: Big game winter range in forested areas	3.58: Crucial Deer and Elk Winter Range 5.41: Deer and Elk Winter Range
Medium-High Use Compatible	Municipal Watershed Protection	10E: Municipal watersheds	3.23: Municipal Watersheds – Water Quality Emphasis 5.22: Municipal Watersheds Water Quality Emphasis
	Scenic Byways	N/A	4.21: Scenic Byways or Railroads 4.22: Scenic Areas, Vistas, Vistas, or Travel Corridors
	Travel Corridors	N/A	N/A
	Ski-Based Resorts	1B: Existing winter sports sites.	8.22: Ski-Based Resorts Existing and Potential
	Dispersed Motorized Recreation	2A: Semi-primitive motorized recreation opportunities in a natural appearing environment	3.31 Backcountry Recreation Year-Round Motorized
	High Use Motorized Recreation	2B: Roaded natural and rural recreation opportunities.	4.31: Dispersed Recreation High Use
	Timber Compatible	7A: Wood fiber production - clearcut suitable lands on slopes < 40% 7C: Wood fiber production and utilization on forested slopes > 40% 7E: Wood fiber production – shelterwood harvest in spruce-fir, ponderosa pine and lodgepole pine on slopes < 40%	5.13: Forest Products

Table 4. Allowable Uses in Each Management Prescription ('X' denotes permitted use.)

Reserve Design Unit	**M2m Prescription**	**Compatible Timber Harvest**	**Compatible Grazing**	**Oil and Gas Extraction**	**Winter Motorized Recreation**	**Summer Motorized Recreation**	**Non-Motorized Recreation**	**Allowable Road Density**
Cores and Linkages	Wilderness		X*				X	0
	Recommended for Wilderness	(phase out)	X*				X	0
	Research Natural Area	by special use permit only	by special use permit only					0 - 0.5mi/mi^2
	Wildlife Linkage		X*			X	X	0 - 0.5mi/mi^2
Low Use Compatible	Ecological Restoration	for restoration	X*				X	0.5mi/ mi^2
	Special Interest Area		by special use permit only		X	X		0.5mi/ mi^2
	Forested Wildlife Habitat	X	X	existing leases honored	X	X	X	0.5mi/ mi^2
	Dispersed Non-Motorized Recreation		X	NSO			X	0.5mi/ mi^2
	Gunnison Sage Grouse Habitat		X	NSO	X	X	X	0.5mi/ mi^2
	Lynx Habitat	X	X	NSO	X		X	0.5mi/ mi^2
	Colorado River Cutthroat Trout						X	
	Bighorn Sheep Habitat	X	X	NSO	X	X	X	0.5mi/ mi^2
	Big Game Winter Range		X	X	X	X	X	0.5mi/ mi^2

Table 4 (cont.) Allowable Uses in Each Management Prescription ('X' denotes permitted use.)

	M2m Prescription	Compatible Timber Harvest	Compatible Grazing	Oil and Gas Extraction	Winter Motorized Recreation	Summer Motorized Recreation	Non-Motorized Recreation	Allowable Road Density
Medium-High Use Compatible	Municipal Watershed Protection	X	X		X	X	X	2mi/ mi^2
	Scenic Byways	X	X	X	X	X		
	Ski-Based Resorts	X			operations only		X	
	Dispersed Recreation	X	X	existing leases honored	X	X	X	2mi/ mi^2
	High Use Recreation	X		X	X	X		2mi/ mi^2
	Timber Compatible	X	X	X	X	X	X	2mi/ mi^2

*Sensitive areas or areas experiencing historical overuse and associated plant community impairment should be placed into total non-use and/or permanently retired.

LAND MANAGEMENT PRESCRIPTIONS

Except where otherwise noted, the following prescriptions correspond to existing prescriptions as defined in the Region 2 Desk Guide (for Forest Plans revised under the 1982 planning regulations). See Table 3 for a cross-reference between these CMA prescriptions, prescriptions from the 1983 GMUG Forest Plan, and prescriptions as defined in the Region 2 Desk Guide.

1. CORE RESERVES AND LINKAGES

Wilderness

Management emphasis is for the protection and perpetuation of essentially pristine biophysical conditions and a high degree of solitude for both wildlife and humans. All resource management activities are integrated in such a way that evidence of current human use, including permitted and recreation livestock, is not noticeable the following season, and so that natural biological processes are not adversely or artificially changed over time by human use. Area is managed pursuant to the Wilderness Act to protect and perpetuate natural conditions while providing opportunities for solitude and self-reliance.

Recommended for Wilderness

Management protects wilderness characteristics pending Congressional designation. Areas with evidence of unacceptable levels of past use are rehabilitated and the affected area restored.

Standards:

- Management actions that would degrade wilderness characteristics are prohibited.
- Withdrawn from mineral entry
- Vacant grazing allotments will not be re-stocked.
- Timber harvest/vegetative manipulation is prohibited.
- New road construction is prohibited. Existing unclassified roads should be converted to trails or closed and decommissioned.
- Motorized travel is prohibited except when authorized for Forest Service administration, or for emergency purposes.
- Discourage competitive contests and group events. Authorize special uses only if compatible with wilderness qualities and values.

Research Natural Area

Research Natural Areas (RNAs) form a long-term network of ecological reserves designated for research, education, and the maintenance of biodiversity. Emphasis is on research, study, observations, monitoring, and educational activities that allow ecological processes to prevail with minimal human intervention. Permit and encourage use by scientists and educators. Motorized and extractive uses are generally prohibited, and non-motorized recreational use is allowed, but not encouraged. Grazing is not allowed if not already occurring, except as part of research, and it is phased out if it is likely to interfere with current and future research.

Standards:

- Protect the natural condition of the ecosystem, its processes, and any species or values for which the RNA was established.

- Until formal establishment, manage proposed RNAs to maintain and enhance the character, research potential, and ecological values for which the areas have been identified.
- Allow uses that maintain or improve the ecological and research characteristics for which the RNA was designated.
- Once RNAs are established, they will be withdrawn from mineral entry.
- Current levels of horseback riding, hunting, fishing, camping, and related low impact uses by the public are allowed to continue. Increases in recreational use will be restricted or eliminated if they threaten or interfere with the objectives or purposes for which the RNA is established.
- Prohibit motorized and mechanized use, except when necessary for research or educational access.
- Require approval of proposals for research from the Regional Research Station and Region 2.
- Prohibit construction of new roads and trails, except when they are necessary to reduce resource damage occurring from existing travelways. In such cases, the roads or trail sections causing the damage should be closed and obliterated.
- Use restrictions or closures under 36 CFR 261 Subpart B when necessary to protect the area from actual or potential damage due to public use.
- The recreation opportunity spectrum class is "primitive" or "semi-primitive, non-motorized."

Wildlife Linkage
Management emphasis is to facilitate daily, seasonal and natal dispersal movements of native wildlife between larger blocks of suitable habitat. Linkage Areas are broad, heterogeneous areas that encompass multiple potential movement pathways for one or more species. Management practices maintain a natural condition to provide animals with the security, food and shelter they need to meet their life history requirements. Linkages provide security from intensive recreational and other human disturbances, although low-intensity dispersed non-motorized recreation activities are permissible.

Standards:

- Motorized travel is minimized to the greatest extent possible to reduce fragmentation and conflicts with vehicles. All motor vehicle and mountain bike use is restricted to designated routes. Prohibit new roads, and close existing roads that inhibit wildlife movement. Restrict open road density to 0.5 miles/sq. mile.
- Winter motorized travel is prohibited.
- Provide signage where roads or highways traverse these linkage areas. Coordinate with state and federal transportation agencies to implement appropriate restoration measures to ensure the safe passage of wildlife across roads and highways that traverse these linkage areas.
- These areas are withdrawn from mineral entry, and are unsuitable for timber production.
- Adjust livestock grazing to meet wildlife habitat objectives.
- Limit grazing to no more than 20 percent forage utilization.
- Vegetation management practices necessary to meet specific biodiversity or wildlife habitat needs are allowed.
- Discourage or prohibit human activities and travel where needed to allow effective habitat use, especially during the seasons of birthing and rearing of young, and during periods of migration. Potential security habitats will be protected from concentrated recreational use.

2. LOW USE COMPATIBLE AREAS

Ecological Restoration
Management emphasizes ecosystem restoration in areas that have been significantly altered or degraded from their natural state by past human activities. Human use will generally not be encouraged and will be regulated in a nonobtrusive and subtle manner, emphasizing minimal visual evidence of management restrictions and controls. Limited extractive and recreational activities uses may occur while maintaining habitats for current and future wildlife and plant species that may exist in the area. Motorized use is restricted to existing, designated routes.

Standards:
- Motorized vehicle use is prohibited, although administrative use of existing roads is permitted for restoration. Roads no longer needed to perform active restoration work shall be obliterated as funds and personnel permit. Restrict open road density to 0.5 miles/sq. mile.
- Construct new roads or trails only when necessary to correct resource damage occurring from existing roads or trails, in which case the road and trail sections causing damage shall be repaired.
- Management manipulation of forests and non-forest terrestrial vegetation and aquatic systems will be limited to that necessary to restore and maintain habitat quantity and quality for native plant and animal species. No logging of Englemann spruce forest type is permitted. Not part of the suitable timber base
- Structures will be removed except as authorized by statute, regulation, or policy.
- Withdrawn from mineral entry
- Restoration will involve allowing natural processes of plant recolonization as much as possible or use of local genetic plant materials.

Special Interest Area
Emphasis is on management of areas of unusual scenic, historical, geological, botanical, zoological, paleontological, or other special characteristics to protect and where appropriate, foster public use and enjoyment of these areas. These areas are withdrawn from mineral entry, and removed from the suitable timber base. New roads are generally prohibited.

Specific management guidelines will be developed for each Special Interest Area to ensure protection of the values for which the area was designated.

Standards:
- Allow new improvements only when they are necessary to maintain, restore or enhance the values for which the area was designated.
- Consider opportunities for Prescribed Natural Fire (PNF; also known as "fire use") using an approved fire use plan, if appropriate.
- Use restrictions or closures under 36 CFR 261 Subpart B when necessary to protect the area from actual or potential damage due to public use.

- Construct new roads or trails only when necessary to correct resource damage occurring from existing roads or trails, provided that there is no net gain in road density, which will be no greater than 0.5 miles/square mile.
- Authorize scientific or educational activities that are compatible with the SIA's values, with a special-use permit.
- Travel is restricted to designated routes.
- Restoration will involve allowing natural processes of plant recolonization as much as possible or use of local genetic plant materials.

Forested Wildlife Habitat
Management objective is to provide high quality, all-season habitat for forested wildlife species, including black bear and gray wolf. Management will provide for a variety of plant communities and successional stages through a combination of human manipulation and natural processes. There are very few developed or designated recreational facilities.

Standards:
- Protect plan communities with a shrub component from livestock grazing during times when damage to the shrub component may occur.
- Protect areas and communities from recreational and resource extraction impacts that are providing important habitat components such as wintering areas, birthing areas, rearing areas and migration routes.
- Promote development of lodgepole pine, mixed conifer and spruce fir late successional forest conditions.
- Prohibit new roads. Motorized travel is permitted only on existing designated roads and motorized trails. Road density shall not exceed 0.5 miles/square mile. Areas that exceed this road-density standard shall (1) restrict travel to a route network that equals 0.5 miles/square mile, and (2) undertake a pro-active road obliteration program to eliminate excessive travelways and bring these areas into compliance with this standard.
- Management manipulation of forests and non-forest terrestrial vegetation and aquatic systems will emphasize the restoration and maintenance of habitat quantity and quality for native plant and animal species.
- Management practices should promote late-successional stages, and logging is prohibited in inventoried and potential old growth. These areas are not suitable for timber production.
- Timber harvest activities will not enter unroaded areas. Roads should be converted to trails or closed and decommissioned upon completion of harvest activity.
- Withdrawn from mineral entry, although existing leases with approved plans of operations will be honored

Dispersed Non-Motorized Recreation
Management provides non-motorized recreation opportunities in a natural or natural-appearing landscape with little or no evidence of recent human-caused disturbance. These areas provide non-motorized recreation near the primitive end of the recreation opportunity spectrum. Seasonal or year-round restrictions on human use may be applied to provide seclusion for wildlife such as nesting for raptorial

birds, big-game rearing areas, and mammals with large home ranges (lynx, mountain lion, wolverine, etc). There is potential for wildlife habitat improvement projects and small vegetation alterations. Investments in compatible resource uses such as livestock grazing, mineral exploration and development etc., may occur, but no new roads may be constructed.

Standards:

- Prohibit new road construction or reconstruction. Existing unclassified roads should be converted to trails or closed and decommissioned.
- Motorized travel is prohibited except when authorized by special use permit for administration of permitted facilities, for Forest Service administration, or for emergency purposes.
- These areas are not part of the suitable timber base. Small vegetative management projects may be allowed that benefit wildlife habitat.
- Discourage competitive contests and group events.
- No surface occupancy mineral leasing allowed.

Gunnison Sage Grouse Habitat

The Gunnison sage grouse (*centrocercus minimus*), whose current range is now restricted to small pockets of the Gunnison Basin, have sustained an almost fatal population decline over the past 50 years. A multi-stakeholder effort, the Gunnison Sage Grouse Working Group, was formed in 1995 to develop a conservation plan to reverse the trend. However, species numbers continue to decline and currently the Gunnison sage grouse is on the USFWS Candidate list for threatened and endangered species.

Management emphasis is to protect and enhance nesting areas, brood rearing areas, and winter range for the endangered Gunnison sage grouse. Standards are in keeping with those laid out by the Gunnison Sage Grouse Conservation Plan[5]. In the case of listing under the ESA, Recovery Plan standards, once developed, would apply.

Standards:

- Generally, livestock grazing is permitted to the extent that it does not conflict with seasonal usage by the grouse and maintains at least a 4" stubble height. Leave 4 inches stubble height for early season use and 6 inches or greater stubble height for late use pastures, or to protect special ecosystem characteristics such as sage grouse leks and brood rearing areas.
- Motorized use is restricted during seasons when sage grouse use these areas, except in emergency situations.
- Travel allowed on designated routes only
- No surface occupancy mineral leasing
- Seasonal noise restrictions may affect proposed activities within audible range of lek sites.

Lynx Habitat

Management emphasis is to protect and enhance denning and linkage habitat for the endangered Canada lynx, in keeping with the conservation measures outlined in the Canada Lynx Conservation Assessment

---

[5] Gunnison Sage Grouse Conservation Plan, 1997

and Strategy[6]. Human activity is limited to avoid snow compaction that may lead to increased competition from other predators, like coyote.

Standards:

- Vegetation manipulation activities will be managed to maintain connectivity between blocks of late successional forest, and to promote late structural stage habitat and dense horizontal cover, with the goal of maintaining or enhancing habitat for snowshoe hare and alternative prey such as red squirrel.
- Winter motorized travel is limited to existing routes. No net increase in over-the-snow routes.
- Limit winter recreation trails (e.g., snowmobiling, cross-country skiing, snowshoeing or other activities) that lead to snow compaction. Special use permits that result in snow compaction are prohibited.
- Manage grazing to maintain the composition and structure of native plant communities. Ensure that grazing does not impede the development of snowshoe hare habitat in natural or created openings. Delay livestock use in disturbance-created openings until these areas are certified as regenerated, and it can be reasonably assured the livestock will not damage snowshoe hare habitat.
- No surface occupancy mineral leasing

Colorado River Cutthroat Trout Habitat[7]

The subspecies is listed as a sensitive species by both the Intermountain and Rocky Mountain Regions of the Forest Service, and is a species of special concern in Colorado. The subspecies occupies less than five percent of its historic range. Management emphasis is to protect and enhance habitat for Colorado River Cutthroat Trout (CRCT). Specific stream reaches are not currently identified in the CMA, although when these data are made available through the Colorado Division of Wildlife they will be integrated into this plan.

Standards:

- Limit impacts from livestock grazing through timing, reduced duration, and reduced numbers in CRCT drainages.
- Actively monitor and protect all CRCT reaches, but especially those with pure or nearly pure populations.
- Prevent stocking of non-native trout; encourage removal of non-native trout from large sections of stream; establish barriers in streams to prevent mixing of non-native and CRCT populations.
- Ensure adequate in-stream flow is maintained for all existing CRCT reaches, and for planned reintroduction areas.
- Do not encourage public fishing in genetically pure stream reaches.
- Identify watersheds with populations of CRCT in Forest Plans, grazing allotments, and AMPs, activity plans and integrated resource plans.
- For each project, permit renewal or other action proposed in CRCT habitat, document and mitigate and/or eliminate impacts to protect Colorado River Cutthroat Trout.

---

[6] Reudiger *et al.* 2000

[7] Mapped information on CRCT locations will be included in the final plan

- Move towards creation and maintenance of 15 populations of CRCT on 60 miles of stream in the Gunnison GMU, and 9 populations on 23 miles of stream on the Dolores.[8]
- Minimize road/stream crossings.

Bighorn Sheep Habitat
Management emphasis is to provide adequate amounts of quality forage, cover, escape terrain, and solitude for bighorn sheep. Management practices limit forest fragmentation and conserve roadless areas.

<u>Standards</u>[9]:
- Resolve conflicts that cannot be mitigated in favor of maintaining bighorn sheep habitat.
- Limit recreational activity during breeding and lambing. Do not construct trails in bighorn habitat, especially in lambing areas.
- Prohibit new road construction. Motorized travel is permitted only on existing designated roads and motorized trails.
- Initiate vegetation treatment projects, including prescribed fire and individual tree selection, to improve bighorn habitat lost to natural succession or human impacts.
- Timber harvest activities will maintain unroaded areas. Roads should be converted to trails or closed and decommissioned upon completion of harvest activity. Open road density is restricted to 0.5 miles/square mile.
- Improve and develop water sources to improve distribution and abundance of bighorns.
- Grazing strategies should be implemented to meet bighorn sheep habitat objectives. Grazing by domestic sheep is prohibited unless adequate temporal or spatial separation can be assured at all times.
- Withdrawn from hardrock mineral entry; no surface occupancy mineral leasing allowed.

Big Game Winter Range
Management emphasizes providing winter habitat for big game (elk, mule deer, and other species). Motorized travel is permitted only on designated routes and is managed to prevent unacceptable stress on big game animals during the season(s) of use by big game. Livestock grazing is permitted to the extent that it conserves forage for wildlife and wildlife habitat.

<u>Standards</u>:
- Restrict management and use activities during the winter and spring periods (November 15-April 30) where conflicts with wintering wildlife are identified.
- Establish stocking levels for livestock to ensure adequate forage is also available for deer and elk. Include achievement of wildlife goals for deer and elk in grazing strategies.
- These areas are not part of the suitable timber base. Silvicultural activities should be designed to maintain or improve habitat for deer and elk.
- Limit the density of open travelways to 0.5 miles per square mile or less.

---

[8] As per: Conservation Agreement and Strategy for Colorado River Cutthroat Trout, March 1999, p. 23

[9] Standards and Guidelines partially adapted from Utah Division of Wildlife Resources Statewide Management Plan for Bighorn Sheep, http://www.wildlife.utah.gov/hunting/biggame/pdf/bighorn_plan.pdf

- Actively use prescribed fire as a tool to improve range health, where appropriate.
- Restrict recreation activities that would disturb deer and elk during winter and spring periods.
- Manage winter recreation so that the security of concentration zones is maintained.
- Manage for a ROS class of Semi-primitive, Non-motorized in the winter and spring. During the summer and fall months, manage for an ROS class of Semi-primitive Non-motorized or Semi-primitive motorized.
- Oil and gas leasing is permissible, although operating and reclamation plans should minimize or mitigate impacts to deer and elk habitat. Winter restrictions are in effect.

3. MEDIUM-HIGH USE COMPATIBLE

Municipal Watershed
Management emphasis is to protect or improve the quality of municipal water supplies. Management practices vary from use restrictions to water resource improvement practices, with the primary objective of meeting water quality standards established for the individual watershed.

<u>Standards</u>:
- Motorized route density will be no greater than 1 mile/sq mile to reduce erosion and other impacts to water quality.
- Motorized travel is permitted only on designated roads and motorized trails.
- The Recreation Opportunity Spectrum (ROS) class is Semi-primitive Motorized on designated travel routes and Semi-primitive Non-motorized in the remainder of the area.
- Close watershed to all travel when road or trail surfaces could be damaged to the degree that water quality would be degraded.
- Withdraw from hardrock and leasable mineral entry.
- Confine livestock trailing to established driveways and historic trailing routes. Reduce or remove livestock if municipal water quality is degraded. Implement other restrictions as necessary to prevent erosion, water contamination, and to protect watershed health.
- Timber harvesting is permissible using the existing road network only when these activities improve wildlife habitat and water quality is not degraded. Clearcuts are not permitted.
- Manage fire and fuels through a “light on the land” approach. Potential control practices and fuel treatments may be necessary in some dense forests to reduce the potential for high intensity fire events.
- Active wildfire suppression shall be employed as necessary to protect the watershed, but the construction of bulldozer-created fire lines should be minimized to reduce erosion.
- Riparian areas within municipal watersheds will be managed according to the standards set forth in Section II, B.3. of this CMA.

Scenic Byways
These types of areas area managed to protect or preserve the scenic values and recreation uses of designated Scenic Byways and Railroads and other heavily-used scenic travel corridors. The landscape

provides high quality scenery while allowing multiple-use management, such as timber harvest, wildlife management, recreation activities, mineral extraction and livestock use.

- Vegetation alterations may be present to enhance the viewing opportunity or to maintain long-term vigor and health of vegetation.
- Because visual quality is emphasized, all activities and interactions maintain the scenic beauty for which the area is designated.
- These lands are available and authorized for oil and gas leasing, with a Controlled Surface Use Stipulation.

Ski-Based Resorts
Management emphasis provides for downhill skiing on existing sites. Management integrates ski area development and uses with other resource management to provide healthy forest ecosystems; vegetative diversity; habitat protection for threatened, endangered and sensitive species; forage production for wildlife; and opportunities for summer non-motorized recreation.

<u>Standards</u>:
- Motorized travel is prohibited, except for administrative or emergency purposes.
- Ski area operations, including new facilities and trails, will protect diurnal security and nocturnal foraging opportunities for Canada lynx.
- Noise and lighting will be minimized to prevent adverse impacts on adjacent forest resources. Any necessary snowmobiles for service or ski patrol must be four-stroke or clean-technology machines.
- Timber harvest is not scheduled and does not contribute towards the allowable sale quantity. Timber harvest activities conducted to create new ski trails shall leave woody debris and snags in inter-trail islands. Logging is prohibited in inventoried and potential old growth.
- No net increase in roads
- New ski runs may not be created in identified wildlife movement corridors.
- Minimize ground disturbance in the construction and maintenance of ski runs.
- Construction activities and ski area operations will protect fen wetlands. Filling wetland areas is prohibited.
- Snowmaking and other water depletions will be conducted in a manner that conserves stream pattern, geometry, substrate composition and aquatic habitat in affected perennial streams.
- Snow management, including snowmaking will be conducted in a manner that prevents slope failures, gully erosion and bank destabilization.
- Withdrawn from mineral entry

Dispersed Recreation
Management emphasis is for dispersed motorized recreation on designated motorized routes. Motorized travel may be restricted or seasonally prohibited to protect physical and biological resources. Concentrated use is discouraged. A variety of plant communities, structural stages, and associated wildlife occur in patterns maintained primarily through ecological processes.

Standards:

- Motorized open route density shall not exceed 2 miles/square mile. Areas that exceed this road-density standard shall (1) restrict travel to a route network that does not exceed two miles/square mile, and (2) undertake a proactive road obliteration program to eliminate excessive travelways and bring these areas into compliance.
- Motorized travel is limited to designated roads and trails.
- Some areas may have restricted summer or winter motorized travel to maintain wildlife habitat during seasons of critical use, such as breeding, brood rearing or migration. Travel restrictions are posted at trailheads.
- Reclaim disturbed lands to a suitable condition consistent with this prescription.
- Existing oil and gas leases will be honored. New leases will be authorized on an NSO basis only.

High Use Recreation
Management emphasis is for (concentrated) motorized recreation opportunities on designated routes. Motorized travel may be restricted or seasonally prohibited to protect physical and biological resources. The potential for contact with other users is moderate to high. Solitude or isolation is less important than the opportunity to participate in desired recreational activities. Despite moderate-to-high levels of motorized use, biological communities are maintained to provide varied, healthy plant communities, structural stages, and associated wildlife.

Standards:

- Provide developed facilities at areas of concentrated use to protect adjacent resources.
- To protect sensitive natural resources, some high-use recreation sites may be hardened, further developed, or additional restrictions may be enforced.
- Motorized route density may exceed 2 miles/square mile. For areas that exceed 2 miles/square mile, create a biologically-based management plan to ensure that undesirable effects on wildlife and other users (noise, pollution, erosion, wetland incursions, user conflicts, etc.) are minimized, mitigated, or eliminated prior to authorizing use. Use shall not be authorized without a specific management plan for the area.
- Management controls may be implemented to protect public safety.
- Allow timber harvest, and mineral leasing and development.
- Allow uses and activities only if they do not degrade the recreational characteristics, scenic qualities or the environment.
- Avoid areas with USDA “sensitive” or local concern plant species and wetlands.

Timber Compatible
Management emphasis is on maintaining forest ecosystem health while providing commercial wood products. Timber management should mimic natural disturbance patterns, avoiding straight lines and geometric shapes. Clearcuts are prohibited in Engelmann spruce-subalpine fir forest types. Harvest activities should be concentrated near existing Forest arterial and collector roads to minimize forest fragmentation and minimize the need for temporary road construction. Motorized travel is permitted only on designated roads and motorized trails. Non-motorized activities may occur on roads closed to vehicular traffic.

All harvest activities should be managed sustainably with an emphasis on local use and subject to the conditions set forth in Section II.C. of this CMA.

Standards:

- No new roads should be constructed for the purpose of timber harvesting with the exception of short, temporary skid roads, which shall be obliterated and restored at sale completion.
- Timber harvest shall be prohibited in any areas containing old-growth forest.
- Prevent public use on temporary roads constructed for timber sales. Design new roads, especially the entrance, for effective closure upon completion of sale activities.
- Protect regeneration/seedlings from livestock damage.
- No road construction or harvest activity on slopes 30 degrees or steeper
- No new roads where significant cut and/or fill would be required on slopes of 30 degrees or steeper
- Avoid timber harvest or road construction within 300 feet of fens.

Grazing Compatible
This prescription is not mapped as a discrete use on the Forest because grazing activities occur throughout much of the Forest, except where identified as being incompatible with other prescriptions. The following standards and guidelines apply to all areas where grazing occurs on GMUG Forest lands, except where more restrictive practices are required to protect identified resources on a site-specific basis.

Management emphasis is on improving soil and vegetation conditions. Active management and well-planned rotational systems are required to prevent resource damage and maintain sustainable range conditions. Range condition is improved through use of vegetation and soil restoration practices, improved livestock management, and regulation of other resource activities. Structural and nonstructural improvements benefit, or at least do not adversely affect, wildlife. Conflicts between livestock and wildlife are resolved in favor of wildlife. Nonstructural restoration and forage improvement practices available are seeding, planting, burning, fertilizing, crushing and plowing. Maintaining or improving healthy range conditions will be given priority over other extractive or high-impact uses. Motorized recreation is permitted only to the extent that it is compatible with maintaining healthy rangeland ecosystems. Dispersed recreation opportunities vary between semi-primitive nonmotorized and roaded natural.

Standards:

- Maintain 2” stubble height, except in sensitive and riparian areas where 4” stubble height is required.
- Reduce livestock activity in riparian zones through fences, herd management or other exclosure methods.
- Monitor rangeland health annually or semiannually to ensure that conditions are improving or maintained in a sustainable condition over the long-term.

- Use certified weed-free hay for all grazing operations (i.e., horses) to prevent noxious weed infestation.
- Existing permitees' motorized use shall be maintained to the extent necessary for conducting activities in accordance with sustainable use for the allotment. Any new roads required by permittees for improvements shall not be made available for public use. Motorized travel is otherwise permitted only on designated roads and motorized trails.

Wildland/Urban Intermix Zone
This prescription is not mapped as a discrete use because a relatively small portion of GMUG National Forest land overlaps with the community protection zone (up to one-quarter mile from the edge of communities). These are areas where appropriate thinning can help reduce the risk to lives and homes from wildland fire. Where fire poses a direct, immediate threat to communities, aggressive suppression is appropriate. The GMUG should work collaboratively with communities and landowners adjacent to Forest Service land to prioritize and help implement risk reduction projects in the wildland-urban interface.

Standards:
- Treat only smaller-diameter trees.
- Prioritize efforts to reduce fuels in areas that have already been roaded because these areas tend to be much closer to communities and have higher fire risks. Roaded areas will provide better access for crews.
- Prohibit fuels reduction treatments in roadless areas, except in instances where these areas directly abut an occupied property, making the creation of defensible space in the home ignition zone (up to 200 feet from a structure) a priority.
- Avoid construction of new roads.
- Avoid the use of mechanical equipment, if possible, to avoid creating paths that could be used for motorized recreation. No new permanent road construction; close existing system and non-system roads.

Travel Corridors
Travel corridors adjacent to Wilderness or Recommended for Wilderness prescriptions have been mapped to indicate where permanent roads penetrate or adjoin these areas. The M2m CMA recognizes that these permanent roads will require on-going maintenance, but the travel corridors are themselves not prescribed for management. Despite edge effects from the roads, habitat adjacent to the road and road shoulder should be managed according to the standards and guidelines of the adjacent prescription.

B. ELEMENTS OF BIODIVERSITY

Introduction
To achieve the M2m conservation management goals and objectives, and to implement the reserve design system, as specified in sections I.A., I.D. and I.C., this Alternative proposes that the Forest Service plan and put into action a combination of solutions on the GMUG Forest. Due to the need for large, intact core wilderness areas and linkages that connect them, as well as the need for greater representation of low- and mid-elevation ecosystem types, M2m has identified several roadless areas that are suitable for Wilderness designation and recommends that the Forest Service propose these as additional Wilderness. This Alternative also identifies areas with high-quality plant communities and recommends that the Forest Service designate them Research Natural Areas for collecting baseline ecological information and as reference sites for monitoring.

To restore ecological health on the GMUG, the Forest Service plan must account for the important ecological role of natural fire in shaping and maintaining ecosystems. Thus, this Alternative provides standards for managing wildland fire as a natural disturbance regime, while prioritizing the protection of life and property.

Another important element in promoting ecological health is effective management of invasive plant species on the GMUG. M2m proposes that the Forest Service take a proactive stance on this issue and endorses following recommendations outlined in the Forest Service's Rocky Mountain Region Invasive Species Management Strategy (2004).

Other components that this Alternative emphasizes are protecting riparian and wetland ecosystems, and recovering extirpated, endangered or sensitive species that are native to the GMUG, which entails foremost identifying and protecting habitat that is suitable for them.

Table 5. Existing Wilderness Areas on the GMUG

Area	Acres
Raggeds	47,963
Collegiate Peaks	49,234
Maroon Bells-Snowmass	19,681
West Elk	176,117
Fossil Ridge	32,018
Uncompahgre	98,520
Powderhorn	14,563
Mount Sneffels	16,476
La Garita	76,991
Lizard Head	11,682
Lizard Head	8,634
Total	**551,879**

1. PROPOSED CORE AREAS AND RESEARCH NATURAL AREAS

Table 6. Recommended for Wilderness[10]

Area Name	Acres
Sawtooth Mountain	28,199
Middle Fork	12,079
Slate River	3,758
West Elk Addition 8	5,535
Cannibal Plateau	14,906
Lottis Creek	1,700
Mount Antero North	6,387
West Elk Addition 4	14,004
Slate River	3,466
Kreutzer-Princeton W	13,448
Dominguez Canyons	15,164
Escalante Forks	14,473

[10] See March 18, 2005 M2m CMA map for locations.

Tabeguache	8,386
Roubideau	18,781
Unaweep	28,160
Electric Mountain	10,878
Kannah Creek	40,766
Matchless	21,016
Whetstone	15,426
Clear Creek	48,626
Turret Ridge	5,114
Crystal Peak	11,547
Tea Kettle Mtn/Beaver Creek	22,901
Carson Peak	9,419
Cathedral Creek	3,274
Alpine Plateau	7,728
Romley	11,878
West Elk Addition 7	2,059
Lizard Head Adjacent	1,171
Priest Mountain 1	17,874
Priest Mountain 4	27,464
Priest Mountain 3	35,763
Priest Mountain 2	9,855
Chipeta West	13,123
Mineral Mountain	1,471
Slumgullion	6,146
Steuben Creek South	3,643
Steuben Creek North	10,749
West Elk Addition 5	23,515
Cochetopa Hill/Seven Creek	78,084
West Elk Addition 2	60,240
Naturita Canyon	11,030
Kelso Point	49,189
Raggeds Addition	22,510
Iron Mountain	6,233
San Miguel	10,394
Total	**787,528**

a. Rationale for Selection of Proposed Wilderness

Given the amount of roadless acreage lost to roads and development during the last planning period, this may be the last plan revision to protect remaining substantial Wilderness quality lands on the GMUG. Both for future habitat needs and future human needs, more Wilderness should be recommended and designated on the GMUG. The GMUG is fortunate to have many hundreds of thousands of acres that are still roadless, mostly wild, lands. Yet loss of roadlessness Forest-wide since the last planning period (1983) is obvious, and has had tremendously detrimental ecological consequences (e.g., the Red Creek, Killdeer, Antero, Matchless and Doubletop areas). For this reason, we urge the Forest to use this planning period to systematically identify and recommend capable lands for Wilderness designation.

This plan makes Wilderness recommendations for lands that possess outstanding ecological, geologic, aesthetic or scenic qualities, and remain pristine in character. While some proposed areas show signs of past management activities, this does not disqualify the areas for recommendation. All proposed areas are legally roadless, and possess wild and remote characteristics necessary for recommendation under the Wilderness Act. All proposed areas are at least 1,000 acres in size for additions to existing Wilderness, or 5,000 acres for stand-alone areas.

b. Areas Recommended for Wilderness

Gunnison National Forest

Alpine Plateau

Alpine Plateau is a narrow, 22,000-acre addition to the Uncompahgre Wilderness, located on the northeast corner of the existing wilderness boundary. Jutting out into the basin, Alpine Plateau is an important area for maintaining lynx habitat. Steep forested hills of mostly Douglas fir tower above the flats of Alpine Plateau itself, affording good denning and foraging sites for lynx, and other wildlife. This area has been designated as Available for Wilderness by the Forest Service.

Carson Peak

The 26,870-acre Carson Peak area contains the 13,000-foot summits of Half Peak and Carson Peak, as well as Cataract Lake, a stunning high mountain gem. This area, located just south of the Handies Peak Wilderness Study Area, possesses very high wilderness qualities owing to its striking scenery and accessibility. Despite its relatively short distance from the Sherman townsite, the high bowl with Cataract Lake at its center affords remoteness and solitude for the hiker or horsepacker. In addition, Carson Peak is also the site of the Wager Gulch Iron Fen, currently proposed as a Botanical Special Area. The water chemistry, flora and fauna at this site are unique to iron fens in Colorado.

Cathedral Creek

This addition to existing wilderness a narrow tongue of a steeply sloping ridge on the north side of the La Garita wilderness. Elevations are moderate, encompassing some areas below 10,000 feet. Dense forests give way to open grasslands, providing critical habitat for both Lynx, and Big Horn sheep. The area’s relatively remote location and undeveloped tributaries of Cathedral and Sheep creeks provide outstanding opportunities for solitude as well.

Cannibal Plateau

This 20,020-acre area contains the highest continuous alpine tundra in the lower 48 states (and is contiguous with Powderhorn and La Garita Wildernesses). The sweeping views from the top of the plateau into the high peaks of the La Garitas to the south are magnificent. In addition, the National Landmark Slumgullion Earthflow lies to the southeast, a world-class geologic formation. The lower conifer-forested slopes below the high tundra have a high percentage of late successional habitats. This area is important as lynx connection habitat, and serves as a gathering and dispersion point for reintroduced moose.

Clear Creek

The Clear Creek proposed wilderness straddles the Gunnsion Delta County border near the northern boundary of the GMUG, and includes many feeder streams that provide vital habitat to genetically pure strains of Colorado River Cutthroat Trout. The area is also important for elk winter range, fawning habitat for mule deer, and winter forage for Canada lynx. Northern goshawks also occur in the area's expansive mature aspen forest.

Cochetopa Hills

The largest remaining roadless area on the Gunnison National Forest is the 98,563-acre Cochetopa Hills. This area is clad in rolling mixed-conifer and spruce-fir forests, and is an important regional wildlife corridor between the Rio Grande/San Juan Basin to the south, and the Gunnison Basin to the north. One of the lowest points on the Continental Divide in Colorado, Cochetopa Hills is a natural crossing point of many wildlife species in and out of the Gunnison Basin, and forms an important ecological link from the La Garitas to the west, and towards Fossil Ridge to the north. The area has been especially noted as a well-used trans-basin lynx crossing point in the USFS Region Two 2004 Lynx assessment.

Crystal Peak

This 14,833-acre area is an addition to the northern edge of the Uncompahgre Wilderness, Steep terrain with dramatic rock outcrops lends a sense of remoteness to the area, and limits forest management activities. The granite spires of Sugarloaf Rock loom above a rich mixture of spruce, open meadow and aspen, making this area rank high in wildlife values. Dense, old growth conifer forests offer excellent habitat for lynx denning in Larson and Crystal Creeks.

East Elk Creek is an addition to the West Elk Wilderness. Most of its 9,330 acres are lower elevation Douglas fir, aspen, shrub, and some mixed conifer and spruce-fir in the higher reaches. These lower elevation habitats are underrepresented among wilderness lands on the GMUG, and provide a connection between the southern-most reaches of the West Elk Wilderness and the Curecanti National Recreation Area boundary. Beaver and West Elk Creek have native cutthroat trout populations in these drainages.

Electric Mountain

This roadless area is dominated by aspen, with conifer at higher elevations. This area is important for lynx habitat, and is adjacent to other core wildlife areas amidst intensifying motorized travel on the Grand Mesa.

Killdeer Creek

Although the perimeter of this area has seen substantial human activity, primarily from logging and grazing, the interior of this 7,995-acre roadless area still retains a remote character. Elevations range from 9,800' to 11,400', and thus provide a good transition zone for wildlife. The combination of forested mountains, meadows, and riparian areas offers a level of ecosystem diversity non-existent in most of the adjacent La Garita Wilderness. The area offers excellent opportunities for hunting, fishing and solitude. This is an area of diverse ecological habitats increasing the Wilderness value of the larger La Garita area.

Kreutzer-Princeton West

Kreutzer-Princeton West is a small sliver on the GMUG side of the Continental Divide, due east of Taylor Park. This area joins with the much larger Kreutzer-Princeton area on the east side of the Divide on the Pike-San Isabel Forest. This area, including Cottonwood Pass area and Sanford Basin, provide good lynx habitat. Because of its location along the Continental Divide, this area provides general ecological connectivity and migration pathways for many species, including lynx, bear and elk.

Lottis Creek

This is a small addition (1,692 acres) to the northeast corner of the Fossil Ridge Wilderness area. This is primarily a boundary adjustment for more effective management, bringing the boundary down closer to the Lottis Creek trail.

Matchless Mountain

The south side of the Matchless Mountain area contains the steep north canyon wall of Taylor Canyon, an important Big Horn Sheep production area. These rocky spires give way to conifered upper slopes, providing good lynx denning habitat, and mid-elevational forest habitat for goshawk, pine marten and elk. The area offers hiking and peak climbing opportunities to 12,000-plus foot Matchless, South Matchless, and Baldy Mountains, which all afford grand views across Taylor Park to the Collegiate Range, and the Three Apostles. This is valuable, mid-elevation interior forest habitat. The current ROS for most of the area is SPNM.

Middle Fork

This 12,676-acre addition of the La Garita Wilderness includes a pristine stretch of Cochetopa Creek. Vegetative communities unique to the Gunnison area are found here, including bristlecone, limber and lodgepole pine. Rare and sensitive plant species including moonwort and Colorado tansy aster are also present. This landscape is important for a variety of wildlife species. A lynx migration corridor traverses this landscape, and Bighorn sheep utilize the summer range around Cochetopa Canyon. Elk, antelope, and deer use the winter range provided in the northeastern portion of Cochetopa Park. Conservation populations of the Colorado River Cutthroat Trout occur in several streams.

Raggeds Addition

This 22,510-acre proposed addition along the Kebler Pass corridor north to McClure Pass would enlarge the Raggeds Wilderness area to approximately 70,000 acres. The addition includes the

Erickson Springs, Tomahawk, Williams Lake and Raggeds areas. This long, narrow area, with its mosaic of aspen and mixed conifer to the south, and oakbrush and ponderosa to the north, is rich in habitat for big game. Its recommendation as Wilderness would help to provide protection for transitional habitat for big game and much needed lower elevation habitat for a variety of wildlife species. It would also aid in preventing potential motorized incursion into the Williams Lake.

Romley

The 11,948-acre Romley joins with its 8,700-acre counterpart on the Pike San Isabel Forest to form an important connective link across the Continental Divide. In turn, both these areas are adjacent to the corresponding Kreutzer-Princeton areas. These four areas combined form a potential protected zone of more than 70,000 acres.

Sawtooth Mountain

Sawtooth Mountain, at 28,299 acres, is an important cross-basin connector within the eastern portion of the Gunnison Basin. Well-known for its excellent elk hunting and pristine quality habitat, Sawtooth Mountain, if protected, would initiate a north-south network of protected lands west of Gunnison, north to Curecanti National Recreation Area, and the West Elk Wilderness. The area is important transitional range for both the Gunnison sage grouse and Canada lynx.

Slate River

These two small additions bring the eastern boundary of the Raggeds Wilderness down steep hill slopes. The proposed additions, which total 7,563 acres, include Mount Schuykill, a popular backcountry ski destination, and Daisy Pass, a wonderful switchbacking climb up an alpine bowl filled with wildflowers and views of the West Elks, Sawatch Range, and Maroon Bells. These areas help fulfill the need for accessible Wilderness close to the Town of Crested Butte, and also offer a more defensible boundary for the east side of the Wilderness.

Steuben Creek

This 32,142-acre area is a merger of Steuben Creek, Sun Park, Little Mill Creek, and Castle Creek roadless areas, and is contiguous to the southeast corner of the West Elk Wilderness. The area is north of highway 50, and 20 miles west of Gunnison. This is important low elevation habitat largely untouched by signs of development. It is readily accessible from Highway 50, but narrow dissected drainages promote solitude and a sense of naturalness. A series of southeast trending drainages and sage/shrub habitat make this some of the best critical winter range for large ungulates in the region, and sage grouse habitat extends into the eastern portion of area. There may be opportunities to enlarge the area by linking adjoining roadless BLM lands.

Slumgullion

The Slumgullion roadless area is south of Lake City, and is bordered by the Rio Grande National Forest to the south and the BLM Slumgullion ACEC to the west. The Colorado Trail and Continental Divide National Scenic Trail pass along the southern boundary of the area. This 10,793-acre area, particularly surrounding Rambouillet Park, possesses high habitat value for lynx, and Boreal owl. While Slumgullion has seen some timber harvest in the eastern section, this area still possesses the essential character of remoteness, especially in its central reaches. Current winter snowmobile use in this area potentially threatens lynx and other values.

West Elk Additions

These areas are lower-elevation additions to the west side of the West Elk Wilderness Area. Covering more than 70,000 acres, the West Elk Additions provide critical big game winter and summer range for a wide variety of wildlife species. Bighorn production areas occur in the south near Cow Creek, cottonwood riparian forests support several populations of Northern leopard frog, and montane forests support northern goshawk, lynx, and cutthroat. The area contains two critical elk migration corridors: one north around local landmarks Mount Lamborn and Landsend Peak, the other through Ferrier Ridge and Black Mesa to the south.

Mineral Mountain

This 4,847-acre addition to the La Garita Wilderness includes the gentle slopes below Mineral Mountain and the steeply sloping canyonsides above Sheep Creek. This roadless area extension includes good lynx and goshawk habitat. Bringing the boundary down closer to Sheep Creek makes the boundary more defensible.

Mount Antero North

This area is bounded by the Continental Divide on the east, Hancock Pass on the North and is high alpine country, to the north of Monarch Pass. This 6,233-acre area has dense conifer forests in the south near No Name Creek, and a broad expanse of alpine tundra on Bald Mountain. It offers good lynx connectivity at Hancock and near Monarch summit.

Southern Uncompahgre National Forest

Lizard Head Adjacent

This area is roadless and a natural extension of the Lizard Head Wilderness area. It contains intact conifer, fir and spruce stands, plus open meadows on south-facing slopes, which are habitats suitable for elk, snowshoe hares, weasels, chipmunks, voles, etc. The area recommended should be protected from future motorized recreational vehicle use in winter.

Iron Mountain

This 6,233-acre area contains all of the wilderness qualities of the Sneffels Wilderness. The area is characterized by diverse vegetative types and provides excellent elk habitat and wildlife linkages.

Teakettle Mountain/Beaver Creek

This region is adjacent to the existing Mt. Sneffels Wilderness. It spans high rocky peaks of 13- to 14-thousand feet with alpine tundra that supports bighorn sheep, elk and deer in the summer. This region’s forested slopes may provide habitat for lynx (sporadic unconfirmed sightings), black bear, possibly wolverine (unconfirmed sightings), mountain lion, bobcat, fox, martin, an occasional moose, and the usual alpine wildlife. It may have been habitat for the last of the grizzly bears documented in this area circa the 1930's.

This area offers challenging climbing and hiking opportunities, sweeping vistas, mixed geology, untrammeled areas, and an opportunity for remote escape while still reasonably accessible from roads, trails and communities such as Ouray, Telluride, Ridgway, etc. With permanent snowfields on the north face of Mt. Sneffels, rock glaciers and perennial streams, this area is the headwaters of major streams (the Dallas drainages) and tributaries to the Uncompahgre River. [11]

San Miguel

As part of a large roadless complex that includes land on the adjacent San Juan National Forest, the San Miguel area exhibits a pristine alpine environment. Open meadows, brilliant wildflowers, steep slopes, jagged peaks, clear lakes and streams, and diverse wildlife, including Canada lynx, are all represented. The area offers excellent opportunities for solitude and quiet-use recreational activities.

Turret Ridge

The 5113-acre Turret Ridge area is proposed as an extension of the Uncompahgre Wilderness, just south of Silver Jack Reservoir. The area is bounded by the Middle and West Forks of the Cimarron River, and by Forest Development Roads 858 and 860. At 12,260 feet, Turret Ridge itself is one of the most challenging technical peak climbs in Colorado. It is also listed by the State of Colorado as one of the outstanding scenic features of the state and offers commanding views to the north, and of Silver Jack Reservoir. This area offers solitude, and challenging hiking and climbing in a remote setting.

Northern Uncompahgre and Grand Mesa National Forest

Dominguez Canyons

This area forms the upper watershed of Dominguez Creek, the largest perennial creek on the Uncompahgre Plateau. It is contiguous with the BLM Dominguez Wilderness Study Area, and therefore offers important continuity with a large, wild roadless area. The majority of the vegetation is shrub with conifer and aspen at higher elevations, all providing excellent wildlife habitat.

Kelso Point

The largest area of roadless landscape on National Forest land on the Uncompahgre Plateau, Kelso is characterized by high quality riparian habitat and stunning old-growth Ponderosa pine forests. The Kelso landscape is adjacent to the upper stretches of Dominguez Canyons and offers unique opportunities for solitude, quiet-use recreation, and horse pack-in hunting.

Unaweep

With expansive views of the La Sal Mountains, Dolores River valley, and Divide Creek area, Unaweep and the Calamity Basin encompass an inspiring corner of the Uncompahgre Plateau. The area is important as year-round wildlife habitat, including elk calving grounds.

---

[11] Compiled with the assistance of former forester Walt Rule, of Ouray, Colorado, in January 2005

Tabeguache

Tabeguache is designated by Congress as a non-motorized area to protect its wilderness character. It is withdrawn from mineral entry and closed to logging and other activities. The area is characterized by a diversity of vegetative types, and provides excellent elk habitat and wildlife corridors.

Roubideau

Roubideau is designated by Congress as a non-motorized area to protect its wilderness character. It is withdrawn from mineral entry and closed to logging and other activities. Contiguous with the BLM's Camel Back WSA, this area is part of the longest wilderness canyon in Colorado. Flowing out of subalpine spruce and aspen forests high on the Uncompahgre Plateau, Roubideau Creek and its surrounding environs provide big game wintering habitat.

Naturita Canyon

This inventoried roadless area is a refuge among a network of roads and associated human impacts. The rugged core of the canyon provides important wildlife habitat in a drier, lower-elevation section of the Uncompahgre National Forest. Naturita Canyon includes ponderosa pine and piñon-juniper forest, habitat for a diverse range of wildlife, such as chickadees, marmots, mountain lion and bear. It contains wilderness qualities that are threatened by encroaching gas drilling and the potential for future motorized and mechanized recreation.

Kannah Creek

This large area occupies the western slopes of the Grand Mesa, exhibiting a vast diversity of habitat from piñon-juniper and riparian to aspen and spruce-fir. Kannah Creek is important not only for the wildlife habitat and quiet recreation it provides, but also because it serves as the municipal watershed for the City of Grand Junction. The proposed wilderness area just touches the edge of the BLM's Adobe Badlands WSA.

Priest Mountain

Forming graceful flat-topped rises, Priest Mountain is at the heart of the Grand Mesa National Forest. The area is made up of four distinct roadless core areas with established motorized corridors in between. The area is dominated by conifers and aspen, with interspersed open meadows. Protection of this central wildland area and its water resources is crucial as the impacts of increased motorized traffic accrue on the Grand Mesa.

Escalante Forks

This roadless area is characterized by high-quality riparian habitat and a diversity of forest types, with a wide range of corresponding wildlife. Most importantly, if provides a wild linkage between vast roadless areas, the Kelso Mesa area and the greater Dominguez watershed.

c. Areas Recommended for Research Natural Areas

Successful development of ecosystem management depends on availability and use of ecological baseline information on natural composition, structure, functioning and on effective monitoring. RNA's provide excellent reference areas for monitoring, and the Forest should make better use of this designation to help protect these high-quality plant communities.

Fens are a type of peatland, the wettest category of wetland. In general, peatlands have organic soils greater than 40 centimeters thick, stay saturated for long periods of time, and contain large carbon deposits. Fens accumulate peat at a very slow rate—about 8-10" of peat every 1,000 years. Some fens on the Grand Mesa have been undisturbed for more than 10,000 years. Fens were rated in 1998 by the United States Fish and Wildlife Service as a Resource Category 1, meaning they are irreplaceable and every possible measure needs to be taken to avoid impacting fens[12]. The Forest should change its current policy of allowing commercial peat mining from these resources. Water rights in fens should be protected or obtained for sustainable protection of fen hydrology.

M2m proposes the GMUG designate and manage the following special element areas as Research Natural Areas:

- Mt. Emmons Iron Fen
- Wager Gulch
- Willow Mesa
- Taylor Peak
- Ward Lakes
- Leon Peak

Mt. Emmons Iron Fen

Dr. David Cooper has called the Mt. Emmons Iron Fen a "world-class resource." This site is in pristine condition and contains the roundleaf sundew, abundant rare lichens and is relatively inaccessible although it is not far from Kebler Pass road. This area is currently a Botanical Special Interest Area and state of Colorado Natural Area. This site is certainly worthy and defensible as a regional RNA.

Wager Gulch

This 600-acre area is located southwest of Lake City on the eastern edge of the Carson/Cataract proposed wilderness area in the southern portion of the Gunnison Basin. This site is comprised of a wetland and fen community in excellent condition. The water chemistry, flora and fauna at this site are unique to iron fens in Colorado. The CNHP report states that "Wager Gulch is an outstanding example of an iron fen community, and has experienced fewer disturbances than other know iron fens of comparable size. Wager Gulch is a wetland of statewide importance." [13]

---

[12] Federal Register, Vol. 46, No. 15, February 4, 1981
[13] CNHP Report for Wager Gulch # S.USCOHP#22989.

Willow Mesa

Willow Mesa is an excellent example of very extensive planeleaf willow carr and alpine biological soil crust plant communities. It is located inside the La Garita Wilderness on it northern edge, and encompasses Baldy Chato, Baldy Alto, and Stewart Peak. The area contains a high diversity of lichens and alpine plant species. There is little evidence of disturbance in the alpine plant communities at this site.

Taylor Peak

The site of a rare alpine plant community, Taylor Peak RNA contains over 1200 acres of alpine tundra communities, and is home to over 20 plant species of local concern. While there are some impacts from roads and past mining activities, site values continue to be very high. Without some form of protection, its proximity to roads and impacts from recreational use of Taylor Park and Taylor Pass pose a threat to its long-term survival.

Ward Lakes and Leon Peak

These sites are in need of protection. Past management practices on the Grand Mesa have degraded surrounding fens, damming and draining them. Ward Lakes and Leon Peak are both sites that contain relatively undisturbed 10,000-year-old rich fens of high quality. These sites have element occurrences of the rare lesser bladderwort and other plant species of local concern. These two RNA's would serve as a control for comparing results of management activities on the Grand Mesa, and elsewhere.

2. RESTORING NATURAL DISTURBANCE REGIMES

Fire Management on the GMUG National Forest

The landscape of the Grand Mesa-Uncompahgre-Gunnison National Forest has been shaped by fire for millennia. Major vegetation types, including piñon-juniper, ponderosa pine, lodgepole pine, Douglas-fir, and spruce-fir, are well known to have evolved with adaptations to fire. Indeed, fire is such an important force in the ecosystems of western Colorado that forests and fire cannot be isolated from each other. Consequently, forest management and fire management must be seen as inextricably linked, and forest plans must include fire plans or at least prioritized direction to prepare the latter.

The following recommendations provide the foundation for a sound GMUG policy on fire management, taking into account the imperative of protecting lives and homes from wildland fire and the important ecological role of fire in shaping and maintaining landscapes:

Protect Life and Property—To prevent loss of lives and homes, GMUG fire policies must first prioritize creating and maintaining defensible space around homes in the wildland-urban interface. A relatively small portion of GMUG National Forest land overlaps with this community protection zone (up to one-quarter mile from the edge of communities). These are areas where appropriate thinning can help reduce the risk to lives and homes from wildland fire. Where fire poses a direct, immediate threat to communities, aggressive suppression is appropriate. The GMUG should work collaboratively with communities adjacent to Forest Service land to prioritize and help implement risk reduction projects in the wildland-urban interface.

Restore Ecological Health—Fuel reduction efforts should focus on the use of prescribed fire to restore natural fire cycles where it can be accomplished without substantial risk of unnaturally high intensity fire. In many cases, careful thinning of smaller trees and underbrush (followed by removal or treatment of this cut material) within lower elevation ponderosa pine and piñon-juniper may be required as a first step before reintroducing fire. In contrast, "fuels reduction," especially commercial logging of bigger, older trees, or logging within aspen, lodgepole pine, or spruce-fir forest types for fire-risk reduction, cannot be justified scientifically.

- *Fuels Reduction, Fire Risk Reduction and Restoration Treatments Should Not Occur in Aspen, Lodgepole Pine, or Spruce-Fir Forest Types Beyond The Wildland Urban Interface*—Beyond the area immediately surrounding homes and communities, fuels reduction should be targeted to vegetative types that are outside their historic range of variability. Aspen, Lodgepole Pine, and Spruce-Fir forest types in the Southern Rockies are NOT currently outside of their natural fire cycles; treatment efforts targeting these forest types would be a waste of resources and might do more harm than good. There is little scientific evidence that reducing fuels in these forest types beyond the home ignition zone actually protects communities, though in rare circumstances it may help firefighters keep fire from reaching structures. Thus, such projects should only be considered in very limited circumstances (such as down slope and upwind from a community where defensible space in the home ignition zone has already been created). In such circumstances, selective thinning should be the only method used in order to reduce density of trees and, therefore, fire intensity.

- *Prioritize Restoration Work*—To maximize the effectiveness of limited federal funds, the Forest Service should prioritize restoration treatments, focusing these treatments in an area within a few miles of communities. To be effective, restoration must be focused on the places where it is needed most. Throughout the West, the forests that are most in need of restoration are those immediately adjacent to communities, often at the base of adjacent mountain ranges. These dry, low-elevation forests of ponderosa pine, Douglas-fir, piñon-juniper, and Gambel oak have been the most altered by fire exclusion, and are the most in need of thinning to restore a fire-tolerant forest structure. Constraining the restoration zone to the area within a few miles of communities will focus restoration efforts where they will yield the greatest benefit. In areas with no nearby noxious weeds, restoration should involve allowing natural processes of plant recolonization as much as possible or use of local genetic plant materials.

- *Let Fire Perform Its Role Where and When It Can Be Done Safely*—Where human lives and property are not at stake, fire suppression should be undertaken only when fire threatens critical or rare components of ecosystems (such as old growth forest and endangered species habitat) while these elements are being restored to healthy levels. The GMUG should abandon its policy requiring fire suppression based on management prescription—for example, instigating suppression activities in all Theme 5 designation areas regardless of forest type, natural fire regime, or proximity to communities and rare ecosystem components. Such a policy can result in ecological harm by preventing cyclical fires from occurring and regenerating fire-adapted forests. In addition, this policy unnecessarily diverts limited resources (money and personnel) from critical community protection work in the wildland-urban interface. To summarize, the decision to suppress fire should be made on the grounds of human life and home protection, rare ecosystem component protection, and historic range of variability, not prescription. To more effectively address wildland fire, the GMUG should establish zones for fire response that transcend management prescriptions. These zones should include areas for suppression, containment/confinement, and burning within acceptable limits.

- *Treat Only Smaller-Diameter Trees*—In lower-elevation, fire-evolved forest types such as piñon-juniper or ponderosa pine, we support vegetation "treatments" (such as prescribed fire and non-commercial thinning) where fire suppression or other activities (e.g., grazing, high-grade logging) have allowed stand densities to increase above natural or pre-European settlement era conditions. Such restoration treatments should preserve all pre-settlement trees and maintain or restore the natural forest composition and structure. As the Forest Service notes, "The removal of large, merchantable trees from forests does not reduce fire risk and may, in fact, increase such risk. Fire ecologists note that large trees are insurance for the future—they are critical to ecosystem resilience. Targeting smaller trees and leaving both large trees and snags standing addresses the core of the fuels problem" (Forest Service's Report to the President, Sep. 8, 2000, p. 11). Concrete mechanisms must be in place to ensure that overly-aggressive thinning and removal of large trees are not implemented in an attempt to cover the cost of thinning treatments.

- *Keep Roadless Areas Wild* —Roadless areas are critical wildlands, and are generally healthier ecosystems than logged areas. Forest Service studies have found that roadless areas account for a very small percentage of the total forest acreage at risk of unnaturally intense crown fire. "Moreover, the Forest Service [sh]ould prioritize efforts to reduce fuels in areas that have already been roaded because these areas tend to be much closer to communities and have higher fire risks" (Forest Service's Report to the President, Sept. 8, 2000, p. 12). The M2m Alternative opposes logging in roadless areas, except in instances where these areas directly abut an occupied property, making the creation of defensible space in the home ignition zone (up to 200 feet from a structure) a priority. Beyond the home ignition zone, logging in roadless areas would not reduce the risk of fire adversely affecting humans and their properties, and could increase fire ignition risk by creating fuels that would dry out in the opened forest. Any fuel reduction projects should also avoid construction of new roads.

Forest plans are, at their core, about the relationships between landscapes and people. In any landscape, there are three situations with regard to people and fire. First, there are those situations where we never want fire because it causes, or has the potential to cause, great damage. Areas near communities—the wildland-urban interface—are an example. Second, there are places where fire can be used as a tool, but only under tightly-prescribed conditions. And third, there are places where fire poses little risk to people and resources, and natural fires can actually help achieve management objectives. Wilderness areas, roadless areas, and other remote lands are examples of the third category. The GMUG forest plan must be developed to account for natural fire and use it wherever possible to achieve management objectives, whether these are social or ecological goals.

Invasive Plant Species and Fire[14]

While wildfire is a natural and recurring event in Colorado's forest ecosystems, the natural fire ecology of our wildlands is seriously compounded by the increased presence of exotic weed invaders.

Before a fire, a healthy native plant community has good ground cover and litter in the soil. All niches are filled both above ground and in the root zone with a diverse mix of native plant species. But after severe fires, native plants are suppressed for a period of two to three years. Consequently, post-fire management should focus on the highest burn severity areas, with special attention given to fire camps, dozer lines, and other areas impacted during the fire suppression period. A strategic program of early detection and timely treatment of weeds for years after the fire will provide the best defense against the rampant spread of new weeds in the burn area. Proper management of domestic livestock and wildlife numbers in line with grazing capacities, preventing the buildup of dangerous woody debris, and an on-going program of early detection of exotic plants coupled with timely eradication to minimize weed seed source, are examples of management practices that will minimize catastrophic weed invasions following fire.

The unprecedented Colorado wildfires of the early 2000s produced alarming consequences to human safety, wildlife habitat, water quality and much more. Perhaps less dramatic but nevertheless detrimental are the long-term effects of the advancement of noxious weeds after large wildfires. Wildfire restoration areas will need special care to prevent this long-term degradation of our precious natural heritage.

3. INVASIVE PLANT SPECIES MANAGEMENT

Dale Bosworth, Chief of the U.S. Department of Agriculture, Forest Service has identified invasive species as one of the four significant threats to our Nation's forest and rangeland ecosystems. Non-native weeds have displaced more than 10 percent of Colorado's native plant species. When exotic flora invade, wildlife habitat deteriorates, water quality diminishes, erosion increases, nutrient cycling and filtration are altered, and recreational values are degraded. Native plants are an integral part of all healthy ecosystems. They provide genetic material that strengthens our major food crops, native medicines, native products, and the natural beauty of the landscape. They provide food and shelter necessary to wild animals and birds.

Native wildflowers cannot compete with invasive plants for nutrients, sunlight and water. As a result, our biologically diverse mountain meadows, grasslands, and wetlands are in danger of being overrun by non-native, invasive weeds.[15] Noxious weeds become established in soils disturbed by a variety of activities, including construction, motorized travel, logging, concentrated livestock grazing, and natural disturbances such as fire. Noxious weed seeds are transported to new sites in numerous ways such as by wind, water, tires, machinery, and people (e.g. via boot tread), as well as wild and domestic animals.[16]

Treatment:

[14] Text is borrowed from Tom McClure. 2002. Colorado Weed Management Association.
[15] Bliss, Chonnie. 2004. Colorado Weed Management Association.
[16] Colorado Weed Management Association. 2002. "Troublesome Weeds of the Rocky Mountain West," 7th ed.

The 2005 Forest Service document Rocky Mountain Region Invasive Species Management Strategy[17] is a useful resource for weed management, and its "General Weed Prevention Practices for Site-disturbing Projects and Maintenance Programs" should be required management on the GMUG, including the formulation of an assessment and treatment plan as follows:

- Identify the Forest's priority species and populations.
- Identify the Forest's priority monitoring and treatment areas.
- Create timetables for inventory and/or treatment of all roads on the Forest/Grassland unit.
- Unless otherwise negotiated, Levels 3, 4, and 5 roadways, and major system trails will be inventoried and treated on a three-year cycle. Level 1 and 2 roads will be on a five-year cycle. More frequent monitoring and treatment is needed; monitor, and treat if necessary, for weeds every year for at least three years after weeds are first found.
- Evaluate the adequacy of existing invasive species inventories.
- Identify and establish at least one Coordinated Weed Management Area per Forest/Grassland annually with local partners.
- Identify funding needed to implement the desired program of work and incorporate this need into program budget planning.
- Schedule validation monitoring of the action plan and summary of past three years' activities.

Prevention:
Because invasive species are so difficult to eradicate once established, the following methods for prevention should be adopted:

(1) To prevent introduction into new areas:
- To the extent feasible, avoid new road and trail construction Forest-wide.
- Especially avoid ground-disturbing activities in remote uninfested areas.
- Avoid new uses in uninfested areas.
- Restrict uses/prohibit modes of travel once first instance of infestation is found.

(2) To prevent spread of existing weed polygons:
- Plan travel management to minimize travel through known infested areas.
- Implement an aggressive education campaign.
- Establish boot and machine-washing stations.[18]
- Close areas to travel where control is not possible.

---

[17] Rocky Mountain Region, USDA Forest Service, December 2004.

[18] Several countries employ such measures as boot and vehicle washing stations, complete with scrub brushes, notably Australia (to control phytotopera fungus) and New Zealand.

4. MANAGEMENT GUIDELINES FOR RIPARIAN, WETLAND, AND AQUATIC ECOSYSTEMS

Riparian and Wetland Ecosystems
Riparian areas are the biological and physical link between terrestrial and aquatic ecosystems. Ninety percent of wildlife species use riparian areas at some point in their life cycles. Riparian areas are of great importance for maintaining water quality and quantity, stabilizing streambanks and providing habitat for fish and other wildlife. Colorado riparian areas are highly threatened by domestic livestock grazing, gravel mining, recreation and development, and their use as transportation corridors.

While riparian areas are unique, they should not be considered independently of uplands. Problematic upland watershed conditions often reduce the effectiveness of management in the riparian zone. To be managed effectively, the whole pasture containing the riparian zone and the whole watershed containing the pasture should be considered. Management must provide an adequate cover and height of vegetation on the banks and overflow zones to promote natural stream functions (sediment filtering, bank building, flood energy dissipation, aquifer recharge and water storage).

Management Guidelines:

Grazing:
The most extensive human-caused influence on riparian zones in the United States has been livestock grazing.[19] However, many riparian areas on the GMUG can be part of a successful grazing system without causing irreparable damage to the area. Riparian areas cannot be used season-long or with both spring and fall use during the same year.

Implement a grazing system that:

- Limits grazing intensity and season of use to provide sufficient rest to encourage plant vigor, re-growth and energy storage;
- Ensures sufficient vegetation is left to protect streambanks during periods of high flow, to dissipate energy and trap sediments; leave 4 inches stubble height for early season use, 6 inches or greater stubble height for late use pastures, or to protect special ecosystem characteristics such as critical fisheries.
- Assesses specific needs of each unique riparian area relative to vegetative potential and capability; stocking rates, duration and utilization levels must be monitored and adjusted to ensure post-grazing re-growth and residual cover (especially prior to high flows).

Recreation:
Riparian areas are clearly one of the most important habitats in the arid West. Riparian areas are also particularly attractive for recreation and wildlife viewing because of their environmental features. Because of their linear nature and connectivity between urban centers, transportation and recreational planning agencies find riparian systems particularly suitable for trails. Trail corridors are planned or proposed for all major riparian areas of Colorado (Clinton K. Miller. 1994. City of Boulder). The

[19] Montana BLM Tech. Bull. #3, Nov. 1997

potential environmental consequences of recreational trails in these areas would have severely detrimental ecological effects.

General Recreation Management Guidelines:
- Minimize number of stream crossings.
- Create hardened stream crossings and/or bridges in heavily used areas.
- Use physical barriers to keep people out of riparian areas.
- Locate new roads, trails and campgrounds outside wetland and riparian areas.
- Move existing roads and trails out of riparian areas, where possible, provided the relocated roads and trails are not more damaging than the original ones.
- Place signage to educate users to stay on the trail.
- Limit impacts in sensitive areas by limiting numbers of users, closing or rerouting trails.
- Reduce road and trail density.
- Restrict access to riparian areas for organized events, competitive races, etc.

General Motorized Recreation Management Guidelines:
- Prevent upgrading trails from single-track to multiple tracks.
- Create erosion control barriers to prevent erosion and sedimentation.
- Provide education and signage to keep motorized users on the trail and out of the streambed.
- Close motorized trails in sensitive areas to prevent resource damage.
- Limit use when wet/muddy conditions prevail.
- Limit numbers of motorized users.
- Restrict access to riparian areas for organized motorized events, competitive races, etc.

Aquatic Ecosystems
Healthy rivers are dependent upon a natural flow regime, i.e. one that varies in magnitude, frequency, duration, timing and rate of change. Natural flows are critical because the flow of water provides the base on which all other river functions are built. The plants, fish, and wildlife in any given river have evolved to adapt to a natural river's unique rhythms.

The sheer productivity of the Gunnison Basin watershed is of immense importance to humans and wildlife alike. The watershed is the second largest producer of water to the Colorado main stem, serving local irrigators and residents throughout western Colorado as well as several western states. On a very good year, Gunnison Basin water even travels as far as Mexico. Unfortunately, many historic human activities (e.g. diversions, dams, excessive grazing, logging and mining) have left their mark on the health of the Basin's lakes, rivers and streams, and wildlife has suffered.

A prime focus of aquatic management on the GMUG should be on preserving high quality habitat, particularly for species at risk, and identifying, securing and protecting rehabilitation areas for these species. Secondary goals should include aggressive monitoring of stream health, and cleanup of acid mine discharge.

Colorado River Cutthroat Trout (*Oncorhynchus clarki pleuriticus*)
Of special concern to aquatic conservation within the Basin is the Colorado River Cutthroat Trout (CRCT), a species that Behnke and Benson (1980) have described as the "canary in the mine" with regard to habitat degradation. CRCT are sensitive to changes in water temperature, cover requirements and spawning habitat, in ways that other fish are not. These habitat requirements are often not met in areas that are moderately to heavily modified, including areas where excessive grazing, road building, motorized recreation, and/or vegetation removal have taken place. Occupying only a sliver of its former range throughout the West, the Colorado River Cutthroat Trout is an indicator species whose health and recovery should guide future management of aquatic ecosystems in many areas of the Gunnison Basin.

Management of aquatic systems must place a high priority on preserving existing habitat for and populations of CRCT, and on rehabilitating additional areas to establish healthy CRCT metapopulations throughout their former range, as outlined in the Conservation Agreement and Strategy for Colorado River Cutthroat Trout (*Oncorhynchus clarki pleuriticus*) in the States of Colorado, Utah, and Wyoming, April 2001.

Boreal Toad (*Bufo boreas boreas*)
Colorado's only alpine species of toad, the boreal toad has been reported in montane habitats throughout the state at elevations between 7,000 and 12,000 feet. Distribution is restricted to areas with suitable breeding habitat in spruce-fir forests and alpine meadows. The toad uses a variety of aquatic habitats including lakes, marshes, ponds, and bogs with sunny exposures and quiet, shallow, non-flowing, off-channel water to breed.

Management of aquatic systems must place a high priority on preserving existing habitat for and populations of boreal toad, and on rehabilitating additional areas to establish healthy boreal toad metapopulations throughout their former range.

Head gates, dams, canals, or other structures associated with water diversion systems can directly destroy boreal toad habitat. Additionally, these structures may impede or alter water flow in such ways as to make areas unsuitable for breeding sites. Unsuitable habitat refers to riparian areas converted to upland sites and where shallow waters, less than 1 ft. (0.3 m) deep, no longer exist in areas that formerly contained breeding ponds. Disturbance, alteration, or contamination of areas may also occur due to dredging of sediments, vegetation cutting, and pesticide application for vegetation and insect control during maintenance activities.

In areas of occupied toad habitat, existing roads must be assessed for their potential of creating barriers to toads and their movement. If it is determined such impacts exist, modifications of roads to provide safe and unaltered movement of toads between essential habitats is recommended. Culverts, or other structures toads may pass through, as well as bridges and seasonal closures, can provide effective mitigation. Adhere to protocols outlined in the Conservation Plan and Agreement for the Management and Recovery of the Southern Rocky Mountain Population of the Boreal Toad, February 2001.

Aquatic Management Guidelines:

- Identify and secure future CRCT introduction areas.
- Prohibit introduction of non-native salmonids in existing and selected future CRCT habitat.
- Acquire adequate instream flows and lake levels, and meet or exceed state, federal, and any local municipal water quality standards.
- Employ tools and strategies outlined in the Pathfinder Project Report.
- Oppose out-of-basin, trans-mountain diversion. Formally object to such proposals in State court.
- Consult with state and other federal agencies prior to implementing any depletion to critical habitat.
- Ensure full compliance with the Clean Water Act.
- Monitor watershed conditions, instream flows, lake levels, and water quality to detect changes in aquatic habitat.
- Measure abundance and diversity of aquatic insect species on an ongoing basis.
- Ensure that temperature levels, dissolved oxygen, salinity, turbidity, hardness, acidity, and alkalinity (water pH) are all within a natural range for that river and its species. A healthy river will also have minimal amounts of pollution and toxics, such as pesticides, nitrogen, phosphate, fecal coliform, and heavy metals.
- Ensure that any new mining permits require permanent protection of water quality from potential discharges. Continue systemic evaluation and cleanup of acid mine discharge, particularly in boreal toad habitat.
- Limit or prohibit livestock grazing when aquatic resources fail to meet minimum riparian habitat guidelines. Aggressively employ Best Management Practices to minimize or prevent elevated sedimentation levels, especially in streams on the state of Colorado’s 303 D list.
- Prohibit gravel mining, or other extractive stream-bed activities.
- Educate the public about the importance of maintaining healthy aquatic systems.
- Cooperate with local municipal water providers using the GMUG for its supplies in the development of Source Water Protection Plans. Incorporate prescriptions into the land management strategies for these source watersheds, i.e., retiring grazing allotments to protect municipal water quality.

a. Wild and Scenic Rivers[20]

The M2m Alternative proposes to manage the San Miguel River according to the criteria of the Wild and Scenic Rivers Act so as to protect its future suitability for designation by Congress. We advocate for Wild and Scenic River studies of the San Miguel River, and major tributaries such as Deep Creek, Horsefly Creek, and Tabeguache Creek. Management to protect suitability for Wild and Scenic River designation includes a prohibition on new diversion structures, withdrawal from mineral entry and mineral location, prohibition of major ground-disturbing activities in a corridor one-quarter mile in width from each bank

---

[20] Compiled with assistance from Patrick Willits, Mayor of Ridgway and Executive Director of the Trust for Land Restoration, which focuses on mined land restoration statewide.

of each river (i.e. total of one-half mile width, plus width of river), and a ban on federal permitting decisions that might disqualify the river from future congressional designation under the Act.

San Miguel River
The one-million-acre San Miguel Watershed lies within a large relatively-undisturbed area of North America, and encompasses significant wetlands and fens. At its heart, the free-flowing San Miguel River extends for 80 miles from high-alpine headwaters above Telluride to a desert confluence with the Dolores River.

The headwaters of the San Miguel River are located in areas of the southern Uncompahgre National Forest. Most downstream tributaries, such as Fall, Deep, Specie, Beaver, Horsefly, Cottonwood and Tabeguache Creeks also flow through GMUG National Forest. Protection of these headwaters and tributaries is important because the San Miguel River is free of major dams and diversions, making it one of only three major river systems left in Colorado where natural hydrologic processes are intact.

Deep Creek boasts clean water, healthy riparian vegetation and remnant populations of Colorado River cutthroat trout, and is a prime location for this native fish species' restoration. Both the USFS and the Colorado Division of Wildlife concur that Deep Creek provides excellent habitat for Colorado River cutthroat trout recovery, and Deep Creek is included in a statewide reintroduction plan.[21] Horsefly Creek and Tabeguache Creek have natural, year-round flow, which maintains downstream hydrologic integrity, and should be considered critical or "special element" areas needing protection to ensure that they are not dammed or diverted.

The Nature Conservancy manages three major preserves along more than 10 miles of the San Miguel River. The BLM has designated parts of the San Miguel River on BLM land as Areas of Critical Environmental Concern; other parts have been designated Special Management Recreation Areas, such the Tabeguache tributary canyon that originates on the Uncompahgre Plateau. The BLM has blocked some road access to the river, concentrating river access to a few places.

In a few locations, the San Miguel River is compromised by mining impacts, e.g. Howard's Fork, which has water quality problems due to mining. In the San Miguel River Restoration Assessment (2001)[22], stakeholders and scientists chose five areas as priority restoration reaches, all of which stem from or flow through the GMUG National Forest. The USFS has done an excellent job of recognizing its responsibility by participating in cleanup. The revised USFS plan should in some way reinforce that, for example by lobbying for money to analyze mine pollution impacts and to fund restoration.

[21] Conservation Agreement and Strategy for Colorado River Cutthroat Trout (*Oncorhynchus clarki pleuriticus*) in the States of Colorado, Utah, and Wyoming, April 2001.
[22] The San Miguel River Restoration Assessment was funded by a grant to San Miguel County by the U.S. Environmental Protection Agency. This assessment was a cooperative effort of the San Miguel Watershed Coalition, The Nature Conservancy, San Miguel County, and the U.S. Geologic Survey.

5. RECOVERY OF EXTIRPATED, ENDANGERED AND SENSITIVE SPECIES

All native species, including those on the brink of extinction or local extirpation, must be managed to insure their continued existence across the landscape. This is a fundamental premise underlying the M2m Conservation Management Alternative. Species that were systematically exterminated by humans should be reintroduced where practicable. The following extirpated, endangered and sensitive species are recommended for recovery on the GMUG Forest:

Colorado River Cutthroat Trout[23] (*Oncorhynchus clarki pleuriticus*): Behnke (1979) suggests that the species occupies less than 1% of its former range. The native cutthroats have declined primarily because of hybridization with introduced trout species (Behnke and Zarn 1976). Water contamination from mining wastes, inadequate streamflows from water diversions, sedimentation from roads and logging, and overfishing have played additional roles in population declines. Colorado River cutthroat trout apparently thrived in a wide variety of habitat conditions, and external factors such as hybridization with non-natives, pollution, and overfishing are the major land management limiting factors. Restoration of the CRCT should be done in accordance with the Conservation Agreement and Strategy for Colorado River Cutthroat Trout in the States of Colorado, Utah, and Wyoming, April 2001.

The **Gunnison Sage Grouse** (*centrocercus minimus*), whose current range is now restricted to small pockets of the Gunnison Basin, has sustained an almost fatal population decline over the past 50 years. The Gunnison Sage Grouse Working Group was formed in 1995 as a multi-stakeholder effort to develop a conservation plan to reverse the trend. However, species numbers continue to decline, and currently the Gunnison sage grouse is on the USFWS Candidate list for threatened and endangered species.

Management emphasis is to protect and enhance nesting and brood rearing areas, production areas, and winter range for the endangered Gunnison sage grouse. Management practices should promote high structural stage habitat. Standards should be in keeping with those laid out in the Gunnison Sage Grouse Conservation Plan (1997). In the case of listing under the ESA, Recovery Plan standards would apply.

Columbian Sharp-Tailed Grouse[24] (*Tymphanuchus phasianellus columbianus*): Columbian sharp-tailed Grouse is native to the GMUG National Forest and was once common on the Uncompahgre Plateau (Hoffman 2001), but has disappeared due to conversion of native rangelands to cropland, livestock grazing, and forest encroachment into grasslands (Giesen 1997). Heavy livestock grazing has severely reduced the quality of brood-rearing habitat (Towry 1984; Giesen and Connelly 1993). Currently, there is one population of Columbian sharp-tailed grouse in the northwestern portion of the state.

Before reintroduction of sharp-tails, a habitat restoration program should be implemented to reestablish native shrubs and other native vegetation. Saab and Marks, 1992, found sharp-tails selected habitat in Idaho that was least modified by livestock grazing. This habitat was typically "flat to rolling... with a diversity of native shrubs, forbs and grasses." They also stated: "[P]rotecting habitats within 2.5 km of

---

[23] See Section B.3., "Aquatic Ecosystems"

[24] Information has been borrowed from the Forest Guardians, Petition to the U.S. Fish & Wildlife Service to List the Columbian Sharp-tailed Grouse as an Endangered or Threatened Species, Oct. 14, 2004.

[leks, or] dancing grounds, is critical for maintenance of summer habitat." Marks and Marks, 1988, found that hawthorn (*Crataegus douglassi*), Saskatoon serviceberry (*Amelanchier alnifolia*) and common chokecherry (*Prunus virginiana*) were very important as winter food sources.

Grizzly Bear *(Ursus arctos)*: The GMUG Wildernesses and surrounding roadless areas should be studied in cooperation with the Colorado Division of Wildlife and the U.S. Fish and Wildlife Service to see how much habitat suitable for this species might exist. This study should also look at increasing the quality and security of habitat through road closures and law enforcement. A beginning strategy to accomplish this is articulated in: Southern Rockies Wildlands Network Vision, Southern Rockies Ecosystem Project, The Denver Zoological Foundation and The Wildlands Project, 2003.

Lynx (*Felis lynx canadensis*): Since 1999, the Colorado Division of Wildlife has released 129 lynx on state National Forests. Most of these lynx are living in the San Juan Mountains, including areas of the GMUG.

The lynx specializes in high mountain boreal forests in Colorado (Armstrong 1972), particularly dense spruce-fir stands (Fitzgerald *et al.* 1994). It can be found in dense coniferous forests in the subalpine zone to timberline. The lynx population also seems to be closely tied to the snowshoe hare population: 35-97% of the lynx diet consists of snowshoe hares, but they also occasionally eat squirrels, mice, grouse and ptarmigans as availability of prey changes (McCord and Cardoza 1982). Snowshoe hare populations determine where lynx are found, and how many of them are found (Brand and Keith 1979). Red squirrel is a very important secondary prey species, especially in Colorado, where snowshoe hare populations are generally lower than in other parts of lynx' range (Buskirk et al. 1999).
Home ranges in the Southern Rockies are estimated at 28 square miles for females and 58 square miles for males. Thus, a metapopulation would require suitable habitat that equals 19,310 square miles of interconnected 386-square-mile patches (Aubrey *et al*. 1999).

Lynx are known to move considerable distances in search of prey and denning sites (Koehler and Keith 1994). Thus, it is very important to maintain landscape linkages between core habitat areas to give this species a chance to reestablish viable populations.

In the GMUG, the following linkage areas for lynx were identified in the Conservation Agreement between the Forest Service, U.S. Fish and Wildlife Service, and the Bureau of Land Management (USDA Forest Service 2004): Cottonwood Pass, Cochetopa Hills/North Pass; Slumgullion Pass; Lizard Head Pass; Red Mountain Pass; Silverton-Lake City; Dallas Divide; McClure Pass; and Battlement Mesa. These areas should receive special consideration for lynx management, especially winter snow travel.

Wolf (*Canis lupus*): The gray wolf was once common throughout much of Colorado. This top-level predator played a very important role on the landscape by controlling populations of deer, elk, bighorn sheep, beaver, and other animals. Wolves did this by culling weaker animals, thereby helping maintain the genetic vigor and integrity of these species. Because the largest and healthiest animals are often selected for harvest, hunting does not replace predation, under which the weakest animals are killed; nor does hunting sufficiently limit populations of deer and elk, which have grown very large due to lack of predators and the fact that most winters over the last 10 years have been relatively mild. As winter range continues to be developed, these deer and elk increasingly reside on private land. The Colorado Division of Wildlife pays over $1 million annually to landowners for game damage.

Wolves are needed as predators. In preying on big game animals, wolves provide carrion for a host of other species, including rare species such as grizzly bears, bald eagles, ferruginous hawks and wolverines, and more common species such as magpies, crows, ravens, and black bears.

In addition to providing important ecological benefits, wolves provide direct benefits to humans. Many people would take pleasure knowing that wolves were back on the landscape. Many backcountry recreationists would enjoy hearing the howl of the wolf and/or actually seeing wolves. In a 1976 poll of visitors to Rocky Mountain National Park, more than 75% of respondents said they would like to see wolves returned to the Park. More recently, in a 1994 poll conducted by Colorado State University on behalf of the U.S. Fish and Wildlife Service, 71% of Coloradoans surveyed stated they support wolf recovery (Manfredo 1994).

Wolves can also provide an economic benefit to communities near the national forest. A 1982 Park Service study indicated that returning wolves to Yellowstone National Park would provide $19 million in direct and indirect economic returns to northwestern Wyoming.

There is no question that wolves would thrive on the habitat available on the GMUG Forest. Wolves are habitat generalists that require large expanses of habitat with minimal fragmentation from roads and other human activities (SREP 2003). As part of the forest planning process, the GMUG Forest should examine the potential socio-economic impacts of wolf reintroduction, and identify actions that can be taken to moderate reasonable concerns about livestock predation.

Wolverine (*Gulo gulo*): Wolverines occupy a variety of habitat types, including tundra and subalpine forests, probably depending largely on density of food sources (Banci 1994). Female wolverines occupied a home range of 100 sq. km in studies conducted in Montana and Alaska. Researchers believe wolverines require large refugia such as wilderness areas and appropriate dispersal and travel corridors between refugia. Dispersal corridors may include routes frequented by prey species, and consequently elk migration routes may serve as useful surrogates for wolverine movement corridors (SREP et al, 2003).

Uncompahgre Fritillary Butterfly (*Boloria acrocnema*): The Uncompahgre Fritillary Butterfly has the smallest total range of any North American Butterfly. All known colonies are associated with patches of snow willow (*Salix nivalis*). All known locations are above 3,810 meters or 12,500 feet and on northwest-facing slopes, which are the coolest and the wettest microhabitat available in the San Juans. The Uncompahgre Fritillary butterfly's habitat is just two verified areas of the San Juan Mountains, including the Sneffels Wilderness Area.

Population data is difficult to assess due to a lack of historical data on the size of an average colony. Butterfly collectors are this species' biggest threat. Additional threats are changing climate patterns (e.g. global warming), disease, parasitism, predation, and trampling of larvae by humans and livestock.

C. ACTIVITIES MANAGEMENT

Introduction

Throughout human history, people have overused Earth's forests. With increasing population on the Earth and increasing appetites for material prosperity, forests cannot supply as they have in the past. The signs of ecosystem decline are present in the loss and decline of species.

The protection, maintenance and restoration of healthy, intact forest ecosystems are now a global imperative. As well as providing carbon sequestration (greenhouse gas) at the global level, GMUG forests have regional and local benefits that cannot be overstated, nor duplicated. Forests provide our clean water and air, the habitat for wildlife, and opportunities for our quiet solitude and spiritual renewal. GMUG forests also provide wood for construction and heating, open space for recreation, and forage for our livestock, among other uses.

Unfortunately, decades of placing such demands on our forests have brought substantial ecological damage to the GMUG. Past practices have meant the loss of over 50% of late-successional conifer forest cover; loss of high quality aspen habitat; loss or imperilment of myriad terrestrial, aquatic and avian species; and overall forest fragmentation, noxious weed encroachment and increased fire risk, brought about by thousands of miles of roads and skid trails that have been built in the GMUG Forest since the first timber was sold over 100 years ago. Additionally, the public has created many new travel routes, adding to already excessive road densities in many areas. Roads separate species populations and individuals, making them more vulnerable to genetic drift, disease, and natural and man-made catastrophe. This fragmentation restricts the gene pool, and ultimately inhibits natural evolution. Species that do not thrive in close proximity with human disturbance are becoming increasingly rare on the GMUG.

But while impacts have been widespread, the potential for conservation and restoration of forest biodiversity on the GMUG remains high. Future management emphasis should be shifted toward maintaining, enhancing and restoring the diversity of native species and natural ecosystem functioning. A central element of this will be to preserve existing large blocks of unroaded habitat for reintroduction of large native carnivores.

1. LAND TENURE ADJUSTMENT[25]

Consolidation of the ownership within the GMUG Forest is an important step towards assuring long-term viability of biological diversity. As one example, consolidated ownership leaves decisions about constructing new roads entirely to the discretion of the Forest Service. Currently, owners of private inholdings within the Forest regularly demand and often receive approval for new or improved roads and motorized access to their property.

---

[25] Parts of this section are borrowed from the Citizens Plan for the Wild San Juans, submitted for San Juan Forest Plan Revision in November 1999.

Ownership is consolidated through direct purchases (generally funded by earmarked Congressional appropriations from the Land and Water Conservation Fund), land exchanges, and, very rarely, outright donations. Acquisitions clearly depend on willing sellers, but the Forest can assist the process by pro-actively encouraging land exchange proponents to offer private lands in key areas.

The M2m Alternative prioritizes consolidation efforts in the linchpins of the reserve design—wilderness and roadless areas, and corridors. Private inholdings should be pursued via purchase or exchange in the following priority:

(1) wilderness areas, recommended wilderness, backcountry areas
(2) linkages
(3) "hotspots" of biological diversity such as rare plant communities or other threatened and endangered species habitat
(4) buffer zones such as ecological recovery zones and wildlife areas
(5) compatible use zones

The Forest Service should vigorously pursue acquisition of private inholdings in the Gothic Special Management area, Floresta Townsite, the High Elk Conservation Corridor, and other ecologically valuable properties.

2. FOREST ECOSYSTEMS AND SILVICULTURE

Timber harvest should only be used as a tool to further the goals outlined in Section I.A., not as an end in itself.

Recommended Management Actions:

- Prevent construction of new roads into existing roadless areas.
- Protect and, over time, restore late-successional forests.
- Establish areas for new pine recruitment and areas for old-growth pine to develop.
- Extend the minimum rotation age between harvests to the following:
    - Aspen 90 Years
    - Douglas Fir 200 Years
    - Spruce 250 Years
    - Lodgepole 120 Years

- Undertake Forest-wide species inventories, focusing on indicator species for specific ecotypes.
- Refrain from logging on steep slopes of over 30 percent incline or in riparian areas.
- Utilize only harvesting techniques that do minimal damage to soil, root systems and understory vegetation.
- Employ selective tree cutting methods when harvesting spruce-fir and ponderosa due to the potential damage from clear-cutting.

- All timber purchasers should employ best stewardship practices.
- Weigh the commercial value of timber against the other values of the entire forest community—undisturbed soil, clean air and water, and intact wildlife habitat.
- Ensure that commercial timber sales provide a positive net return to the government.
- Below cost or taxpayer subsidized commercial timber sales are unacceptable.
- Reintroduce fire as an important ecological restorative tool.
- Include 100' buffer zone from wetlands and 300' buffer zone from fens.

3. LIVESTOCK GRAZING

Introduction
Humans and domestic livestock have long been part of the Gunnison Basin ecosystem and an instrument of ecological change. Despite a long history of resource degradation through over-use, healthy range conditions are now appreciated from both an environmental *and* an economic point of view. Our increasing human population makes it imperative to define a healthy interaction between human and ecological communities. Users, managers and interested parties must work together and be flexible, use different means to achieve desired conditions, and set goals consistent with ecological knowledge and community values.

Despite being one of the most pervasive uses of Western public lands, livestock grazing is a privileged use, not an ecological imperative, since the animals grazed are not native to the GMUG areas. As such, livestock grazing must be practiced with care, recognizing that this activity can cause severely adverse impacts to biological diversity, soils, and water quality, etc. The GMUG Forest Service must also recognize differences between historic and current use, changing Western population dynamics and growing ecological knowledge.

• While historic ecological damage caused by overgrazing is widely acknowledged, many heavily impacted areas have recovered to properly functioning hydrologic, vegetative and geologic condition by simply changing grazing timing, intensity and duration. Although public lands livestock numbers have been reduced substantially in the last 70 years, many large areas of public rangeland remain impacted and changed, and many continue to decline due to current over-use. Sensitive areas or areas experiencing historic overuse and associated plant community impairment should be placed into total non-use and/or permanently retired. Grazing should be curtailed or eliminated in areas where Threatened, Endangered or Sensitive species have failed to make a full recovery.

Management Actions:
• The Forest will enforce existing standards that are adequate to protect and restore rangeland. Grazing management practices must maintain sufficient residual vegetation on both upland and riparian sites to protect soil from wind and water erosion, and to buffer temperature extremes.

Acceptable management practices promote plant health by addressing the kind and class of livestock, season of use, and duration, distribution, frequency and intensity of grazing use. Management practices must provide periodic rest or deferment from grazing during critical growth periods to allow adequate recovery and regrowth of vegetation, and to provide opportunities for seed dissemination and seedling establishment.

Rangeland will be managed to achieve and maintain, to the extent feasible, the potential natural community (PNC) of vegetation, which is the composition and structure of vegetation that would likely exist in the absence of intensive and persistent human activity. Where establishing the PNC is infeasible, the GMUG shall develop, as part of rangeland planning, a desired plant community (DPC) that emphasizes native plant species as much as possible, and manage the respective areas to achieve the DPC.

• The Forest will require intensive management from permittees. The Forest and permittee will work together to develop appropriate grazing systems; no single grazing system works in every location. Season-long, passive grazing is unacceptable. The use of riders is preferable to fences to keep cattle from grazing sensitive areas, since riders can pay daily attention to what the animals are eating. Any planned grazing system requires attentiveness to range condition on a daily basis and is preferable to season-long passive grazing. Following grazing in any one pasture, the pasture must be "cleaned" of stragglers.

To ensure compliance with management practices generally, the Forest will employ a monitoring system such as suggested in the Forest Service Rangeland Analysis and Management Training Guide. Specifically the Forest Service should implement riparian area monitoring methods as discussed in Methods for Evaluating Riparian Habitats with Applications to Management (GTR INT-221). The Forest will encourage use of established photo points.

• Range improvement projects will be designed consistent with overall ecological functions and processes. Natural occurrences such as fire, drought and flooding, and prescribed land treatments will be combined with livestock management practices to move toward the sustainability of biological diversity across the landscape. This will provide natural vegetation patterns, a mosaic of successional stages, and vegetation corridors that maximize wildlife habitat connectivity.

Grazing management will occur in a manner that does not encourage establishment or spread of noxious weeds. In addition to various methods of weed control, livestock may be used where feasible as a tool to inhibit or stop the spread of noxious weeds, such as domestic sheep used to reduce leafy spurge, or horses to reduce non-native thistles. Where reseeding is required, native plant species and natural revegetation will be used to sustain ecological functions and site integrity. Colorado Best Management Practices and other scientifically-developed practices to enhance land and water quality will be used in the development of activity and range improvement plans.

• The Forest will encourage public participation in Forest Plan-level grazing decisions, allotment management planning, and yearly-grazing planning. The Forest will encourage relationships between permittees and interested parties to assure local cooperation. Permittees and interested parties can benefit from agency-sponsored range ecology and livestock grazing management and training sessions. The Forest will arrange public meetings and yearly range readiness tours to visit critical allotments before, during and after the grazing season.

4. OIL, GAS AND COAL BED METHANE LEASING AND PRODUCTION ON THE GMUG

Oil and Gas

Significant oil and gas resources lie beneath parts of the GMUG National Forest. This is especially true of the northern and northeastern portions of the GMUG. For example, much of the Grand Mesa National Forest and part of the Gunnison National Forest overlie the southern portion of the Piceance Basin, a geologic formation with trillions of cubic feet of natural gas. All signs point to rapidly-expanding gas development in the Piceance Basin, as evidenced by the pace of drilling occurring in western Garfield County.

• In managing for the development of oil and gas resources, the Forest Service should protect the roadless portions of the GMUG National Forest, including all Inventoried Roadless Areas (IRA), and avoid impacts from natural gas well development within 2 miles of municipal watersheds and other sensitive areas. A moratorium on drilling within these areas should be in place until the necessary information is acquired about the potential short- and long-term impacts of natural gas well development and production, and until appropriate mitigation measures are established.

In addition, the Forest Service should emphasize the following in the management of oil and gas development on public land under its purview:

- Protection of both surface and ground water, especially as it may relate to water wells, fens, springs, and streams. All water within a 2-mile radius of gas wells should have baseline studies conducted to determine quality. For example, testing should occur for methane, BTEX, salinity and any other component that can result from drilling.
- Use of alternative technology and best practices. This includes buried wells and pipelines, directional drilling, no flaring, the removal of all waste in tanks, keeping pad size to no more than 2 acres, painting all equipment in a way that camouflages the operations, noise mitigation to keep all constant noise (such as from compressors) to 40 decibels or below, etc.
- Use of lease exchanges and lease buy-backs as mitigation possibilities for IRAs and other sensitive areas
- Requirements of bonding and escrow on a per-well basis (of at least $25,000 per well upfront) for reclamation of major impacts
- Requirements of bonding for weed control to better address noxious weed issues that arise from drilling disturbances
- Effective reclamation plans that include public input. Public lands with gas development have a dismal record of successful reclamation—particularly in arid climates. Spreading seed on hard-packed dry ground will not produce vegetation.
- Thorough evaluation of alternatives to keep roads out of roadless areas. Any oil or gas development should utilize existing roads to access well pads. New infrastructure (including pipelines, compressor stations, etc.) should be placed along existing roads. The roadless areas themselves should be closed to leasing, as allowed by 36 CFR 228.102(c)(1)(iii).

- The Forest should realize its obligation to prevent degradation of water supplies such as those that have occurred in Silt.

Coal Bed Methane

The production of coal bed methane is fundamentally different than conventional oil and gas production inasmuch as it requires dewatering of the coal seam and disposal of produced waters. The dewatering of coal seams is problematic for several reasons. First, it may cause a drawdown of the water table, leading to the drying up of springs and wells. Second, the dewatering of coal seams frees the methane gas, which can potentially migrate into different strata through joints or cracks in the bedrock. This gas could leak out to the surface, forming a direct health hazard to humans and wildlife, and could also contaminate previously clean sources of groundwater.

But the larger problem inherent to coal bed methane production lies in the disposal of produced waters removed from the coal seam. These waters may be highly sodic and/or saline. If released at the surface, they could contaminate near-surface groundwater and surface waters as well as poison soils. In addition, even if the quality of the produced water is not problematic, the quantity of discharge can cause massive increases in erosion, change the fundamental chemical signature of surface water bodies, and interfere with the survival of aquatic life. As a result, this produced water could upset the timing and rhythm of natural flow patterns, as well as the water's chemical integrity, upon which fishes and other aquatic creatures depend. Thus, the new Forest Plan should require all produced waters to be re-injected into subsurface strata where groundwater is of lower quality than the injected water.

Forest Plans And The Leasing Process

One purpose of the National Forest Management Act (NFMA) is to fully integrate the direction of all multiple-use activities on the Forest into one management document (e.g., 36 CFR 219), including an analysis of oil and gas leasing (36 CFR 228.102(c)). The M2m Alternative therefore treats oil and gas leasing, and subsequent development, as just one of the multiple uses of the GMUG, not as a dominant or primary use over other Forest uses as has historically occurred. Oil and gas leasing and minerals management are still the most poorly managed and integrated of all Forest uses. Other Forest uses such as timber development are planned under a standard procedure with a relatively high level of detail that oil and gas planning has barely begun to approach.

Along with better integration of oil and gas leasing with other Forest uses, this Alternative imposes a higher standard of compliance with the 1987 Federal Onshore Oil and Gas Leasing Reform Act (FOOGLRA). The regulations implementing FOOGLRA, (36 CFR Part 228) must be strictly adhered to. FOOGLRA mandates two distinct and separate decisions for oil and gas leasing. The first is referred to as the "d" decision (from 36 CFR 228.102(d)) and decides which lands are administratively available for leasing. The second decision is referred to as the "e" decision (36 CFR 228.102 (e)) and applies to the leasing of specific sites.

The "d" decision is the time to look at "big picture" items such as endangered species, critical habitat, winter range, watershed, landscape fragmentation, and scenic and recreational values that may be affected over a leased area. It is *not* appropriate to offhandedly authorize a large area for leasing and then claim these issues will be addressed on a site-by-site basis. Additionally, it is inappropriate to analyze an area for the "d" decision unless an interest in leasing has been expressed or where potential for oil and gas occurrence is high. Those areas not analyzed for the "d" decision should not be authorized for leasing. If industry expresses interest in leasing these areas in the future, a Forest Plan Amendment, with full public participation, must be completed before these areas are leased.

In order to properly use the "d" decision, the Forest Service must actively exercise the discretionary no-lease authority granted by FOOGLRA. In fact, the regulations requires the Forest to identify those areas that will be "closed to leasing ... through exercise of management direction," (36 CFR 228.102(c)(1)(iii).

The "e" decision should be used to make whatever adjustments are necessary at a specific site to avoid or reduce adverse impacts to sensitive resources, within a larger overall management plan. Such adjustments include, but are not limited to, placement of a well-site to avoid a perenially wet area or elk calving ground, restrictions on time of year when activity is allowed, or the no surface occupancy (NSO) stipulation. The NSO should not be used as a substitute for a no lease decision. NSO should only be used in those cases where it is technically and financially feasible for an oil and gas operator to directionally drill into the area. Also, an NSO stipulation should not be applied to roadless areas because surface disturbance around the perimeter of core areas would cause an edge effect, reducing the effectiveness of the habitat in the core area and/or linkage corridors.

Most often, the environmental consequences of development are examined only when a lessee submits an application for a permit to drill, with the assumption that any such consequences can be mitigated through the use of appropriate lease stipulations. This process is inadequate for several reasons. Once a lease is granted and an application for a permit to drill (APD) is requested, the government has a legal obligation to allow development. The lease stipulations the government can use at this point are notoriously ineffective at mitigating environmental damage. One example is the timing restrictions, which are routinely waived because it costs too much to cease drilling once it has begun. Another problem is any attempt to make the lease too restrictive could result in a lawsuit brought by the oil and gas operator alleging a taking of their lease rights.

The M2m Alternative requires the "e" decision be made in a separate site-specific NEPA document when the leasing of particular tracts is proposed, and not in a programmatic, forest-wide document as has occurred on other forests in the region.

The M2m Alternative requires a reasonable foreseeable development (RFD) scenario developed in conjunction with the BLM.[26] This is simply a best guess based upon currently known geologic strata, past activity, and future demand. The first priority for determining the RFD is an accurate picture of the number and locations of wells on the Forest. Next, because it is impossible to accurately predict the oil and gas prices and political factors over the next 15 years that will determine the level of drilling activity on the Forest, this Alternative calls for a regular periodic review of the RFD scenario to keep it current. If a review of the RFD shows a change in the level of oil and gas activity on the Forest, then additional NEPA analysis will be conducted before any more leases are issued.

[26] See 36 CFR 228.102(c)(3) and (4).

Waivers, exemptions, or modifications (WEMs) to stipulations will only be granted under extraordinary circumstances. There will be no WEMs for no surface occupancy stipulations. WEMs will only be granted after review that includes full public involvement.

Oil and Gas Road Systems
The cumulative effects and the long-term consequences of roads have not been adequately analyzed in oil and gas leases. This analysis must occur at the time of the "d" decision because the effects of a large road network cannot be addressed on a site-by-site basis. Most roads should be open only to gas production personnel during the production period both to minimize disturbance and to prevent development of a tradition and expectation of road use by the general public.

Site-Specific Recommendations
The M2m Alternative's most important goal is to require greater analysis *before* leasing and less reliance on lease stipulations, which are too often waived, exempted, or modified. Managers will never be able to evaluate or mitigate the cumulative effects of oil and gas development using lease stipulations.

The following management prescription areas are not available for oil and gas leasing in the M2m Alternative: Wilderness Areas, Recommended for Wilderness, Research Natural Areas, Linkages, Ecological Restoration Areas, Special Interest Areas, Municipal Watersheds, and Ski-Based Resorts.

No surface occupancy leasing stipulations should be applied to protect other significant scenic, environmental, and recreational features in areas otherwise available for leasing.

5. COAL AND HARDROCK MINING

Coal Mining
Coal mining has been and will continue for the foreseeable future to be an important component of the diverse economy and community of the GMUG region. Currently the coal industry is undergoing dramatic growth as the price of natural gas soars and the demand for cleaner-burning coal increases. The M2m Alternative stresses that current and future mining must occur in a manner that simultaneously protects and maintains our existing environmental, cultural and economic resources so that when coal mining ceases on the GMUG, we will be left with a diverse and stable environment and economy.

The Forest Service should assure that mine operations minimize their environmental and social impacts; mitigate those impacts they cannot avoid; and reclaim and restore old mines and mine facilities in a timely fashion.

To that end, we believe that the following management guidelines should be adhered to:

- New road construction, exploration pads and gobvent borehole pads associated with coal mining should be limited to the greatest extent possible.
- Mines should employ the smallest drill rigs and heavy machinery possible, thereby limiting the width of necessary roads.

- Any new roads should be considered ‘temporary,’ gated and locked to public access, and fully obliterated and restored to pre-mining conditions when mining is complete.
- Any new road building associated with mining should be accompanied by closing and obliterating other roads on the GMUG forest.
- Mines should be allowed to capture for use the raw methane that is currently vented to the atmosphere.

Hardrock Mining

Since the earliest settlement of the Gunnison Basin and surrounding landscapes, the extensive mineralization underlying the mountains has proven an attractive lure for mining operations of all types. From the pick-and-shovel gold operations of the Nineteenth Century to the contemporary corporate titanium and molybdenum proposals, mining throughout the GMUG and indeed the whole country has ridden on the shoulders of extremely permissive federal policy. The Hardrock Mining Act of 1872 (30 U.S.C. § 22 *et seq.*), still in effect today, essentially opens the federal public lands (including our National Forests) to mineral exploration and extraction.

Unlike other extractive industries such as timber, oil and gas, and coal mining, under the 1872 Act hardrock miners pay no royalties to federal, state, or local governments in return for the minerals they take. In addition, minimal environmental regulation of mining activity frequently leaves these very same governmental entities and their constituents with disrupted mountainsides, polluted water, and expensive cleanup bills.[27]

Rainwater that leaches through portals and over wasterock piles enters our rivers with a lower pH and a host of harmful heavy metals and sediment. In the Coal Creek watershed, source of the Crested Butte municipal water supply, a multi-million dollar water treatment facility is necessary to protect human consumers and aquatic species from the perpetual toxic runoff of the now closed Keystone Mine. At the same time water from the abandoned Standard Mine appears to be contributing unhealthy levels of zinc and cadmium to Coal Creek, requiring another expensive cleanup. Although mining companies must post a bond to cover the costs of reclamation when their operations close, presently and historically these bonds have been woefully inadequate to address the extensive environmental damage inherent to mining.

Today, the Hardrock Mining Act of 1872 persists as an outdated vestige of earlier times. In addition to the legacy of pollution it has left throughout the GMUG, the Act continues to foster large-scale projects from multi-national mining conglomerates eager to take minerals from the public domain without paying any compensation back to the public. Signed into law by President Ulysses S. Grant, the Hardrock Mining Act reflects the values his day, creating an enormous federal subsidy aimed at promoting settlement of the West, at a time when land was limitless and environmental understanding virtually nonexistent. The underlying ideology of the 1872 Act stands in stark contrast to the mandates of the subsequently created federal land management agencies and laws mandating cleaner air and water. As such, it is important that the Forest Service, as well as the other agencies, establish policies that reflect modern day thoughts and

[27] For example, a retaining dam at the Summitville Mine breached after operations had ceased at that site. Although the breach caused significant toxin loading into the Alamosa River, the foreign operators could not be held accountable for the costly cleanup.

values—where resources are becoming increasingly scarce and human dependence on healthy, functioning ecosystems is becoming increasingly apparent. Noise, dust, vibration, air and water pollution, and traffic from mining operations all degrade surrounding wildlife populations, vegetative communities, and human communities.

Management Actions:

- The geographic areas of watersheds providing municipal water supplies will be withdrawn from hardrock mineral entry.
- Research Natural Areas will be withdrawn from hardrock mineral entry.
- Special Interest Areas will be withdrawn from hardrock mineral entry.
- All other Core Reserve and Linkage Areas will be withdrawn from hardrock mineral entry.
- The Forest Service will aggressively pursue funding sources to purchase outstanding mining claims, rather than allow new operations.
- No plan of operations will be approved that would cause unnecessary or undue degradation to natural Forest values. Specifically, approved plans of operation will:
    - Protect ground and surface waters from changes in pH, temperature, salinity, as well as increases in sediment, organic material, nitrogen-containing compounds, dissolved metals, and any other pollutants;
    - Minimize discharge of air pollutants;
    - Minimize the frequency, duration, and mode of ingress and egress to the mine and associated facilities on federal lands;
    - Avoid or minimize new road construction, particularly in roadless areas; wherever possible travel will be limited to existing roads;
    - Contain a detailed plan to prevent the propagation of noxious weeds; and
    - Contain a detailed plan for the storage and transportation of fuels, explosives, and other materials that present a fire risk.
- Baseline air and water quality data will be collected, at the operators' expense, before any new operation is approved.
- Air and water quality monitoring will continue throughout the duration of the operation and 20 years beyond at the expense of the operator.
- No plan of operations will be approved that jeopardize endangered, threatened, or sensitive species.
- All equipment will operate under 78 decibels when measured at a distance of 50 feet.
- The Forest Service will complete a comprehensive site survey of cultural and historic artifacts, and will not allow any activity where the integrity of such resources would be threatened.
- No plan of operations will be approved unless the operator first secures all requisite federal, state, and municipal permits.
- No plan of operations will be approved unless the operator first secures any water rights necessary for the operation.
- The Forest Service will only allow structures that are necessary for mining. Whenever possible the operator will utilize temporary structures instead of permanent improvements.

- All mine operators will be required to post a bond sufficient to cover the actual costs of comprehensive cleanup of facilities, as well as the potential for complications throughout the duration of the mine and beyond.
- The Forest Service will also identify and prioritize for reclamation any closed mines that present a threat to human and ecosystem health.

6. RECREATION AND TRAVEL MANAGEMENT

Guidelines to Manage Recreation on the GMUG
Since the GMUG Forest Plan DEIS was released in 1982, all major categories of recreation have increased on the Forest more than ten-fold. Recreation now accounts for roughly 75% of the gross domestic product (in dollars) of national forests. This dramatic rise in travel and recreation poses a serious threat to the health of public lands.[28]

The public seeks to recreate in our National Forests to enjoy wild streams, solitude, beautiful vistas, wildlife, clean air, and the forest in its natural state. Recreation and travel management has a significant role in determining landscape condition since it dictates how, when, and where people access public lands. Landscape health is diminished in places with human development; recreational experiences are diminished as landscape health declines. Where it can, the Forest Service must prioritize reversing ecological degradation of areas of the GMUG that have sustained and continue to sustain excessive recreational use. In order to protect and enhance healthy biodiverse habitats, the Forest Service must adopt policies that prevent new areas from becoming similarly impacted. The Forest Service has an opportunity on the GMUG to develop comprehensive recreation plans that provide for public use while maintaining protection for the land.

Over the past three decades, recreational access and use have shifted dramatically with considerable increases in the number of people recreating on public lands and the advent of newer and more advanced motorized and mechanized forms of recreation. According to a 2001 BLM study, 1,500 new off-road vehicles are sold per day nationwide, with one-third going to new owners[29].

Despite the proliferation of motorized recreational vehicles on public lands, non-motorized recreational pursuits remain considerably more popular with the public.[30] Non-motorized recreational pursuits are also growing at faster rates than motorized pursuits. For example, hiking increased by 94% (48 million participating in 1994-5) and birdwatching increased by 155% (54 million participating in 1994-5), while

---

[28] Southern Rockies Ecosystem Project, The Denver Zoological Foundation and The Wildlands Project. 2003. Southern Rockies Wildlands Network Vision. Colorado Mountain Club: Golden, Colorado; Southern Rockies Ecosystem Project. 2004. The State of the Southern Rockies Ecoregion. Colorado Mountain Club: Golden, Colorado.

[29] BLM Off-Highway Vehicle Management Strategy. 2001.
[30] Forest Service, USDA. 2004. Trends in activity participation since Fall 1999. http://www.srs.fs.usda.gov/trends/recupdate0907.pdf

off-road driving increased by 44% (28 million participating in 1994-5) over a 12-year period between 1982-3 and 1994-5.[31] Despite the increasing demand for non-motorized recreation, motorized recreation has a disproportionate impact on the land.

Recreation is the dominant use of public lands in terms of numbers of participants as well as acreage, and this use is continuing to grow. It is essential that the Forest Service develop comprehensive and thoughtful recreation plans that allocate uses across the landscape in such a way that cumulative and site impacts are minimized to within reasonable limits. Where impacts are unacceptably high (i.e., the condition of the landscape is in long-term decline as measured by a series of biological and physical parameters), recreation uses must be reallocated to prevent further impacts and to allow the area to recover.

Recreation plans must be based primarily on a comprehensive analysis of landscape condition. An analysis of the types of recreation in demand relative to what currently exists is also fundamental.

In the planning process, the Forest Service's task is to ensure that recreational allocations, in concert with other land uses, do not impair landscape health but rather improve it where possible. The agency should provide a wide spectrum of opportunities within this broader mandate, and at no point should the agency sacrifice the goal of landscape sustainability to provide additional recreational opportunities.

The overall goals of the GMUG's recreation plan should be:

1. Ensure landscape sustainability and reduce landscape fragmentation.
2. Provide for a reasonable spectrum of uses within the ecological constraints of the landscape.
3. Plan for the long-term by anticipating trends in recreational use and ecological condition.
4. Utilize monitoring to facilitate compliance with standards and guidelines, and to indicate the need for adjusting standards and guidelines and/or devising new ones.
5. Avoid allocations to special recreational activities that exceed existing or expected budgets.
6. Protect the last remaining roadless places by allowing only recreation that is compatible with retaining the roadless character in these areas.

The mechanism to achieve these goals should be (1) determining the number and types of recreational activities that are appropriate in the GMUG, (2) developing zones for recreational access based on a comprehensive ecological and socio-economic analysis, and (3) applying rigorous standards and guidelines to each zone. The identification of recreational activities should be based on the ecological resources of the Forest, desired and existing opportunities, the appropriateness of various types of recreation in National Forests, and the ability of the GMUG to adequately manage recreational uses to minimize resource damage and conflicts between recreationists.

Because off-road vehicles (ORVs) have and will continue to impact resources and other Forest users, the Forest Service must analyze and plan for ORV recreation carefully. The damage that modern vehicles can inflict on public lands necessitates that the Forest Service only allow ORV recreation where it can

---

[31] Cordell *et al.* 1997. Outdoor Recreation in the United States: Results from the National Survey on Recreation and the Environment, Forest Service, USDA.

guarantee that it has the resources and skills to manage it adequately. Further, the Forest Service must implement policy that insures that significant resource damage will not occur at the site or landscape scale. Experience garnered over the last few decades has taught forest users that dispersed ORV recreation leads to the creation of new routes. ORV recreation should be encouraged only in certain areas (e.g. Taylor Park) that are identified in the plan as a unique category with a customized set of standards and guidelines.

Applying considerably more rigor to the management of ORVs will help preserve and restore natural quiet in the backcountry and the types of recreation that depend upon it. Until recently, our landscape seemed capable of providing everything to everyone. Of late, with the explosion of various types of more intensive recreation, it has become clear that we must proactively plan to maintain natural quiet in the backcountry. Hence, the GMUG must incorporate an analysis of noise into its recreation plan by creating standards and guidelines for various prescriptions that will ensure a quiet backcountry.

Access to our public lands, while beneficial to users, can also disturb natural habitats: we must ensure that our recreational pursuits do not excessively impact natural and cultural resources, wildlife habitat, watersheds, special status species, and where applicable, wilderness area values. High-quality recreation experiences in National Forests depend on healthy and intact landscapes.

General Management Recommendations

- Restrict all motorized and wheeled vehicle travel to designated routes and trails marked as open on forest recreation/travel maps.
- Restrict snowmobile travel to designated routes and areas marked as open on forest recreation/travel maps.
- Disallow jet-ski use, and impose speed limits on motorboats where preserving natural quiet is a priority or where limits are needed to protect fisheries or waterfowl.
- Vehicles may only travel on routes that are designated as open for the specific type of vehicle and may only travel on routes where the vehicle width does not exceed the road/trail bed width.
- Restrict travel on singletrack routes to foot, horse, or two-wheeled travel only. Limit user-tread to 24”.
- Use seasonal closures as necessary to protect wildlife, plant communities, soils, and water quality, and to avoid excessive resource damage, especially during elk calving seasons.
- Locate high-use areas in previously disturbed zones where further impacts can be geographically contained and are at least one mile from riparian and sensitive species habitat, and one mile from Wilderness boundaries, special management areas, or other areas of special concern. Monitor high-impact areas, and relocate them or otherwise mitigate impacts when the resource shows signs of significant deterioration.
- Establish management goals and objectives based on desired future conditions (ecological and experiential) for each recreation zone. Objectives should include route density standards, and maximum noise levels and differentials.
- Set route density standards for each recreation zone. Establish standards for both open road density (ORD) (roads open to motorized vehicle use) and total route density (TRD) (which includes roads closed to motorized vehicles but not yet reclaimed and devoid of vegetation).

Roadless Areas
Preserving the remote backcountry character should be the goal of recreation management in roadless areas.

- Prohibit all non-emergency motorized use in roadless areas.
- Prohibit any new road and motorized trail construction in roadless areas of National Forests.
- Prohibit re-construction and new construction of staging areas in roadless areas.

Motorized Recreation Areas
These areas are zones in which motorized recreation is permitted in an intensive fashion on designated routes. Similar to a downhill ski area, the motorized area's boundary and trails are marked clearly, and the trails are built to withstand the hard use imposed by motorized recreation vehicles. The plan includes standards and guidelines crafted especially for this type of use.

- These areas should be relatively small, have well-marked boundaries, and be constructed to withstand intensive recreation.
- Boundaries will be marked so that ORVs cannot inadvertently wander out of the area.
- Use will be restricted to designated routes marked on a map and to designated areas marked on the ground.
- Motorized recreation events will be permitted on an individual basis via the special use permitting process, and will only occur within the permitted boundary.
- Agency should limit the use of two-stroke engines on public lands, phasing out such engines over a five-year period, as is recommended for the National Forest in the recently submitted Off-Highway Vehicle recommendations for the U.S. Forest Service.
- Close existing routes where historic and/or continuing damage is occurring, including routes that have been created by passage of vehicles but that have not been designated by the Forest Service. Existing system routes should be closed and obliterated if they cannot be managed to limit resource damage.

Special Use Permits
These permits involve road easements, land trades, maintenance of dams, etc.

- No mitigation is allowed for disturbance or hydrology change to fens.
- Wetland disturbance must be supported by 404 permits and high-quality wetland mitigation.

Special Use Events
As recreational events grow in popularity, the Forest Service must establish consistent approaches to accepting and analyzing applications, incorporating use into capacity models, and fairly allocating use between outfitters, event organizers, and dispersed users. Adventure races are events of super-endurance, round-the-clock, multi-sport racing, and because of their potential for impacts that must be limited in frequency. Those events that are permitted should be carefully managed to minimize impacts to wildlife and ecosystem health.

- All special recreation event applications for events greater than 49 participants or on 5 or more contiguous acres must submit an application at least nine months in advance of the requested event date.
- The Forest Service must complete its environmental review and issue the permit at least two months before the event date.
- Capacity models and recreation allocations must include outfitter days and special recreation event days in the allocation process.

Ski Areas
Ski areas on National Forests proliferated during the 20th century. Now in the 21st century, as snow levels are less reliable and the public expects more motorized recreation, it is becoming apparent that approval of ski area development and permitting must adapt to new demands.

The Forest Service should limit two-stroke engines on Forest Service lands; any necessary snowmobiles for service or ski patrol must be four-stroke or clean-technology machines.

Recreational activities on ski areas should be limited to ski and snowboard activities. The use of commercial snowmobiles, heli-skiing, etc., is incompatible with the nature of what non-motorized snowriders expect from their ski area experience. The addition of commercial motorized recreation on ski areas poses an unnecessary risk, as has been exemplified by several snowmobile-skier collisions.

- When considering Land Exchanges near ski resorts, the Forest Service must apply the following rules:

  - Appraisal values must account for the full development potential of land near ski resorts.
  - Environmentally sensitive lands must not be traded out of public hands. These include lands containing wetlands; habitat for threatened, endangered and sensitive species; rare plant associations; fens; etc.
  - The cumulative impacts of development made possible by any selected lands must be considered in full.
  - There must be significant public support for the proposed exchange.
  - Appraisals must be open so that the public has an opportunity to comment on this critical aspect of land exchanges prior to any final agency decision.
  - Appraisals must be made by an independent third party rather than contractors hired by the land exchange proponent.
  - Socio-economic impacts to political jurisdictions must be fully analyzed.

No ski area expansion proposal should be considered in the NEPA process unless a genuinely demonstrated purpose and need is presented for additional public recreational opportunities to alleviate legitimate crowding, safety, or operational issues. A thorough feasibility study must be conducted to ensure that additional needed public recreational opportunities demonstrably outweigh impacts to habitat. Any alternative that alleviates any such demonstrated problems, short of expanding the ski area outside the current ski area footprint, should first be adopted. Demonstration of purpose and need shall include an assessment of skiers/acre, lift-line waiting times, vertical transport in people per hour, and other measures necessary to assess crowding, bottlenecks, or other conditions that may limit the skier recreational experience. Such measures shall be compared with other similarly situated ski resorts, and shall be compared against other actions needed to maintain or improve the recreational experience of National Forest and ski area users.

- Permits for new ski areas and ski area expansions shall only be granted when the agency and the permittee follow stringent guidelines for environmental protection in areas of wildlife habitat, land disturbance, tree-cutting, old-growth forest, and wetlands protection.

Outfitters

Non-profit educational outfitters that provide services to the public directly related to furthering the mission of the Forest Service are finding it increasingly difficult to have access to the GMUG Forest. The GMUG needs to allocate capacity between commercial outfitters, dispersed users, special recreation events, and non-profit education outfitters in a fair way. This includes assuring that non-profit educational outfitters are not disadvantaged in the allocation process, and even are given a priority allocation, so long as these outfitters provide services that directly further the mission of the Forest Service, e.g., leave-no-trace education, responsible backcountry travel, recreational skills and safety training, and natural history education.

Outfitters seeking to provide a non-motorized experience to clients are having increasingly difficult time acquiring outfitting permits in areas where such experiences exist. More and more, because wilderness permits are limited, non-motorized recreation outfitters are forced to provide services in areas where motorized use precludes a wilderness-like experience. By only allowing ORV and snowmobile outfitters to operate in prescribed motorized areas, the GMUG will help balance outfitter opportunities and assure that all outfitters have a place to operate that is appropriate to the experience they are trying to provide.

Regulatory Support for Restricting Off-Road Vehicles

The Forest Service has a substantial legal obligation to plan for ORV use, continually monitor ORV use areas for adverse effects, and take action to protect resources from ORV damage. Some of the relevant citations are below.

ORV areas and trails shall be located to minimize harassment of wildlife or significant disruption of wildlife habitats. Regulations require the agency to locate trails to "minimize harassment of wildlife or significant disruption of wildlife habitats" (36 C.F.R. ß 295.2(b)(2)).

Off-road vehicle use shall be planned and implemented to protect land and other resources, promote public safety, and minimize conflicts with other uses of the National Forest System lands (36 C.F.R. ß 219.21(g)).

The Forest Service is required to restrict or prohibit the use of trails by ORVs where “analysis indicates that [motorized use] off road will cause considerable adverse effects on the resources or other forest visitors” (36 C.F.R. ß 295.2(a)). In addition, motorized trails “shall be located to minimize conflicts between off-road vehicle use and other existing or proposed recreational uses of the same or neighboring public lands...” (36 C.F.R. ß 295.2(b)(3)).

Regulations prohibit placement of "a vehicle or other object in such a manner that it is an impediment or hazard to the safety or convenience of any person" (36 C.F.R. ß 261.10). "Off-road vehicle management plans shall provide vehicle management direction aimed at... minimizing conflicts among users..." (36 C.F.R. ß 295.2(b)).

Management of ORVs: "Areas and trails shall be located to minimize damage to soil, watershed, vegetation or other resources of public lands" (36 C.F.R. ß 295.2(b)(1)). "The effects of use by specific types of vehicles off roads on National Forest System lands will be monitored. If the results of monitoring, including public input, indicate that the use of one or more vehicle types off roads is causing or will cause considerable adverse effects on the factors and resource values referred to in 295.2, the area or trail suffering adverse effects will be immediately closed to the responsible vehicle type or types until the adverse effects have been eliminated and measures have been implemented to prevent future recurrence as provided in 36 CFR part 261" (36 C.F.R. ß 295.5).

D. EVALUATING THE PERFORMANCE OF THE M2m DESIGN

The performance of this CMA in fulfilling the stated goals and objectives and achieving the standards of conservation reserve design can be evaluated in several different ways. To assure consistency with other large-scale conservation maps, Table 7 provides a comparison of the CMA map to Potential Conservation Areas identified by the Colorado Natural Heritage Program, to the Southern Rockies Wildlands Network Design (an ecoregion-wide assessment of conservation areas based on ecosystem representation and landscape connectivity for wide-ranging animals), and to The Nature Conservancy's Conservation Portfolio (based on biodiversity representation, as identified by the SITES model). In addition, we performed a cross-check to ensure that habitat for lynx, Gunnison sage grouse, bighorn sheep and the winter range for elk, as well as other attributes such as fens and goshawk nest locations are adequately captured by this CMA.

In comparing the Colorado Natural Heritage Program (CNHP) Potential Conservation Areas (PCAs) to the M2m CMA, we find that core areas designated by the CMA capture 18% of the PCAs identified as 'outstanding', 78% of those identified as 'very high', and 58% of the high-rated PCAs. It is surprising, at first, to see that 76% of what is recognized by CNHP as outstanding Conservation Areas falls in the Low Use Compatible category in the M2m CMA. However, the entirety of this area is identified in the CMA as Gunnison sage grouse habitat, managed according to the specific needs of this species and allowing uses only to the extent that they do not impair the habitat. It then becomes clear that there is no discrepancy and that both assessments are designed to specifically consider the needs of this endemic species.

A comparison of the Southern Rockies Wildland Network Design (SRWND) and the M2m CMA is particularly useful as similar categories (core, linkage, low use compatible, and medium use compatible) were employed in both assessments. Indeed, the comparison reveals a strong correlation between the two: 82% of area identified as core in the SRWND and 66% of SRWND wildlife linkages are designated as core or linkage in the M2m CMA. As the CMA provides a much finer-scale and more detailed assessment of the GMUG landscape, it is expected that there will be some area where the two designs do not match perfectly. However, the areas of non-agreement are minimal (e.g., only 2.5% of SRWND core areas and

5.5% of the linkage areas fell in the medium-high use category mapped for the CMA). Overall, the correlation between the two is strong, lending greater credibility to the prescription boundaries as mapped for the CMA.

Seventy-three percent of the sites that The Nature Conservancy identified in their Conservation Portfolio as having high conservation value are captured by core areas, and 100% of sites with moderately-high conservation value are captured by core or low use compatible areas in this CMA. As The Nature Conservancy's SITES analysis is a very coarse-scale assessment of conservation areas within the ecoregion (the analysis unit used in the model being approximately 3,000-acre hexagons), it is anticipated that the polygons identified by the model as having high conservation value based on their criteria of biodiversity representation also encompass extraneous areas beyond the actual conservation targets. Therefore, it is apparent that there is a strong correlation between TNC's assessment and the designation of management prescriptions proposed by this CMA.

While the best available data for each of the focal species was used to create the M2m prescription map, a retrospective analysis of these data is desirable to ensure that these important habitat areas were properly considered in the CMA (Table 8). Doing so, we find that 100% of the USFS-identified lynx linkage habitat and nearly 55% of the lynx denning habitat was designated in the CMA as either core or linkage habitat. Habitat for bighorn sheep, Gunnison sage grouse, and elk winter range are designated in the M2m CMA as low use compatible prescriptions, so an overlay of habitat for these species with the CMA map shows that 91% of bighorn sheep habitat, 95% of Gunnison sage grouse habitat, and 87% of elk winter range habitat is captured.

These comparisons demonstrate strong correlations between the CMA and other data sources identifying areas with important habitat values. This evaluation lends credence to the M2m CMA, and helps to confirm that the M2m CMA proposes a valid conservation reserve design within a multiple-use management framework.

Table 7: Comparison of the M2m Reserve Design to Other Assessments of Areas with Conservation Value in the GMUG

		M2m Reserve Design Categories			
Conservation Assessment	**Conservation Category**	**Core**	**Linkage**	**Low Use Compatible**	**Medium-High Use Compatible**
CNHP Potential Conservation Areas	Outstanding	18.2%	0.2%	76.6%	5.1%
	Very High	78.1%	0.3%	17.2%	4.4%
	High	57.9%	1.8%	31.1%	9.2%
	Moderate	7.3%	1.8%	36%	54.9%
Southern Rockies Wildlands Network Design	Core Wilderness and Core Agency	79.8%	2.5%	15.2%	2.5%
	Wildlife Linkage	27.8%	37.9%	28.8%	5.5%
	Low Use Compatible	15%	10.7%	66.4%	7.8%
	Medium Use Compatible	7.3%	8.1%	40.2%	44.5%
TNC Portfolio Sites	High	72.8%	2.3%	23.8%	1.1%
	Moderately High	53.7%	0	46.3%	0
	Moderate	56.6%	6.3%	24.7%	12.4%
	Moderately Low	24.2%	4.3%	48.9%	22.5%
	Low	42.4%	0	23.7%	33.9%

Table 8. Comparison of the M2m Reserve Design to Identified Habitat Areas for Focal Species (Based on USFS and CDOW Species Data)

	M2m Reserve Design Categories			
Focal Species	**Core**	**Linkage**	**Low Use Compatible**	**Medium-High Use Compatible**
Lynx denning habitat (USFS)	48.1%	6.6%	29.4%	15.9%
Lynx linkage habitat (USFS)	50.9%	48.9%	0.1%	0
Bighorn sheep habitat (CDOW)	61.2%	5.5%	24.3%	9%
Gunnison sage grouse habitat (CDOW)	14.7%	1.2%	79.4%	4.7%
Elk winter range habitat (CODW)	42.4%	0	23.7%	33.9%

The effectiveness of this CMA over the long-term must also be measured. This is best done by monitoring the population health of select species in each of the GMUG ecosystem types. Management Indicator Species (MIS) are commonly used to estimate the effects of management on native fish and wildlife populations and their associated habitats. Table 9 lists selected MIS for each ecosystem type in the GMUG. Monitoring components (both Forest-wide and project level) must be properly designed, funded and implemented on an ongoing basis. As a first step, the Forest should work to establish baseline data for these species where it presently lacks data. In developing monitoring protocols for each MIS, the Forest Service should adhere to the following principles:

(1) Solicit and incorporate expert advice.

(2) Ensure that protocols are peer-reviewed by experts outside the Forest.

(3) Make expert advice and peer reviews available to the public.

(4) Employ replicable and statistically sound monitoring methods at regular, pre-determined intervals over a long duration to be able to discern population trends.

(5) Prepare monitoring reports that are available to the public at regular intervals.

These principles boil down to two key concepts: the process of selecting monitoring methods should be transparent and the methods should be scientifically sound.

Table 9. Management Indicator Species for Ecosystem Types in the GMUG (Species in bold type are the primary indicator for that ecosystem type.)

Ecosystem Type	M2m comments
Semi-desert and sagebrush shrublands	**sage grouse** Brewer's sparrow biological soil crust
Montane shrubland	**Lewis' woodpecker** black bear green-tailed towhee Virginia's warbler
Piñon-juniper woodland	**gray vireo** piñon jay biological soil crust
Ponderosa pine forest and woodland	**Abert's squirrel**
Douglas fir forest	**Cassin's finch** blue grouse *Usnea* lichens
Montane mixed-conifer forest	**three-toed woodpecker**
Lodgepole pine forest	**pine marten** hairy woodpecker
Aspen forest	**goshawk** red-naped sapsucker western wood-peewee
Limber pine and bristlecone pine forest	**gray jay** Clark's nutcracker
Engelmann spruce-subalpine fir forest	**snowshoe hare** lynx
Alpine tundra	***Kobresia*, sedges** biological soil crusts lichens
Aquatic ecosystems	**Colorado River cutthroat trout** aquatic invertebrates American dipper
Wetland and riparian ecosystems	**beaver** willow species Wilson's warbler MacGillivray's warbler

	boreal toad chorus frog Colorado River cutthroat trout
Fens	**mosses** lesser bladderwort roundleaf cinquefoil
Cliffs	**black swift** peregrine falcon golden eagle
Caves	**Townsend's big-eared bat**

LITERATURE CITED

Allen, A.W. 1983. Habitat suitability index models: Beaver. U.S. Fish and Wildlife Service. FWS/OBS-82/10.30 Revised.

Aplet, G.H., and W.S. Keeton. 1999. Application of historical variability concepts to biodiversity conservation. Pp. 71-86 in R.K. Baydack, H. Campa III, and J.B. Haufler, eds. Practical approaches to the conservation of biological diversity. Washington, D.C.: Island Press.

Armstrong, D.M. 1972. Distribution of Mammals in Colorado. Monogr. University of Kansas Museum of Natural History, 3:1-415.

Aubry, K.B., G.M. Koehler, and J.R. Squires. 1999. Ecology of Canada lynx in southern boreal forests. Pp. 373-396 in L.R. Ruggiero, K.B. Aubry, S.W. Buskirk, G.M. Koehler, C.J. Krebs, K.S. McKelvey, and J.R. Squires. Ecology and Conservation of Lynx in the United States. Department of Agriculture, Forest Service, Rocky Mountain Research Station. General Technical Report RMRS-GTR-30WWW.

Banci, Vivian. 1994. Wolverine. *in* The Scientific Basis for Conserving Forest Carnivores: American Marten, Fisher, Lynx and Wolverine in the western United States. USDA Forest Service. Rocky Mt. Forest and Range Exper. Stat. General Technical Report RM-254. Fort Collins, CO. Chapter 4. 74-98 pp.

Baker, W.L. 1992. The landscape ecology of large disturbances in the design and management of nature reserves. Landscape Ecology 7: 181-194.

Behnke, R.J. 1979. Monograph of the native trouts of the genus *Salmo* of western North America. USDA Forest Service, Rocky Mountain Region, Denver, Colorado.

Behnke, R.J., and M. Zarn. 1976. Biology and management of threatened and endangered western trouts. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado. General Technical Report RM-28.

Behnke, R.J., and D.E. Benson. 1980. Endangered and threatened fishes of the upper Colorado River basin. Cooperative Extension Service, Colorado State University, Fort Collins. Bulletin 503A.

Berger, J., P.B. Stacey, L. Bellis, and M.P. Johnson. 2001. A mammalian predator-prey imbalance: Grizzly bear and wolf extinction affect avian neotropical migrants. Ecological Applications 11: 947-960.

Brand, C.J and L.B. Keith. 1979. Lynx demographics during a snowshoe hare decline in Alberta. J. of Wildlife Management, 43:827-849.

Buskirk, S.W., L.F. Ruggiero, K.B. Aubry, D.E. Pearson, J.R. Squires, and K.S. McKelvey. 1999. Comparative ecology of lynx in North America. Pages 397-418 in L. R. Ruggiero, K.B. Aubry, S.W.

Buskirk, G.M. Koehler, C.J. Krebs, K.S. McKelvey, and J.R. Squires. Ecology and Conversation of Lynx in the United States. Department of Agriculture, Forest Service, Rocky Mountain Research Station. General Technical Report RMRS-GTR-30WWW.

Carroll, C., M.K. Phillips, N.H. Schumaker, and D.W. Smith. 2003. Impacts of landscape change on wolf restoration success: planning a reintroduction program based on static and dynamic spatial models. Conservation Biology 17(2): 536-548.

Cooper, D.J. 1996. Water and soil chemistry, floristics, and phytosociology of the extreme rich High Creek fen, in South Park, Colorado, USA. Can. J. Bot. 74: 1801 – 1811.

Cooper, D.J., and Andrus, R. 1994. Patterns of vegetation and water chemistry in peatlands of the west-central Wind River Range, Wyoming. Can. J. Bot. 72: 1586 – 1597.

Cooper, D.J., L.H. MacDonald, S.K. Wenger, and S. Woods. 1998. Hydrologic restoration of a fen in Rocky Mt. National Park, Colorado. Wetlands 18: 335-345.

Cooper, D.J. and L.H. MacDonald. 2000. Restoring the vegetation of mined peatlands in the southern Rocky Mountains of Colorado, USA. Restoration Ecology 8(2): 103-111.

Constanza, R., R. d'Arge, R. de Groot, S. Farber, M. Grasso, B. Hannon, K. Limburg, S. Naeem, R.V. O'Neill, J. Paruelo, R.G. Raskin, P. Sutton, and M. van den Belt. 1997. The value of the world's ecosystem services and natural capital. Nature 387: 253-260.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States: U.F. Fish and Wildlife Service Report FWS/OBS-79/31. Washington D.C.

Crête, M. 1999. The distribution of deer biomass in North America supports the hypothesis of exploitation of ecosystems. Ecology Letters 2: 223-227.

Crête, M., and M. Manseau. 1996. Natural regulation of cervidae along a 1,000 km. latitudinal gradient: change in trophic dominance. Evolutionary Ecology 10: 51-62.

Dahl, T.E. 1990. Wetland losses in the United States: 1780s to 1980s. U.S. Fish and Wildlife Service. Washington D.C.

Dobson, A., K. Ralls, M. Foster, M.E. Soulé, D. Simberloff, D. Doak, J.A. Estes, L.S. Mills, D. Mattson, R. Dirzo, H. Arita, S. Ryan, E.A. Norse, R.F. Noss, and D. Johns. 1999. Regional and Continental Restoration. Pp. 129-170 in M.E. Soulé and J. Terborgh (eds.). Continental Conservation: Scientific Foundations of Regional Reserve Networks. Washington, D.C.: Island Press.

Estes, J.A., K. Crooks, and R. Holt. 2001. Predation and diversity. Pp. 857-878 in S. Levin (ed.). Encyclopedia of Biodiversity. San Diego, CA: Academic Press.

Fahrig, L., J.H. Pedlar, S.E. Pope, P.D. Taylor, and J.F. Wegner. 1995. Effect of road traffic on amphibian density. Biological Conservation 73: 177-182.

Fitzgerald, J.P., Meaney, C.A. and D.M. Armstrong. 1994. Mammals of Colorado.
Denver Museum of Natural History.

Foreman, D. 1995. Wilderness areas and National Parks: The foundation for an ecological nature reserve network. Wild Earth 5 No. 4: 60-63.

Foreman, D. 1998. Around the campfire: The ever-robust wilderness idea and Ernie Dickerman. Wild Earth 8: 1.

Foreman, D. 1999. The Wildlands Project and The Rewilding of North America. Denver University Law Review 76 (2): 535-553.

Foreman, D., and H. Wolke. 1992. The Big Outside. New York: Crown Publishers.

Forman, R.T.T., D.S. Friedman, D. Fitzhenry, J.D. Martin, A.S. Chen, and L.E. Alexander. 1995. Ecological effects of roads: Toward three summary indices and an overview for North America. Habitat fragmentation and infrastructure: Proceedings of the international conference on habitat fragmentation, infrastructure and the role of ecological engineering, Sept. 17-21, 1995, Maastricht-The Hague, The Netherlands.

Frankel, O.H., and M.E. Soulé. 1981. Conservation and Evolution. Cambridge, U.K.: Cambridge University Press.

Franklin, J.F., and R.T.T. Forman. 1987. Creating landscape patterns by forest cutting: Ecological consequences and principles. Landscape Ecology 1: 5-18.

Giesen, K.M. 1997. Seasonal movements, home ranges, and habitat use by Columbian Sharp-tailed Grouse in Colorado. Special Report #72, Colorado Division of Wildlife, terrestrial wildlife reasearch.

Giesen, Kenneth M., and John W. Connelly. 1993. Guidelines For Management of Columbian Sharp-Tailed Grouse Habitats. Wildlife Society Bulletin 21:325- 333.

Groom, M., D.B. Jensen, R.L. Knight, S. Gatewood, L. Mills, D. Boyd-Heger, L.S. Mills, and M.E. Soulé. 1999. Buffer zones: Benefits and dangers of compatible stewardship. Pp. 171-197 in M.E. Soulé and J. Terborgh (eds.). Continental Conservation, Washington, D.C.: Island Press.

Grumbine, R.E. 1990. Viable populations, reserve size, and federal lands management: a critique. Conserv. Biol. 4: 127-132.

Grumbine, R.E. 1992. Ghost Bears—Exploring the Biodiversity Crisis. Island Press.

Gunnison Sage Grouse Conservation Plan. 1997.

Harris, L.D. 1984. The Fragmented Forest: Island Biogeography Theory and the Preservation of Biotic Diversity. Chicago, IL: University of Chicago Press.

Hendee, J.C., G.H. Stankey, and R.C. Lucas. 1990. Wilderness Management. Golden, CO: Fulcrum Publishing.

Hoffman, R.W. (Technical editor). 2001. Northwest Colorado Columbian Sharp-tailed Grouse conservation plan. Northwest Colorado Columbian Sharp-tailed Grouse Work Group, Fort Collins, Colorado.

Hoover, R.L., and D.L. Willis (eds.). 1987. Managing Forested Lands for Wildlife. Colorado Division of Wildlife.

Janzen, D.H. 1986. The external threat. in M.E. Soulé (ed.). Conservation Biology: The Science of Scarcity and Diversity. Sunderland, MA: Sinauer Associates.

Jeo, R.M., M.A. Sanjayan, and D. Sizemore. 2000. A conservation area design for the central coast region of British Columbia, Canada. Special Report by Round River Conservation Studies, Salt Lake City, UT.

Johnston, Barry C. 1997. Ecological Types of the Upper Gunnison Basin. USDA Forest Service, GMUG National Forests.

Kay, C.E. 1990. Yellowstone's northern elk herd: a critical evaluation of the "natural regulation" paradigm. Ph.D. dissertation, Utah State University, Logan, UT.

Kay, C.E., and F.H. Wagner. 1994. Historic condition of woody vegetation on Yellowstone's northern range: A critical test of the "natural regulation" paradigm. Pp. 159-169 in D. Despain (ed.). Plants and their environments. Proceedings of the first biennial conference on the greater Yellowstone ecosystem. U.S. National Park Service Technical Report NPS/NRYELL/NRTR-93/xx.

Koehler, G.M. 1990. Population and habitat characteristics of lynx and snowshoe hares in north central Washington. Canadian Journal of Zoology 68: 845-851.

Koehler, G.M., and K.B. Aubry. 1994. Lynx. Pp. 74-98 in L.F. Ruggiero, K.B. Aubry, S.W. Buskirk, L.J. Lyon, and W.J. Zielinski, technical eds. The Scientific Basis for Conserving Forest Carnivores: American Marten, Fisher, Lynx, and Wolverine in the Western United States. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. General Technical Report RM-254.

Koehler, G.M. and A.B. Keith. 1994. Lynx. *in* The Scientific Basis for Conserving Forest Carnivores: American Marten, Fisher, Lynx and Wolverine in the western United States. USDA Forest Service. Rocky Mt. Forest and Range Exper. Stat. General Technical Report RM-254. Fort Collins, CO. Chapter 4. 74-98 pp.

Lambeck, R. J. 1997. Focal species: A multi-species umbrella for nature conservation. Conservation Biology 11: 849-856.

Langner, L.L., and C.H. Flather. 1994. Biological diversity: Status and trends in the United States. USDA Gen. Tech. Rept. RM-244, 24 pp.

Leopold, A. 1937. Conservationist in Mexico. American Forests, Vol. 43, March 1937. 118-120.

Leopold, A. 1941. Wilderness as a land laboratory. Living Wilderness 6: 3.

MacArthur, R.H., and E.O. Wilson. 1967. The theory of island biogeography. Princeton, N.J.: Princeton University Press.

Manfredo, Dr. Michael J. 1994. Colorado Residents' Attitudes and Perceptions Toward Reintroduction of the Gray Wolf (Canis Lupus) Into Colorado. Colorado State University, Human Dimensions in Natural Resources Unit, in cooperation with the U. S. Fish and Wildlife Service.

Marks, Jeffrey S. and Victoria Saab Marks. 1988. Winter Habitat use by Columbian Sharp-tailed Grouse in Western Idaho. Journal of Wildlife Management 52(4): 743-746.

Mattson, D.J. 1997. Wilderness-dependent wildlife—The large and the carnivorous. International Journal of Wilderness 3: 34-38.

McCord, C.M. and J.E. Cardoza. 1982. Bobcat and lynx. Wild mammals of North America: biology, management and economics. 728-766 pp.

McKelvey K.S., S.W. Buskirk, and C.J. Krebs. 1999. Theoretical insights into the population viability of lynx. Pp. 21-38 in L.R. Ruggiero, K.B. Aubry, S.W. Buskirk, G.M. Koehler, C.J. Krebs, K.S. McKelvey, and J.R. Squires. Ecology and Conservation of Lynx in the United States. Department of Agriculture, Forest Service, Rocky Mountain Research Station. General Technical Report RMRS-GTR-30WWW.

Miller, B., R. Reading, J. Strittholt, C. Carroll, R. Ross, M.E. Soulé, O. Sanchez, J. Terborgh, D. Brightsmith, T. Cheeseman, and D. Foreman. 1998. Using focal species in the design of nature reserve networks. Wild Earth 8: 81-92.

Miller, B., B. Dugelby, D. Foreman, C. Martinez del Río, R. Noss, M. Phillips, R. Reading, M.E. Soulé, J. Terborgh, L. Wilcox. 2001. The importance of large carnivores to healthy ecosystems. Endangered Species UPDATE 18: 202-210.

Naiman, R.J., C.A. Johnston, and J.C. Kelley. 1988. Alteration of North American streams by beaver. BioScience 38: 753-762.

Nash, R.F. 2001. Wilderness & The American Mind. Fourth Edition. New Haven, CT: Yale University Press.

Newmark, W.D. 1987. Mammalian extinctions in western North American parks: A landbridge perspective. Nature 325: 430-432.

Newmark, W.D. 1995. Extinction of mammal populations in western North American national parks. Conservation Biology 9: 512-526.

Noss, R.F. 1983. A regional landscape approach to maintain diversity. BioScience 33: 700-706.

Noss, R.F. 1991. Wilderness recovery: Thinking big in restoration ecology. The Environmental Professional 13: 225-234.

Noss, R.F. 1992. The Wildlands Project Land Conservation Strategy. Wild Earth. Special Issue 1992.

Noss, R.F., and L.D. Harris. 1986. Nodes, networks, and MUMs: Preserving diversity at all scales. Environmental Management 10: 299-309.

Noss, R.F., and A.Y. Cooperrider. 1994. Saving Nature's Legacy: Protecting and Restoring Biodiversity. Washington D.C.: Island Press.

Oksanen, L. and T. Oksanen. 2000. The logic and realism of the hypothesis of exploitation ecosystems. American Naturalist 155: 703-723.

Power, M.E., D. Tilman, J.A. Estes, B.A. Menge, W.J. Bond, L.S. Mills, G. Daily, J.C. Castilla, J. Lubchenco, and R.T. Paine. 1996. Challenges in the quest for keystones. BioScience 46: 609-620.

Powers, T.M. 1996. Lost Landscapes and Failed Economies. Island Press. Washington, D.C.

Pressy, R.L., C.J. Humphries, C.R. Margules, R.I. Vanewright, and P.H. Williams. 1993. Beyong opportunism: Key principles for systematic reserve selection. Trends in Ecology and Evolution 8: 124-128.

Ruediger, B. J. Claar, S. Gniadek, B. Holt, L. Lewis, S. Mighton, B. Naney, G. Patton, T. Rinaldi, J. Trick, A. Vandehey, F. Wahl, N. Warren., D. Wenger, and A. Williamson. 2000. Canada Lynx Conservation Assessment and Strategy. USDA Forest Service, USDI Fish and Wildlife Service, USDI Bureau of Land Management, and USDI National Park Service. Forest Service Publication #R1-00-53, Missoula, MT. 142 pp.

Ripple, W.J., and E.J. Larsen. 2000. Historic aspen recruitment, elk, and wolves in northern Yellowstone National Park. Biological Conservation 95: 361-370.

Saab, Victoria Ann, and Jeffrey S. Marks. 1992. Summer Habitat Use By Columbian Sharp-tailed Grouse in Western Idaho. Great Basin Naturalist 52(2), June 1992.

Servheen, C.J., S. Waller, and P. Sandstrom. 2003. Identification and management of linkage zones for wildlife between the large blocks of public land in the northern Rocky Mountains. U.S. Fish and Wildlife Service and University of Montana: Missoula MT.

Shields, W.M. 1987. Dispersal and mating systems: investigating their causal connections. Pp. 3-24 in B.D. Chepko-Sade and Z.T. Halpin, eds. Mammalian Dispersal Patterns: The Effects of Social Structure on Population Genetics. Chicago, IL: University of Chicago Press.

Shelford, V.E., editor. 1926. Naturalist's Guide to the Americas. Baltimore, MD: Williams and Wilkins.

Shelford, V.E 1933. Ecological Society of America: A nature sanctuary plan unanimously adopted by the Society. December 28, 1932. Ecology 14: 240-245.

Shinneman, D.J., R. McClelan, and R. Smith. 2000. The State of the Southern Rockies Ecoregion. Southern Rockies Ecosystem Project, Nederland, CO.

Simberloff, D.J., D. Doak, M. Groom, S. Trombulak, A. Dobson, S. Gatewood, M.E. Soulé, M. Gilpin, C. Martinez del Rio, and L. Mills. 1999. Regional and Continental Restoration. Pp. 65-98 in M.E. Soulé and J. Terborgh (eds.). Continental Conservation. Washington, D.C.: Island Press.

Soulé, M.E., J.A. Estes, B. Miller, D.L. Honnold. 2005. Highly interactive species: conservation policy, management, and ethics. BioScience: 55:168-176.

Soulé, M.E., J. Estes, J. Berger, C. Martinez del Rio. 2003. Ecological effectiveness: Conservation goals for interactive species. Conservation Biology 17: 1238-1250.

Soulé, M.E., and J. Terborgh (eds.). 1999. Continental conservation: Scientific foundations of regional reserve networks. Covelo, CA: Island Press.

Soulé, M.E., and R. Noss. 1998. Rewilding and biodiversity: Complementary goals for continental conservation. Wild Earth Vol. 8, No. 3: 18-28.

Soulé, M.E., and D. Simberloff. 1986. What do genetics and ecology tell us about the design of nature reserves? Biological Conservation 35: 19-40.

Soulé, M.E., and B.A. Wilcox. 1980. Conservation Biology: Its Scope and Challenge. In: Soulé, M.E., and B.A. Wilcox (eds.) Conservation Biology: An Evolutionary-Ecological Perspective. Sunderland, MA: Sinauer Associates.

Southern Rockies Ecosystem Project, The Denver Zoological Foundation and The Wildlands Project. 2003. Southern Rockies Wildlands Network Vision. Colorado Mountain Club: Golden, Colorado.

Southern Rockies Ecosystem Project. 2004. The State of the Southern Rockies Ecoregion. Colorado Mountain Club: Golden, Colorado.

Terborgh, J., J. Estes, P. Paquet, K. Ralls, D. Boyd-Heger, B. Miller, R. Noss. 1999. The role of top carnivores in regulating terrestrial ecosystems. Pp. 39-64 in M.E. Soulé and J. Terborgh, eds. Continental Conservation: Scientific Foundations of Regional Reserve Design Networks. Covelo, CA: Island Press.

Terborgh, J., L. Lopez, P. Nuñez V., M. Rao, G. Shahabuddin, G. Orihuela, M. Riveros, R. Ascanio, G.H. Adler, T.D. Lambert, and L. Balbas. 2001. Ecological meltdown in predator-free forest fragments. Science 294: 1923-1925.

Towry, Robert K., Jr. 1984. Wildlife Habitat Requirements. IN Managing Forested Lands For Wildlife. Robert L. Hoover and Dale L. Wills, eds. Colorado Division of Wildlife.

USDA Forest Service. 2004. Southern Rockies Canada Lynx Amendment, Draft Environmental Impact Statement. USDA Forest Service, Region 2, Lakewood, CO.

Watson, J., D. Freudenberger, and D. Paul. 2001. An assessment of the focal species approach for conserving birds in variegated landscapes in southeastern Australia. Conservation Biology 15: 1364-1373.

Websites: General GMUG Forest Website (source of general Forest information): http://www.fs.fed.us/r2/gmug/, GMUG ftp site (source of some data layers for GIS analyses): ftp://ftp2.fs.fed.us/incoming/r2/gmug/, Sources for Colorado River Cutthroat: http://wildlife.state.co.us/aquatic/cutthroat/index.asp

White, C.A., C.E. Olmsted, and C.E. Kay. 1998. Aspen, elk, and fire in the Rocky Mountain national parks of North America. Wildlife Society Bulletin 26: 449-462.

Wilcove, D.S., C.H. McLellan, and A.P. Dobson. 1986. Habitat fragmentation in the temperate zone. Pp 237-256 in M.E. Soulé (ed.). Conservation Biology: The Science of Scarcity and Diversity. Sunderland, MA: Sinauer Associates.

Wilcox, B.A., and D.D. Murphy. 1985. Conservation strategy: The effects of fragmentation on extinction. American Naturalist 125: 879-887.

The Wilderness Act. 1964. Public Law 88-577 (16 U.S. C. 1131-1136) 88th Congress, Second Session, September 3, 1964, in Watson, Jay, ed. 1998. The Wilderness Act Handbook third edition (revised). The Wilderness Society, Washington, D.C.

Wilen, B.O. 1995. The nation's wetlands. Pp. 473-476 in E.T. LaRoe, G.S. Farris, C.E. Puckett, P.D. Doran, and M.J. Mac (eds.). Our living resources: a report to the nation on the distribution, abundance, and health of U.S. plants, animals, and ecosystems. U.S. Department of the Interior, National Biological Service, Washington, D.C.

APPENDIX

I. The M2m Citizens' GMUG Conservation Vision Survey

June 23, 2004

Dear Friends,

We are writing to invite you to participate in an important effort to produce a conservation vision for protecting the Grand Mesa, Uncompahgre and Gunnison National Forest (GMUG). The Forest Service is, at this time, required to complete a Forest Plan Revision that details various management activities and uses that are permitted across the GMUG. Mountains to Mesas – a coalition of three local conservation organizations (High Country Citizens' Alliance, Sheep Mountain Alliance, and Western Colorado Congress) and one regional organization (Southern Rockies Ecosystem Project) – is taking this opportunity to create a conservation biology-oriented management plan for the GMUG that will serve as a unified vision for conservationists while providing the Forest Service with a management alternative for inclusion in the upcoming Forest Plan Revision.

The Forest Plan is a master document revised only once every fifteen years and it guides virtually all other management decisions throughout the forest. As such, it is critically important that we take every step possible to ensure the Plan contains adequate protection for delicate ecosystem functioning throughout the entire range of the GMUG.

We urge you to contribute to this process by taking a few moments to complete the enclosed survey. The purpose of this survey is to draw on extensive local knowledge of the forest, including areas of conservation significance (e.g. sensitive areas, wildlife habitat, ecological processes) as well as areas of acceptable levels of consumptive uses (e.g., recreation, timber harvesting, mining). We also want to ensure ample consideration of the ideas and concerns of the local conservation community.

After you have completed the survey, please sign the agreement stating that we may use the information you have provided. The conservation vision for the GMUG is a "document of the people" and your quotes – in combination with established scientific justification – will help substantiate and personalize the final document.

Please take advantage of this opportunity to share your personal knowledge of the Forest and respond with comments, concerns or specific information that the Mountains to Mesa group should consider. Your intimate knowledge is critical to providing the Forest Service with a comprehensive vision for protecting our National Forest.

Thank you for your input. Please return your completed survey and signed agreement in the enclosed envelope. Please do not hesitate to call with any questions you may have regarding M2m or the survey.

Sincerely,

Sam Sorkin
Public Lands Director
High Country Citizens' Alliance
PO Box 1066 ~ 724 Elk Avenue
Crested Butte, CO 81224

(970) 349-7104

Enclosures:
Survey
Maps of GMUG
Return envelope

Grand Mesa, Uncompahgre and Gunnison National Forest
Conservation Vision

SURVEY

Please take a few moments to complete all or portions of this survey and return it in the enclosed envelope by **July 23 2004**. *Your input is critical to the creation of a comprehensive and inclusive vision for the GMUG!* Please use additional pages as necessary.

1. **Please list or sketch on the attached map areas of *conservation significance*. These may include important wildlife habitat, migratory corridors, sensitive lands or other special places. For each location, provide a brief explanation or justification of their significance.**

2. **Please list or sketch on the attached map existing impacted areas (due to extractive use, recreation, or other impacts). Please note whether these uses should be discontinued or whether they may proceed in these locations without causing undue degradation.**

3. **Recognizing that the Forest Service is obliged to facilitate multiple uses, are there areas in the GMUG where consumptive uses may continue without causing undue degradation to sensitive natural areas, wildlife species and ecosystem processes?**

4. **Please list or sketch on the attached map areas of *recreational importance*. These can be areas with rare recreational opportunities, areas that are easily accessible, areas with historically high levels of recreational use, or other important areas. Please include a description of the types of recreational activities for which these areas are important (i.e. hunting, fishing, hiking, etc.).**

- **Please list or sketch on the attached map appropriate areas for each of the following special land designations. For each proposed designation, please provide a brief explanation or justification.**

    a. **New wilderness designations or additions to existing wilderness areas:**

    b. **Cultural resources and special interest areas:**

    c. **Endangered species recovery areas (e.g., Gunnison sage grouse; Canada lynx):**

    d. **Important wildlife habitat or migratory corridors:**

    e. **Research/natural areas:**

    f. **Other:**

- **What considerations should the forest management plan take into account regarding:**

    a. **Fire management in different habitat types (e.g., ponderosa pine, shrub-oak, mixed-conifer, etc.):**

b. **Insect and disease management:**

c. **Reintroduction and recovery of extirpated and endangered species (e.g., Colorado River cutthroat trout, Canada lynx, Gunnison sage grouse, gray wolf):**

d. **Grazing:**

e. **Developed recreation (skiing, camping):**

f. **Dispersed/undeveloped recreation (hiking, backpacking, horse-packing, guiding and outfitters):**

g. **Travel management road closures; route changes; motorized, mechanized, and pedestrian access):**

h. **Timber management:**

i. **Mineral development (coal, hard rock mining):**

j. **Oil and Gas Development:**

k. **Other:**

- **In your opinion, what additional issues of particular concern need to be addressed in the Forest Plan Revision?**

I hereby authorize Mountains to Mesas to use the information I have provided in their conservation vision, and to use quotations taken from my responses.

____

Signature *Date*

____

Please Print Your Name

Appendix II.

Conversion Chart

1 square mile = 640 acres
1 hectare = 2.47 acres
1 acre = .4 hectares
1 kilometer = .6 miles
1 mile = 1.609 kilometers
1 square kilometer = .36 square miles
1 square mile = 2.590 square kilometers

Appendix III. MAPS OF GMUG

- Land Status
- Lynx Linkages
- Major Vegetation Types
- Wilderness and Roadless

Mountains to Mesas Recommended Wilderness Areas (West)

(With Area Acreages)

Mountains to Mesas Recommended Wilderness Areas (East)

(With Area Acreages)