December 8, 2017

Dear GMUG Planning Team,

Colorado Mountain Club, High Country Conservation Advocates, The Wilderness Society, Ridgeway Ouray Community Council, Western Colorado Congress, Sheep Mountain Alliance, Rocky Mountain Wild, and the Great Old Broads for Wilderness' Grand Junction and Northern San Juan chapters submit the following comments for consideration and incorporation in the Grand Mesa, Uncompahgre and Gunnison (GMUG) National Forest Land and Resource Management Plan revision. This submission addresses *Draft Assessment 9: Recreation*.

We appreciate the opportunity to review this very important chapter. Recreation is the most popular and prolific use of the GMUG, and is an economic engine for the western region of Colorado. Millions of people travel and reside in the GMUG region to enjoy the unique recreational assets of the area and their tourism dollars are the lifeblood of local communities. We hope the feedback below helps to supplement existing data and encourage the forest to gather better metrics in order to inform a robust and sustainable forest plan.

Information Gaps

While the report is relatively comprehensive, there are some crucial information gaps that should be recognized. Comprehensive data on dispersed recreation trends do not appear to be included in this assessment. Activities that take place off-trail, such as rock climbing, backcountry skiing, and boating are hardly mentioned in the draft assessment, yet the GMUG is home to world-class opportunities and frequented by locals and visitors seeking these types of recreation. Furthermore, both rock climbing and undeveloped skiing are among the top five activities expected to grow in popularity over the next 50 years, according to the 2012 Cordell report cited in the recreation assessment.[1] We understand that it is difficult to capture data on these types of recreation, but hope you acknowledge their importance and seek to gather more input from these user groups throughout the planning process.

In addition, information on recreation settings and associated experiences is missing. We were disconcerted to read that the GMUG was "unable to locate a complete set of maps" for the existing ROS.[2] In the meantime, as discussed below, we recommend that you add a section to this chapter of the final report that delineates as best you can current recreation settings, and the experiences and benefits that they offer. This will help the public and planners identify desired settings and strategies to work towards them. In addition, we hope that any data that is available will be digitized and made available to the public as soon as possible. We ask that the GMUG correlate any future reports and analysis with comprehensive maps made available on the planning website and with links from the appropriate narrative sections within the PDF planning documents.

Fourteeners

It is not clear what data the forest is using when listing 14er peak elevations. Most current topo maps including the Forest Service's Uncompahgre National Forest (Mountain Division) still use "the old standard elevations" as do most of the popular climbing sites on the internet. Therefore, the elevation of Mount Sneffels; should be 14,150 ft., not 14,158 ft.; Wetterhorn-14,015 ft., not 14,021 ft.; San Luis Peak is 14,014 ft., not 14,021 ft., Uncompahgre Peak is 14,309 ft., not 14,321 ft., and Wilson Peak is 14,017 ft.,

[1] Cordell, H.K. (2012). Outdoor recreation trends and futures: A technical document supporting the Forest Service 2010 RPA Assessment. A recreation research report in the Internet Research Information Series (IRIS). http://www.treesearch.fs.fed.us/pubs/40453

[2] Recreation Assessment Page 51

not 14,023 ft. For some reason Castle Peak is correct at 14,279 ft. which seems odd given the discrepancy in the listed elevation of the other 14ers. Please clarify and cite where peak elevation data is coming from. Also please clarify that there are in fact six "Fourteeners" located on the GMUG (Uncompahgre, Wetterhorn, Castle, San Luis, Sneffels, and Wilson), some sections only note five.

In addition to the 14ers, there should be mention of the number of ranked peaks over 13,000 feet (thirteeners). While they certainly don't see the use that the 14ers do, and most will remain obscure, it would be a mistake to believe they aren't growing in popularity and seeing more use. There are a lot of recreational users who actively pursue thirteeners in Colorado, and many of these peaks have use trails, rock cairns, summit registers, and the like on them. In the San Juan Geographic Area, there are several "Centennial Peaks" (part of the highest 100 peaks in the State) including Dallas Peak (13,809 ft.) and Teakettle Mountain (13,819 ft.). These two peaks are some of the most difficult to climb of the Centennial Peaks (by the standard route). As the number of people who complete their goal of climbing the fourteeners rises, many are expanding their hiking and climbing goals to include the centennial thirteeners and many other thirteeners in the GMUG. This of course could lead to increasing impacts to fragile terrain from increased visitation. We recommend also that the GMUG document to the degree data is available (and where it is not document the information gap) the condition of trails and routes on these peaks, and the trends related to use and condition of these peaks. This will help the public and planners in the plan revision to identify desired conditions and strategies to achieve them.

Key Issues for Recreation on the GMUG

Recreational Infrastructure. The draft identifies "Trails" as a key issue. We recommend that you modify this to be "Recreational Infrastructure" and highlight the issue of Trails under this header as follows:

> **Recreational Infrastructure** ~~**Trails**~~
> • Trail opportunities may not be aligned to recreational settings, public desires, and resource conditions ~~motorized routes and loop routes are desired by the public~~
> • The condition of existing trails, recreational roads, and facilities are declining because of budget shortfalls and are not sustainable.
> ~~Front country hiking trails are desired by the public~~
> ~~• Mountain biking challenge routes and loops are desired by the public~~

Well-maintained and planned infrastructure for recreation (facilities and transportation infrastructure) is fundamental to a quality experience and a sustainable setting, as the draft report notes. The significant funding backlogs and anticipated annual shortfalls is a major issue for the GMUG where recreational use is on the rise and recreational funding is in decline, and thus should be identified as a key issue in the final report.

Resource impacts from dispersed camping. For dispersed recreation, the Draft Assessment states that "dispersed camping demand and impacts are increasing, and may be reaching unacceptable levels."[3] Dispersed camping in many areas has already reached unacceptable levels. Also, the GMUG states that "…campgrounds and designated dispersed sites may be needed" and "additional and updated toilet facilities may be needed."[4] Again, many areas on the GMUG, notably around the Crested Butte and Taylor Park areas, are beyond the "may be needed" stage. The Assessment should recognize the absolute needs to inform the need for change and plan revision and, to the degree possible, document the "hot spots", their condition, and the scope and magnitude of required management attention.

[3] Recreation Assessment Page 2.
[4] Recreation Assessment Page 3.

Sustainable settings. The planning rule requires the GMUG to provide for sustainable settings, opportunities, and access.[5] Under the current plan, the GMUG is not managing for sustainable settings, and may not even have clear inventory of the existing settings and experiences and benefits those settings provide. We therefore recommend that you modify the language in the Key Issue sections related to settings so that it is more comprehensive and robust as follows:

> ~~**Recreation Opportunity Spectrum**~~ **Sustainable Recreational Settings**
>
> - The Forest Plan strategic direction for recreation settings is outdated
> - We do not have a current spatial inventory of current recreational settings, and lack an understanding of their sustainability, and a strategy to ensure sustainability reflective of current recreation and budget trends.

Connecting forests to communities. In developing the 2012 planning rule, the Forest Service incorporated the concept of connecting people with nature[6], and recognized that there are populations that are traditionally underserved by the agency and the lands it administers. These include economically disadvantaged and culturally diverse populations. To the GMUG's credit, the GMUG included a discussion of this issue in this chapter of the draft assessment report[7] and recognized that there are significant barriers to participation for certain populations on the GMUG.[8] Yet the section on key issues does not recognize that inequities exist and the agency is not effectively connecting specific populations to the national forest lands and nature. We recommend that this issue be added to the list of key issues as it will take a substantial shift in thinking and management to begin to address these inequities over the life of the plan.

Developed Recreation Opportunities and Activities

Please describe what constitutes a "Snowpark," how it is managed, and how it is distinguished from other trailhead facilities. For example, the Uncompahgre Geographic Areas notes there are "several winter trailheads for both snowmobiling and cross country skiing" but there are no Snowparks listed in Table 6. Please provide a list and map of all "Snowpark" locations on the forest.

It is unclear whether backcountry huts and yurts are captured in the Recreation Assessment as either developed sites or dispersed activities. Several hut and yurt operators utilize forest service land and permits and their status and use patterns should be reflected in the assessment.

The undersigned organizations encourage the GMUG to complete an updated Recreation Facility Analysis (RFA) during this planning process to more adequately understand the infrastructure needs and costs on the forest. Given the decline in budgets and current maintenance backlog, this information should inform the development of new facilities to ensure they can be maintained appropriately.

Dispersed Recreation and Trails.

Appendix A – Summary of Recreation Activities by Geographic Area. The description of dispersed recreation opportunities by geographic area seems heavily weighted towards motorized use (listed as one of the most common activities in each area) and yet, according to 2014 visitor use data, it accounts for

[5] 36 CFR 219.10(b)(1)(i)
[6] 36 CFR 219.8(b)(6)
[7] Recreation Assessment Pages 46-47.
[8] For instance, page 29 states that 98% of all visits to the GMUG were by Caucasions. Yet, demographics for the GMUG counties shows that the Hispanic population, for example, is 17% of the general population. See Appendix 1, page 96.

only 20% of overall summer use. Winter recreation is also under-represented as a common use in the Gunnison and San Juan Geographic Areas.

Trails. The issue of trail placement, management and maintenance is significant. It would be helpful to include a breakdown of trail miles and types by settings. So, for example, it would be helpful to know if there are motorized trails in non-motorized ROS settings, as well as the miles and types of trail experiences in each type of setting. It would also be helpful to include a description of the current trail system in terms of its physical condition, and known specific impacts to resources. Lastly, maps showing these metrics would help considerably.

The Recreation Assessment mentions that some users are advocating parallel trails for different users. While it is fine to include the idea as a possible strategy in the report, you might also want to mention that doing so would require significant more funding and could have negative impacts on resources.

Dispersed recreation pursuits. Rock climbing is not listed as a dispersed recreation activity. We recommend that the forest incorporate data provided by the Access Fund and other climbing organizations to better understand where this activity is occurring and how it may be impacting surrounding resources.

Dispersed camping. Although high-use dispersed camping was indicated as a concern with regard to resource degradation and sanitation issues, little quantified data was presented to quantify the current impacts across the forest. If you have an inventory of dispersed camping "hotspots" please include the information in the draft report. Otherwise please list the inventory as an information gap. This data is useful for evaluating the impacts of this recreational use and implement forest-wide direction and adaptive management techniques to manage it.

Regarding the 300-foot off-road driving buffer, does the Forest Service have data on impacts resulting from this buffer? If so, please include the information in this report. If not, please cite it as an information gap. Also, the Forest Service should consider reducing the 300-foot off-road driving distance (or where it is applied) in places where its allowance is leading to resource damage or proliferation of user-created routes.

Jeep trails. The assessment does not include any data on the numbers off-road vehicles that are using the popular jeep roads or the impacts that result. This information is needed to assess the future management of these areas. For example, there is very little mention of the traffic jams and safety hazards from having so many vehicles on narrow shelf roads.

Recreational Desires

The draft report in the section on key issues states that "Additional motorized routes and loop routes are desired by the public" as are more front country hiking trails and mountain biking challenge routes.[9] Can the GMUG document the source of this information? Is it from surveys or anecdotal? Is it comprehensive? For instance, do we know the types of trail recreation that minority populations seek? Do we know the types of opportunities birdwatchers seek? If the information is anecdotal, you should say so, and identify as an information gap the need to gain a scientifically-based understanding of public desires for recreation. If the information is based off surveys, the forest should cite the survey and its statistical underpinnings.

Recreation Opportunities on Other Federal and State Lands

[9] Recreation Assessment Page 3

Thank you for recognizing that recreation management is a regional endeavor. It would be helpful to add more detail to this section to describe the magnitude, scope, and extent of different types of recreation settings and opportunities in the greater GMUG region. For instance, do the surrounding BLM lands provide extensive dispersed opportunities and what types?

It would also be helpful to describe the recreational niches of each of the major recreational providers in the GMUG region, including the GMUG's recreational niche. This is fundamentally important to developing desired condition statements in the plan revision, and, while ensuring that the region is providing a mix of opportunities, recognizing that the GMUG may not offer recreational settings for some types of recreation.

Winter Recreation and Travel Management

Winter travel management planning. In 2015, the Forest Service promulgated subpart C of the travel management rule at 36 CFR 212 that requires each forest to restrict oversnow vehicle (OSV) use to a designated system of routes and areas displayed on an oversnow motorized vehicle use map (OSVUM). Designations must be designed to minimize impacts to resources and other recreational uses.[10] If implemented properly, the rule presents an important opportunity to enhance quality recreation opportunities for both motorized and non-motorized users, protect wildlife during the vulnerable winter season, prevent avoidable damage to air and water quality, and restore balance to the winter backcountry.

The rule does allow forests to adopt previous decisions made with public involvement that restrict OSV use to designated areas and routes. 36 C.F.R. § 212.81(b). However, prior to adopting such decisions on an OSVUM, the Forest Service must ensure: (a) the administrative record for those decisions documents compliance with the minimization criteria; (b) there are no changed circumstances that warrant additional environmental analysis and/or re-application of the minimization criteria; and (c) the existing allocations comply with the required "closed unless designated open" approach by restricting OSV use to discrete, specifically delineated open areas and routes.

We are happy to see that the GMUG on Page 49 of the draft report acknowledges that the GMUG will need to evaluate existing winter use management plans for compliance with subpart C, and take the steps necessary to achieve full compliance with subpart C. While the draft report states that travel planning is completed for two of the three forests, it does not provide more information on those plans (e.g., dates completed, zones covered). In addition, it does not provide an overview of the winter use management situation. For example, by our calculation, approximately 79 percent of the forest (over 2 million acres) is open to cross-country OSV travel and only about 70,000 acres outside of designated Wilderness are closed (about 2 percent of the forest outside of Wilderness). We request that this information be included in the final report as it will help inform the need for change and plan revision.

We investigated the administrative winter use situation on the GMUG with the information we could find online and in our files. This is what we found:

Grand Mesa National Forest OSV Designation Decisions (1994 Travel Management plan)

- This plan changed general travel management on the Grand Mesa NF from "travel anywhere" to "travel on designated routes only" but explicitly exempts OSV travel from this restriction: "Snowmobile travel on snow will not be restricted over most of the Forest." [11]

[10] 36 C.F.R. §§ 212.55(b), 212.81(d). The rule's requirements flow from Exec. Order No. 11,644, 37 Fed. Reg. 2877 (Feb. 8, 1972), *as amended by* Exec. Order No. 11,989, 42 Fed. Reg. 26,959 (May 24, 1977).
[11] FOREST SERVICE, *Grand Mesa Travel Decision Notice*, 3 (1994)

- Eleven percent of Grand Mesa NF is closed yearlong to all motorized travel including OSV travel for various reasons such as protecting public safety, municipal watersheds and big game winter range. Additionally, Certain areas are closed from Nov. 15 – May 1 to protect big game on their winter range.
- We did not find consideration or application of the minimization criteria in the relevant NEPA documents, and no indication that the forest is operating under the required "default closed unless designated open position."

Uncompahgre National Forest OSV Designation Decisions (2002 Travel Plan)

- 61% of the forest is open to "all modes of travel…both on and off routes yearlong."[12] While certain areas are subject to seasonal motorized travel restrictions to protect elk calving and bird nesting, the ROD specifically states that the responsible official "stopped short of making area-wide, or route-specific decisions specifying type/category of use for the remainder of the forest" regarding winter travel.[13]
- We did not find consideration or application of the minimization criteria, and the plan appears to operate under a default open management system.

Gunnison National Forest OSV Designation Decisions (2010 Travel Management plan and special orders)

- This forest does not have a winter motorized use plan or direction except for the Crested Butte area where there is a dispersed winter recreation strategy in the Crested Butte Area[14], a special order for Washington Gulch Winter Recreation Management[15], seasonal area closures to protect wildlife in Flattop Mountain and Almont Triangle,[16] and five special orders restrict OSV use.[17] These are:

Area/Trail	Date	Reason
West Brush Creek[18]	Dec. 29, 2015 – Dec. 31, 2020	Prevent conflicts of winter uses within the West Brush Creek Analysis Area
East Brush Creek[19]	"	"
Middle Brush Creek	"	"
Cement Creek	"	"
Upper East River Area	"	"

- The special orders affect only a small portion of the forest and do not apply the minimization criteria even though they address conflicts between uses.

Lastly, Subpart C requires designation of areas and routes for OSV use "on administrative units or Ranger Districts, or parts of administrative units or Ranger Districts, of the National Forest System *where*

[12] FOREST SERVICE, *Uncompahgre National Forest Travel Plan. At 4.* (2002).
[13] *Id.* at 9.
[14] FOREST SERVICE, *Dispersed Winter Recreation in the Crested Butte Area: Decision Notice Finding of No Significant Impact* (1995).
[15] FOREST SERVICE, *Decision Memo Washington Gulch Winter Recreation Management*, (2005).
[16] This is listed on the website, but I could not find any decision documents supporting these closures
[17] http://www.fs.usda.gov/detail/gmug/landmanagement/projects/?cid=fseprd488168.
[18] FOREST SERVICE, GMUG-2015-22, WEST BRUSH CREEK WINTER RECREATION ANALYSIS AREA, 1 (2015).
[19] FOREST SERVICE, GMUG-2015-24, EAST BRUSH CREEK WINTER RECREATION ANALYSIS AREA (2015).

snowfall is adequate for that use to occur."[20] None of the planning documents for GMUG indicate that minimum snow depths have been implemented.

There are two articles (attached) relevant to winter recreation suitability and planning that should be incorporated into the assessment report, and considered best available science. These are:

- Hatchett, Ben. May 15, 2017. Evaluation of Observed and Simulated Snow Depths for Commencing Over Snow Vehicle Operation in the Sierra Nevada, Prepared for the Winter Wildlands Alliance. The author is developing a method for land managers to estimate trailhead snow depth by correlating SNOWTEL data with snow conditions at trailheads.

- Lucretia E. Olson, John R. Squires, Elizabeth K. Roberts, Aubrey D. Miller, Jacob S. Ivan, and Mark Hebblewhite, 2017. Modeling large-scale winter recreation terrain selection with implications for recreation management and wildlife. In Applied Geography, Volume 86, Pages 66-91. The authors modeled terrain selection of motorized and non-motorized recreationists, including snowmobile, backcountry ski, and snowmobile-assisted hybrid ski to better understand the environmental characteristics favored by winter recreationists, and thus predict areas of potential conflict or disturbance. Field locations were Vail Pass and the San Juan Mountains. Areas predicted to have only motorized recreation were more likely to occur further from highways, with greater forest road densities, lower canopy cover, and smoother, less steep terrain, while areas with only non-motorized recreation were closer to highways, with lower forest road densities, more canopy cover and steeper terrain. This work provides spatially detailed insights into terrain characteristics favored by recreationists, allowing managers to maintain winter recreation opportunities while reducing interpersonal conflict or ecological impacts to sensitive wildlife. This study will aid the GMUG in identifying areas suitable for various types of winter recreation in the plan revision, especially because it was conducted in the two adjacent forests to the GMUG.

Winter ROS. We agree with the need to complete a Winter Recreation Opportunity Spectrum inventory and include it in the final assessment report. We encourage you to reach out to Winter Wildlands Alliance who has done the most thinking regarding what a winter ROS should look like, and can provide some examples.

Winter activities. There is very limited discussion of 'hybrid use' for snowmobile access backcountry skiing in the Assessment but should be a major item to discuss, particularly in the Crested Butte Area.

Impacts of OSVs. Although the conflict between motorized and non-motorized winter use references safety concerns, many of the user experience and environmental impacts attributed to summer OHVs (e.g. noise, pollution, soil impacts) apply to snowmobiles as well. Additionally, snow or fresh powder, should be considered as a recreational resource in need of management. There is a finite amount of prime terrain for winter recreation and the resource can be degraded (tracked-out) with over-use. A snowmobiler can "consume" the resource much faster than a skier or snowshoer so it is important to note that the carrying capacity of one acre of terrain is far higher for non-motorized users but may be quickly exceeded with just one motorized user.

Developed Ski Areas

While Monarch Ski Area is listed as a developed recreation site within the Gunnison Geographic area, it is not listed as one of the three permitted ski resorts on the GMUG. Monarch operates under a permit with the Pike-San Isabel National Forest just adjacent to the GMUG along the continental divide. It is

[20] 36 C.F.R. § 212.81(a) (emphasis added).

important to note that Monarch Ski Area now authorizes side-country ski/snowboard access through a gate which directs backcountry skiers onto GMUG forest lands.

Potential Need for Change

We recommend the following modifications to the need for change related to recreational settings:

- In order to ensure that desired recreation settings in the winter and the summer are maintained, a spatial map of desired recreation settings is needed. Consider direction to manage toward those desired conditions for recreation, integrated with the full spectrum of multiple use activities that occur on the GMUG.
- Consider a landscape-scale strategy to provide adequate motorized recreation opportunities as well as acceptable levels of noise in non-motorized areas.
- In order to sustain quality recreational settings and opportunities in the winter, there is a need to develop a winter-specific recreational opportunity settings system for the GMUG.

We recommend the following modifications to the need for change related to dispersed recreation:

- Consider strategic direction to manage dispersed camping and use.
- Consider strategic direction to provide ~~the desired opportunities and~~ sustainable recreational settings and opportunities for the diverse types of dispersed recreation on the GMUG, taking into account the recreational niche of the GMUG and proximal recreation providers.
- There is a need to provide direction for subsequent winter travel management planning, including identifying suitable lands for winter motorized recreation, winter recreational opportunity spectrum settings, and management direction related to minimum snowpack and conflict.
- There is a need to provide direction for managing on-the-ground motorized recreation, including identifying suitable lands for on-the-ground motorized recreation, and management direction related to conflict and sustainability.

We also recommend adding the following need for change:

- Consider strategic direction to enhance the connections of people to nature with an emphasis on currently underserved populations.

Geographic Areas

Gunnison Basin Geographic Area

The recreation assessment does not mention Brush Creek, near Crested Butte which sees highly concentrated dispersed camping with no facilities. Please include Brush Creek as another valley in the Crested Butte area that is heavily impacted by campers all summer and fall. A similar situation to Musicians Camp exists about five miles up, where there is no facility.

San Juan Geographic Area

The Recreation Assessment needs to include winter activities that include backcountry skiing, alpine skiing, heli-skiing, ice climbing, snow shoeing, snowmobiling, and cross country skiing. In the Lake City-Ouray-Telluride Triangle, backcountry skiing (alpine touring) is more common than cross country skiing. In the Ouray region, summer activities should indicate more emphasis on hiking as the predominant use. It should also be noted that there are summer-use backcountry huts that connect Last Dollar Pass to Ouray. Also in the Ouray region, backcountry skiing is at least, if not more, popular as crosscountry skiing. These uses require different terrain, topography, elevation, aspect, and snow cover

and should be analyzed separately. Parking at the top of Red Mountain Pass is becoming an issue but also helps keep the number of users at appropriate levels so too many parties are not skiing or riding on top of each-other. A Port-O-Pottie has been added at the top of the pass and this has been well used. Additionally, Ouray has been an ice-climbing destination for quite some time, not just 'recently'. In the Telluride and Mountain Village/Greater Telluride Region: This seems to be the only section of the assessment where the terminology for skiing, cross country skiing, Nordic skiing, back country skiing, alpine skiing, and heli-skiing are used correctly. It also documents both Heli Tracks and the Telluride Ski Area.

A large omission in this area is failure to mention San Juan Huts as key recreation resource. Backcountry skiers have been using these huts and accessing terrain on the North Side of the Sneffels Range from Telluride for many years. The forest should also note the history of conflict and incompatible use between winter motorized use in close proximity with non-motorized hut visitors. In general, the assessment also does not accurately reflects the volume of backcountry skiers in the Red Mountain Pass and Ophir areas.

Uncompahgre Plateau

The recreation assessment fails to recognize that mountain bike use has occurred on the Plateau for 30 years. The sentence that states "Two long distance mountain bike trails, the Tabeguache and Paradox Trails, provide multi-day opportunities from Telluride to Moab" is not accurate. Neither of these trails go from Telluride to Moab, although there is a different bike route that does.

Conclusion

We hope that the Forest Service will incorporate this feedback into a more comprehensive recreation assessment report, complete with maps, in order to gain a clearer picture of current recreation trends and conditions on the forest.

Thank you for your consideration of these comments.

Julie Mach
Conservation Director
Colorado Mountain Club
710 10th St. Suite 200
Golden, CO 80401
juliemach@cmc.org

Matt Reed
Public Lands Director
High Country Conservation Advocates
PO Box 1066
Crested Butte, CO 81224
(970) 349-7104

Vera Smith
Forest Planning and Policy Director
The Wilderness Society
1660 Wynkoop St., Suite 850
Denver, CO 80202
Vera_smith@tws.org

Additional partners below...

Jim Stephenson, Public Lands Chairman
Ridgway Ouray Community Council
PO Box 272
Ridgway, CO 81432
(970)626-5594

Steve Allerton
President
Western Colorado Congress
134 N 6th St
Grand Junction, CO

Lexi Tuddenham
Executive Director
Sheep Mountain Alliance
PO Box 389
Telluride, CO 81435

Alison Gallensky
GIS and IT Director
Rocky Mountain Wild
1536 Wynkoop St., Suite. 900
Denver, CO 80202
(303) 546-0214
alison@rockymountainwild.org

Robyn Cascade & Laurie Shannon, co-leaders
Northern San Juan Broadband
Great Old Broads for Wilderness
greatoldbroads.org

Sherry Schenk, leader
Grand Junction Area Chapter,
Great Old Broads for Wilderness
sherryleeschenk@gmail.com

Attachments:

- Hatchett, Ben. May 15, 2017. Evaluation of Observed and Simulated Snow Depths for Commencing Over Snow Vehicle Operation in the Sierra Nevada, Prepared for the Winter Wildlands Alliance. The author is developing a method for land managers to estimate trailhead snow depth by correlating SNOWTEL data with snow conditions at trailheads.
- Lucretia E. Olson, John R. Squires, Elizabeth K. Roberts, Aubrey D. Miller, Jacob S. Ivan, and Mark Hebblewhite, 2017. Modeling large-scale winter recreation terrain selection with implications for recreation management and wildlife. In Applied Geography, Volume 86, Pages 66-91.
- Appendix 1: Sample reports from Headwater Economics EPS-HDT Application, available at http://headwaterseconomics.org/tools/eps-hdt

Evaluation of Observed and Simulated Snow Depths for Commencing Over Snow Vehicle Operation in the Sierra Nevada

Prepared for the *Winter Wildlands Alliance*
Benjamin Hatchett, Ph.D.

Draft Report Submitted: May 1, 2017
Revised Final Report Submitted: May 15, 2017

Executive Summary:

Over-snow vehicle (OSV) recreation represents a significant component of winter season recreation in the Sierra Nevada. In order to minimize negative impacts on natural resources such as vegetation damage and soil compaction during OSV operation, a minimum snow depth must be present, however to our knowledge no specific minimum value has been defined. Winter Wildlands Alliance suggests 46 cm (18 in) while some National Forest Special Orders require 30 cm (12 in). The minimum depth requirement is further complicated by the mechanical properties of snow that vary as a function of snow density. Nonetheless, resource managers tasked with opening and closing OSV trailheads over large spatial areas do not have the capability to visit each trailhead to obtain a snow depth measurement. Instead, they often must rely on remote measurements or historic opening dates. This study evaluates the use of station measurements and a process-based, semi-distributed snowpack model to inform OSV trailhead decision making. Using a conservative rule-of-thumb estimate of a minimum depth of 90 cm (12 in.) of compacted snow at a snow density of 0.3 g/cm^3, daily snow water equivalent measurements from 38 SNOwpack TELemetry (SNOTEL) weather stations are used to develop a relationship to determine when sufficient snow depths exist to open areas to OSV usage. Under an assumption of lower density snow (0.2 g/cm^3), the evaluated depth (45 cm) is consistent with the policy suggestion of Winter Wildlands Alliance (approximately 18 in). Output of snow depth anomalies (deviations from average conditions) from the SNOwpack Data ASsimilation (SNODAS) model is examined for the northern, central, and southern Sierra Nevada to demonstrate how this readily available model can be incorporated into decision making. Last, a protocol for citizen-science based depth measurements at OSV trailheads was developed for subsequent use that can provide additional data to complement SNOTEL and SNODAS estimates.

Analysis of SNOTEL data identified that median timing of achieving sufficient snow depths for OSV operation during the past 15 years (2003-2017) varied by elevation ($R^2 = 0.39$) from mid-October to late December. The long period of record (1981-2017) of SNOTEL stations enabled an analysis of long-term trends in opening dates. Since 1981, opening dates have increased at a rate of approximately 0.6 day per year, which today means that opening dates are nearly three weeks later. Linear relationships ($0.25 > R^2 > 0.66$) between snow depth and station elevation over four latitudinal bands were satisfactory to inform OSV opening decisions if station topographic settings (i.e., distance from the mountain crest) are considered. Incorporation of SNODAS output is recommended for decision making provided its limitations owing to uncertainty are appropriately factored into the decision process. A recently developed online tool, Google Climate Engine, that provides satellite-derived normalized differenced snow index is highlighted for additional guidance in identifying anomalous snow coverage conditions at the mountain range scale with high spatial resolution (500 m). To provide specific examples of the

types of weather conditions that lead to substantial snowpack losses after the depth requirement has been met, several specific case studies are summarized to highlight the types of weather conditions that lead to this scenario. The combined use of station and remotely-sensed data with model output is recommended for use in deciding when to open OSV trailheads.

Key Science Points:

1. Median dates of snow water equivalent (SWE) > 90 mm vary by elevation (R^2=0.39) from early November to late December.
2. Median dates of achieving SWE > 90 mm have increased by approximately 0.5 day per year over the past 37 years.
3. Timing of SWE > 90 mm varies by elevation with higher elevation sites achieving it earlier but with greater variance compared to lower elevation sites.

Unit Conversions: 25.4 mm (2.54 cm) = 1 in.; 1 m = 3.28 m

1. Introduction

Over snow vehicle (OSV) recreation represents a significant and growing component of winter season recreation in the mountains of California (Figure 1a) and throughout the western United States. With few exceptions, the annual increase in OSV registrations in California increased by 4-10% per year during the period from 1990-2008 (California Department of Parks and Recreation 2010). The proximity of the northern and central Sierra Nevada (Figure 1b) to large population centers such as the greater Sacramento and San Francisco metropolitan areas (Figure 1a) creates appreciable demand for OSV recreation in a relatively limited and ecologically sensitive area. In order to minimize negative impacts on natural resources such as vegetation damage (Stangl 1999) and soil compaction (Baker and Bithmann 2005) during OSV operation, a minimum snow depth must be present. To our knowledge, no precise value of this minimum depth has been produced via studies quantifying OSV use and disturbance. Further complicating the minimum depth requirement is the dependence of snow depth on the density of the snow, which varies seasonally and as a function of weather conditions. Newly fallen snow densities can vary from 0.05 g/cm^3 (typical interior western US powder snow) to 0.3 g/cm^3 (very wet coastal snow or compacted snow; Sturm et al. 2010). Although many national forests in California have a required minimum snow depth of 30 cm (12 in) for OSV use, not all forests have such a requirement (California Department of Parks and Recreation, 2010).

Resource managers tasked with opening and closing OSV trailheads over large spatial areas may not have the capability to visit each trailhead to obtain a snow depth measurement. Instead, they must rely on remote measurements or historic opening dates. This work aims to provide guidance to resource managers in using readily available snowpack data from weather stations (which may or may not provide depth measurements) and to highlight available online tools that can inform their decision making. Under a conservative snow density assumption (see Methods in section 3), we estimate the median timing of achieving sufficient snow depths for OSV operation and their trends through time. Relationships between timing of sufficient snow depth and elevation are examined. Several cases where snowpack losses during early winter are highlighted to provide resource managers with examples of the weather conditions at play in these events. This information may help increase situational awareness at times when trailheads

may require closure to OSV use during the early season. Two web tools with map-based graphical user interfaces are provided with examples for how they can be applied to OSV trailhead decision making. A citizen science-based protocol for snow depth measurement was developed and can be implemented in subsequent winters. The results from this study can serve to facilitate continued research on snowpack trends during early season, the impact of these trends on winter recreation, and to facilitate improved resource management of areas where OSV is allowed.

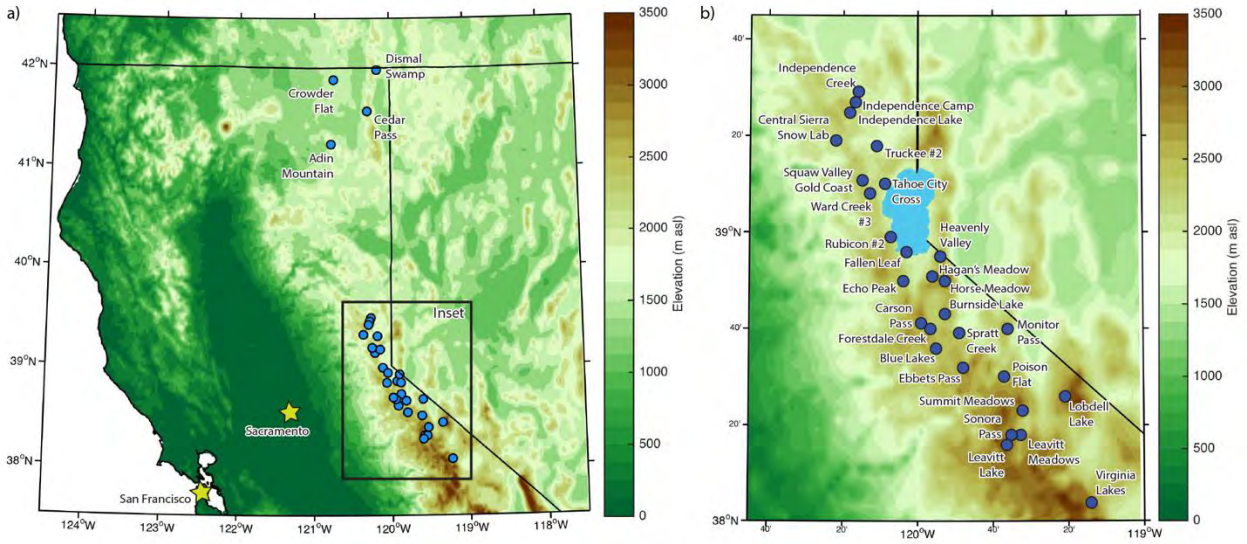

Figure 1: (a) Map of Sierra Nevada (and northern regions) with SNOTEL stations used in the analysis shown as blue dots. (b) Inset map showing stations in Lake Tahoe region of California. Elevations are shown as filled contours with 125 m intervals.

2. Data

Daily maximum temperature, minimum temperature, snow water equivalent, and precipitation from 38 SNOTEL stations spanning October 1 1980-February 28 2017 were acquired from the Natural Resource Conservation Service (http://www.nrcs.gov/snotel). Daily, gridded output at 25 km horizontal resolution of snow depth and snow water equivalent from the SNODAS model is available from October 1 2003-present. The data can be downloaded from the National Snow and Ice Data Center or accessed via a graphical user interface (GUI) at the National Operational Hydrologic Remote Sensing Center webpage (https://www.nohrsc.noaa.gov/interactive/html/map.html). The GUI allows the user to select the specific area, date, and variable of interest. SNODAS output was acquired for January 2012, January 2016, and March 2016. MODIS Aqua-derived normalized differenced snow index (NDSI) values at 500 m horizontal resolution are available between 1 October 2002-28 February 2017 and was acquired for January 2012, January 2016, and March 2016. The NDSI is created by differencing bands of remotely sensed reflectance in bands that snow reflects (0.66 mm) from the band that it does not reflect (1.6 mm) and dividing by the sum of the reflectance of these bands. NDSI was acquired from the Google Climate Engine GUI (www.climateengine.org; Huntington et al. 2017).

3. Methods

No established value exists for a minimum snow depth for OSV operation, but anecdotal values used by managers vary between 30-45 cm (12-18 in.) depending on compaction, which can be used as a surrogate for density. Such anecdotal values for minimum snow depth do not take into account variability in snow density. To provide a conservative estimate of sufficient snow depth for non-intrusive OSV operation, we specified 90 mm of snow water equivalent (SWE) at each SNOTEL station as the required depth for approval of OSV use. This value was obtained by the equation SWE [mm] = d [mm] * ρ_s / ρ_w and making the assumption that in a coastal snowpack with marginal compaction, ρ_s is typically 0.3 g/cm^3 (Sturm et al. 2010). Newly fallen snow varies from 0.05 g/cm^3 to 0.3 g/cm^3 with maximum densities observed during spring of 0.6 g/cm^3 (Sturm et al. 2010), therefore the chosen value appears reasonable to approximate a depth d of 300 mm (11.8 in.) for early-midwinter conditions in the Sierra Nevada. This depth value is consistent with values used by the United States Forest Service. The same SWE value under the assumption of less dense snow (0.2 g/cm^3) implies a depth of 45 cm, which is close to the depth recommended by the Wilderness Wildlands Alliance. Our SWE value is also close to that suggested by Patterson (2016), who chose 100 mm of SWE as a threshold value for winter recreation in the Rocky Mountain National Park of Colorado. Early in the season, low snow depths allow winter recreation to have the greatest effects on vegetation (Fox and Kiesse 2004). One would expect some degree of interannual and intraannual variability in snow density (in addition to snowfall and temperature regimes). Our approach can be considered conservative, as we use a density value on the upper end of the range of newly fallen snow and characteristic of midwinter, existing snow densities. This implies that more SWE is required to attain the depth threshold. As indicated above, using a lower density value would imply less SWE is required to achieve the minimum of 30 cm depth.

We take an exploratory approach towards examining the characteristics of early season snowpack development. Our study focuses on the northern and central Sierra Nevada (Figure 1b) but we also examined data from far northern California (Figure 1a). The region of focus (Figure 1b) has stations near 13 of the 19 California Sno-Parks, which are popular OSV staging areas (California Department of Parks and Recreation, 2010). Five of these Sno-Parks are in the Huntington Lake region near Fresno, California where no SNOTEL data is collected. We report the median timing of when each SNOTEL station achieves the minimum required 90 mm of SWE as a function of station elevation and latitude along with the variance. We also examined the frequency that stations would achieve 90 mm of SWE (thus allowing safe OSV operation) but then underwent a decline in SWE to less than 70 mm (the assumption being that OSV operation would no longer be recommended). Stations that underwent such a behavior two or more times and are located near popular OSV trailheads are noted. Examples are provided to demonstrate how warm and dry conditions as well as wet and warm conditions can produce SWE loss during early season and an example is provided to show rapid early melting at lower elevations. Climate normals, or average conditions, were calculated using the median of observed precipitation and SWE over the period 1981-2010 for each day of each year from October 1 to February 28 (where October 1, or the start of the water year, is taken as day 1). Unless otherwise specified, all years are expressed in terms of their respective water year that begins on October 1 *of the previous calendar year* and ends on September 30 of the calendar year of the water year. Least squares estimates were used to fit linear models to the data and the

coefficient of determination (R^2 or the square of the correlation) as well as the linear regression equation are reported.

4. Results and Discussion

4.1 Trends in 90 mm SWE

Binning stations by elevation (low, middle, and high), the range of dates upon which 90 mm of SWE is achieved demonstrates substantial interannual variability (Figure 2). Median dates (black dots) of 90 mm SWE range from late January to early November with differences on the order of two to four weeks between individual years (Figure 2). Some years have small intra-station variability between 90 mm SWE dates (e.g., 2009 in Figure 2b) while others have larger intra-station variability (e.g., 2005 in Figure 2a). Long-term 37 year linear trends demonstrated substantial increases in the median date of 90 mm of SWE for all elevations with slopes on the order of 0.6 days yr^{-1} at middle and high elevations. Curiously, lower elevation stations had a slower rate of increased median opening date (0.3 days yr^{-1}). This finding is worthy of continued study as it may result from asymmetric rates of warming (greater rates at higher elevation compared to low elevation) or may imply that precipitation and temperature regimes during early season precipitation events are more strongly influencing middle and high elevation regions. Regardless of the causality of the warming, over 37 years, these rates equate OSV opening dates to be delayed nearly three weeks from historical assumptions developed over the past 20-40 years. For example, suppose a manager assumes that an OSV trailhead 'typically' opens in mid-November. Our findings suggest that during the past 10-15 years, this station may not actually achieve sufficient snow to open until early December. As a result, we only report the median opening dates for the past 15 years so that these dates are not biased towards the earlier opening dates of the 1980s and 1990s and are more representative of recent conditions. Low elevation (> 2146 m) stations typically open in late December with middle elevation (between 2146 m and 2520 m) and high elevation (> 2520 m) opening in early areas opening in early December.

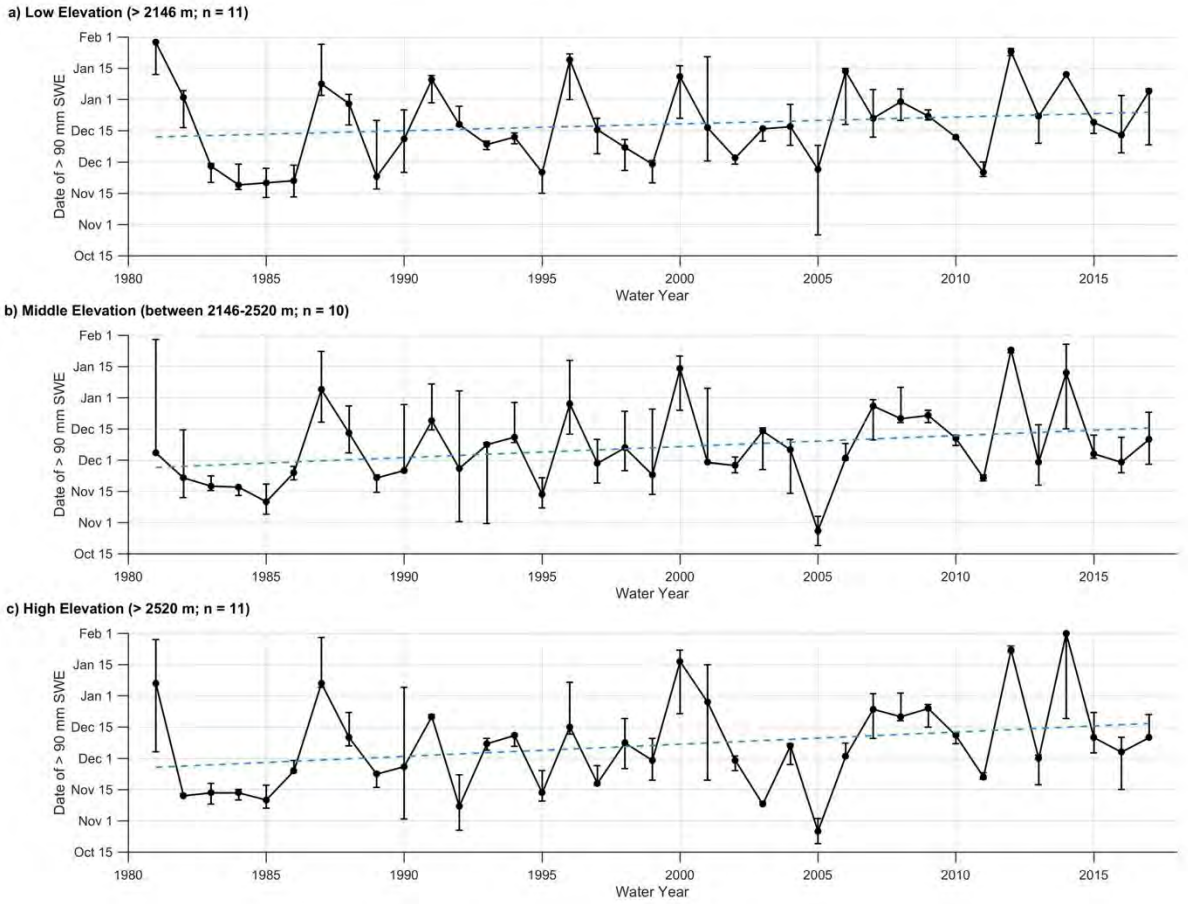

Figure 2: (a) Average median date of achieving >90 mm SWE (black line) with capped bars representing the upper and lower quartile. Dashed blue line represents the 37 year linear trends. (b) As in (a) but for middle elevation stations. (c) As in (a) but for high elevation stations. Note that substantially fewer stations existed at all elevations prior to 1990.

4.2 Median timing of achieving 90 mm SWE

Due to the identified trends towards later dates of achieving 90 mm SWE, we report the median timing of this date over the past 15 years (2003-2017). Middle to higher elevation sites typically achieve 90 mm of SWE during the month of November, with lower elevation sites taking until middle to late December (Figure 3). Please note that the x-axis is reversed in Figure 3 such that the earliest (latest) stations reaching 90 mm SWE are on the left (right). The role of latitude in typical OSV opening dates varies markedly. This results from the relationship being complicated by the southward increase in elevation of the Sierra Nevada that can offset the cooling experienced by more northerly latitudes during the transition into boreal winter. Section 4.3 addresses the latitude-specific relationships in more detail. The larger dot sizes in Figure 3 indicate greater variance in the timing of 90 mm SWE and tend to be concentrated in the higher elevations. This is due to interannual precipitation variability; some years have cold, wet fall seasons while other years are much drier or are characterized by warmer wet storms (such as in October 2009 and October 2016) where little precipitation falls as snow. The moderate positive correlation ($R^2 = 0.39$) at the mountain range scale indicates that elevation alone can be used as a

first order measure to indicate the timing of OSV trailhead opening. Comparisons of historical opening dates as a function of elevation with the timing of 90 mm SWE at nearby stations would provide useful information regarding the use of elevation in determining trailhead opening timing.

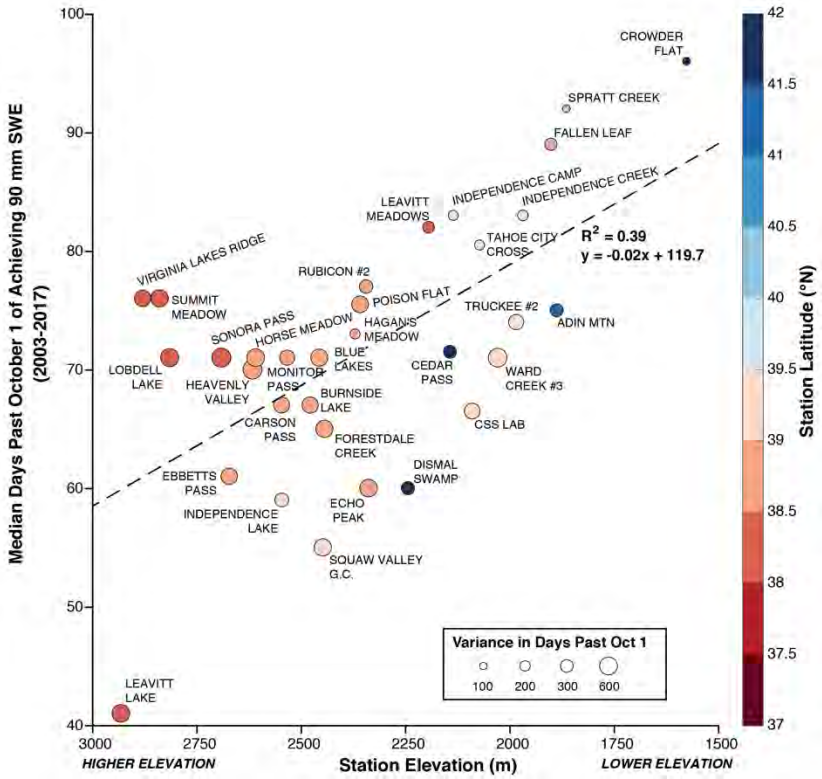

Figure 3: Timing of median opening date (>90 mm SWE; in days past October 1) of OSV usage by station elevation (y-axis) and latitude (filled contours). Dots are sized by the variance in days past October 1 of achieving 90 mm SWE. Dashed black line denotes the linear fit ($R^2 = 0.39$). Note the reversed direction of x-axis so that higher elevation stations are shown to reach satisfactory snow water equivalent earlier.

4.3 90 mm of SWE by station elevation, binned by latitude

Regardless of latitude, the increasing value of the slope coefficient in the slope equation (*m* in $y = mx + b$) with time for all locations (Figures 4-7) indicates the preferential increase in snow accumulation at higher elevation that builds throughout the winter season. At the highest latitudes of the study area, SWE as a function of station elevation is strongly correlated with elevation ($0.86 > R^2 > 0.96$) throughout the early portion of the winter (Figure 4). For the north Tahoe region (Figure 5), SWE is less well-explained by elevation but still moderately positively correlated ($0.51 > R^2 > 0.66$). Presumably this results from the variability of station locations with respect to the Sierra Nevada crest. A strong rain shadow effect results as orographic precipitation enhancement along the windward side depletes moisture and precipitation is inhibited by descending adiabatic motions as air parcels move downstream (to the east). This results in why stations near the crest, such as the Central Sierra Snow Lab (CSS Lab) or Squaw Valley Gold Coast have higher SWE values than the linear fit estimates while stations lying in the lee of the crest (Tahoe City Cross and Independence Camp) tend to have lower SWE values (Figure 5).

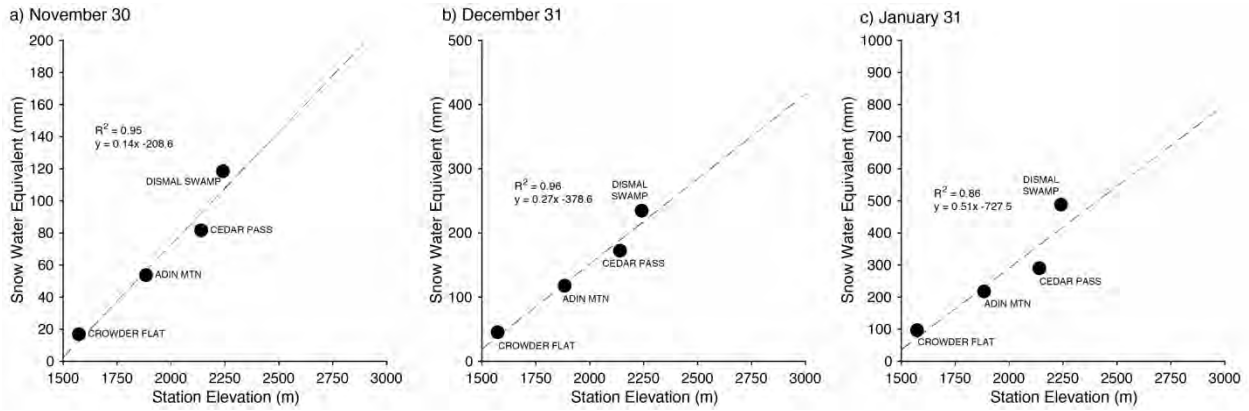

Figure 4: Relationship between station elevation and snow water equivalent for varying end-of-month dates: (a) November 30, (b) December 31, and (c) January 31 for far northern California (>40°N).

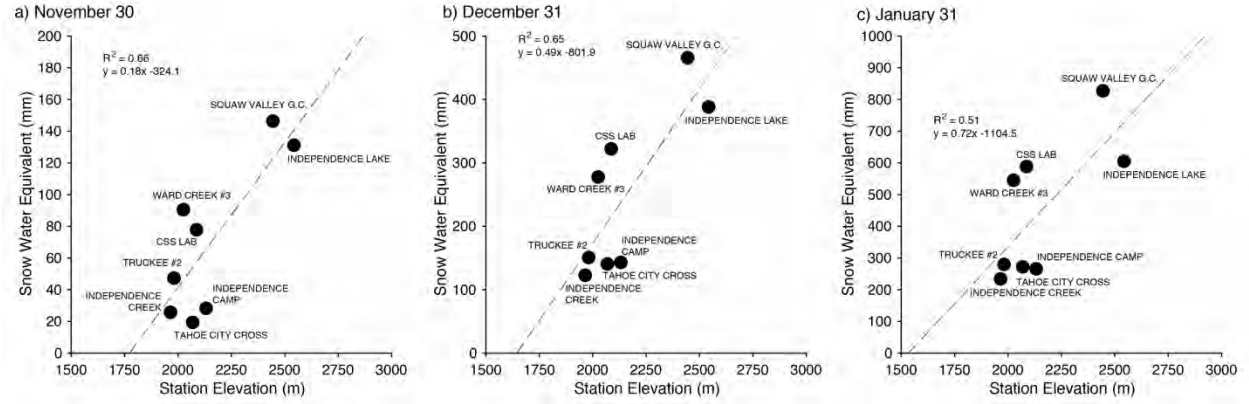

Figure 5: As in Figure 4, but for the north Tahoe region (39-40° N).

Moving further south into the south Tahoe region (Figure 6), increased spread of observed SWE as a function of station elevation is observed, leading to weaker correlations ($0.36 > R^2 > 0.41$). The rain shadow effect may again be influencing the results in this case as Echo Peak sits along the crest while many of the other stations lie well to the east of the crest in the Carson Range (Figure 1). Regardless, the Fallen Leaf to Heavenly Valley relationship can serve as a first-order estimate of low to higher elevation SWE, especially if Carson Pass and Blue Lakes (OSV trailhead) are considered as well. Blue Lakes can be considered a maximum estimate of SWE (and depth) given that it tends to have more SWE than predicted by the linear model. The decrease in SWE dependence on elevation with decreasing latitude continues into the central Sierra (Figure 7) where relationships between SWE and elevation are moderately (at best) and positively correlated ($0.25 > R^2 > 0.31$). Leavitt Lake is likely influenced by wind-driven gauge overcatch and thus should always be considered as a maximum bound on the possible SWE for its elevation; note how it plots far above the linear estimates regardless of date of year (Figure 7). Lobdell Lake and Virginia Lakes Ridge are located well east of the Sierra Nevada crest and thus tend to have less SWE for their elevation than the linear model predicts. Virginia Lakes is a major OSV access point with substantial sensitive riparian and aspen habitat in the area, and thus it is recommended to wait to allow OSV operation until the station reports 90 mm

SWE. This conservative approach may prevent damage to sensitive habitats. On the contrary, the use of Leavitt Lake as an indicator (which has virtually an identical elevation to Virginia Lakes Ridge) would likely promote damage via compaction or unintentional erosion as this station likely is reporting more snow than actually exists regionally.

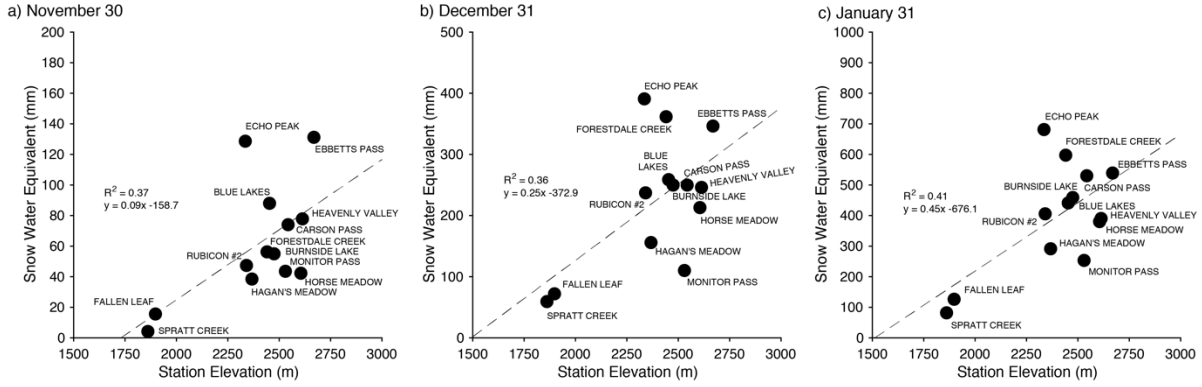

Figure 6: As in Figure 4, but for the south Tahoe region (38.5-39° N).

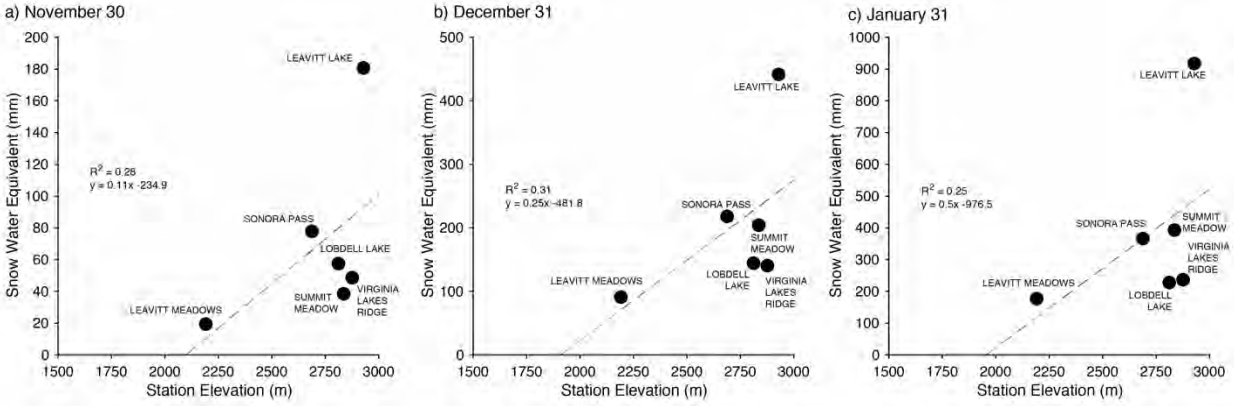

Figure 7: As in Figure 4, but for the central Sierra region (<38.5° N).

4.4 SWE loss once 90 mm has been achieved

A possible concern for OSV trailhead managers arises when sufficient snowpack develops to open the trailhead but is then followed by weather conditions that deplete the snowpack. Such depletion can put vegetation and soil at risk for disturbance during OSV operation. Figure 8 shows the number of times each station underwent a SWE reduction from 90 mm to below 70 mm during the period of study, plotted as a function of elevation. Stations with multiple SWE depletions near OSV trailheads are bolded. Large variability is observed in the number of SWE depletions as a function of elevation. Contrary to expectation, middle and upper elevation stations did exhibit multiple occurrences of SWE depletion. The most frequent depletions (two) for popular OSV destinations at high elevation occurred at Ebbetts Pass with Ward Creek and Leavitt Lake representing middle elevations. Very low elevation stations, as expected, showed the highest frequency of SWE depletion. Squaw Valley, the CSS Lab, and Echo Peak are all at middle elevations but located close to the Sierra Crest and may be some of the most susceptible to intense midwinter rain-on-snow events (Guan et al. 2016). The lack of SNOTEL stations west of the crest prohibited an analysis of lower elevation windward side

evaluations. Snow pillow data is available for this region, but we were unable to download this data in an automated manner at this time. Continuing work seeks to acquire the windward side data in order to extend the analysis to this region.

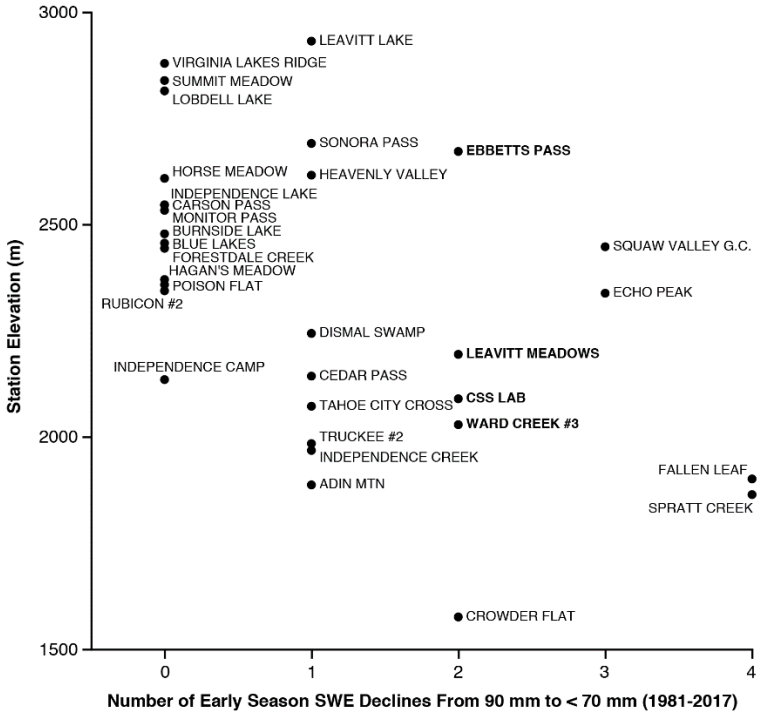

Figure 8: Number of occurrences for each station, by elevation, that SWE declined from 90 mm to below 70 mm before February 28 during the period from water years 1981-2017. Bolded stations are known to have nearby OSV trailheads and had multiple early SWE declines observed.

Three processes that can lead to SWE depletion are presented in Figures 9-11. Two of these examples are examined in a spatial manner in Figures 12c, 13, and 15. The first process is that of a wet snow drought (Hatchett and McEvoy, manuscript submitted to *Bulletin of the American Meteorological Society*) observed at Ward Creek (a popular OSV trailhead above the west shore of Lake Tahoe). A wet snow drought occurs when precipitation is above normal (note dashed gray line is well above the blue line in Figure 9a) but SWE is below normal (note thick dark green line is below the light thin green line in Figure 9a). Wet snow droughts are produced by warmer storms with higher elevation rainfall and exacerbated by above normal temperatures (occasional departures of maximum temperatures shown in Figure 9b). By late November, sufficient SWE existed to open the trailhead, however in early December a warm storm (note precipitation increase, SWE decrease, above normal maximum temperatures (note that maximum temperature controls precipitation phase at daily time steps; Rajagopal and Harpold (2016)) in Figure 9) caused SWE to decline below the 70 mm threshold (horizontal dashed black line in Figure 9a). Continued warmer storms with accumulating precipitation but falls in SWE combined with several above normal maximum temperatures led to the establishment of snow drought conditions for the remainder of December before a colder storm promoted substantial SWE accumulation on January 3 2017. This wet snow drought period coincided with the holiday

period and likely intensive OSV use of the area and demonstrates an example of how closure of this trailhead may have been warranted in early December to prevent damage to the landscape. A view using SNODAS output of the evolution of this season is presented in section 4.6 (Figure 13).

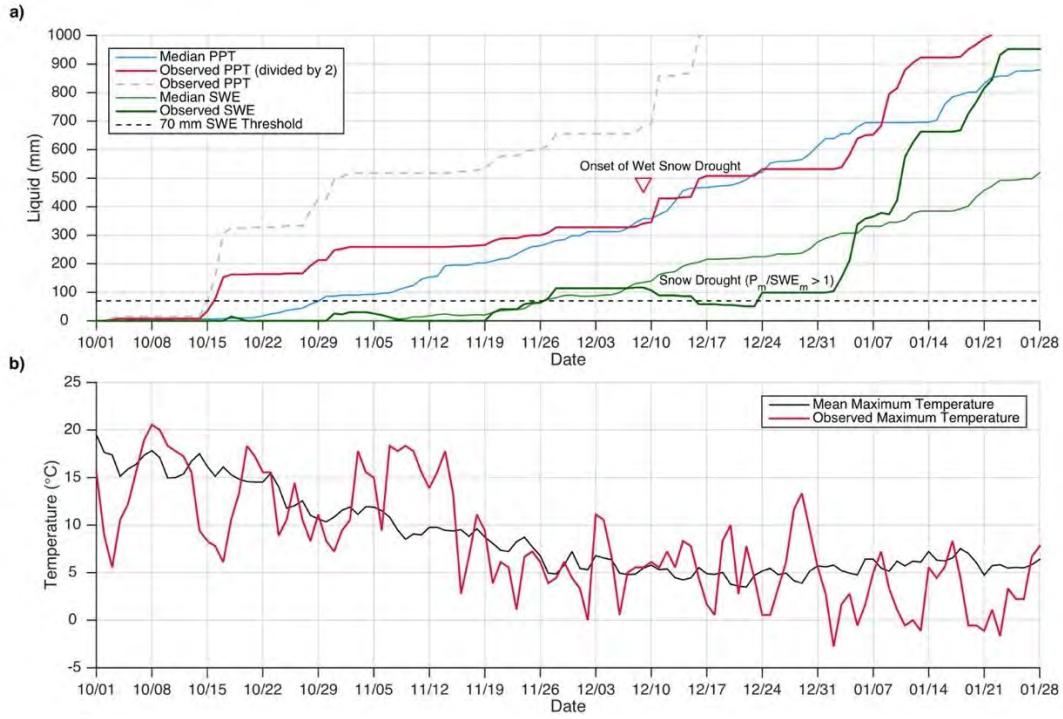

Figure 9: Example of SWE loss due to onset of wet and warm snow drought conditions at Ward Creek, California. (a) Observed precipitation shown in red but divided by two (dashed grey shows actual precipitation and the 1981-2010 median precipitation is shown in blue) and observed SWE in dark green (1981-2010 median SWE is shown by the thin green line). (b) Observed (red) and mean 1981-2010 maximum temperature.

A second SWE depletion example occurred at the Truckee station during a warm spell in early January of 1994. Below average SWE conditions existed throughout the December-February 1994 period, with SWE values hovering just below the 90 mm SWE threshold for several weeks in December until finally surpassing 90 mm on January 5 1994 (Figure 10a). Several days later, a period of persistent above average temperatures ("warm spell" on Figure 10b) coincided with a weak precipitation event (rain) that led to SWE depletion during the second and third weeks of January (Figure 10a). SWE did not decline continuously during this period, rather it reached a steady-state minimum but did not recover until early February. The relative flatness of the observed precipitation (red line in Figure 10a) indicates the multiple extended dry periods during the peak of winter. The combination of above average temperature with likely clear sky conditions (deduced from the lack of precipitation) implies that the Truckee observations represent a minimum SWE loss, as much greater losses would have resulted on sun exposed slopes due to radiation and above normal daytime temperatures. Lower elevation regions likely also lost appreciable snow due to the thermal regime.

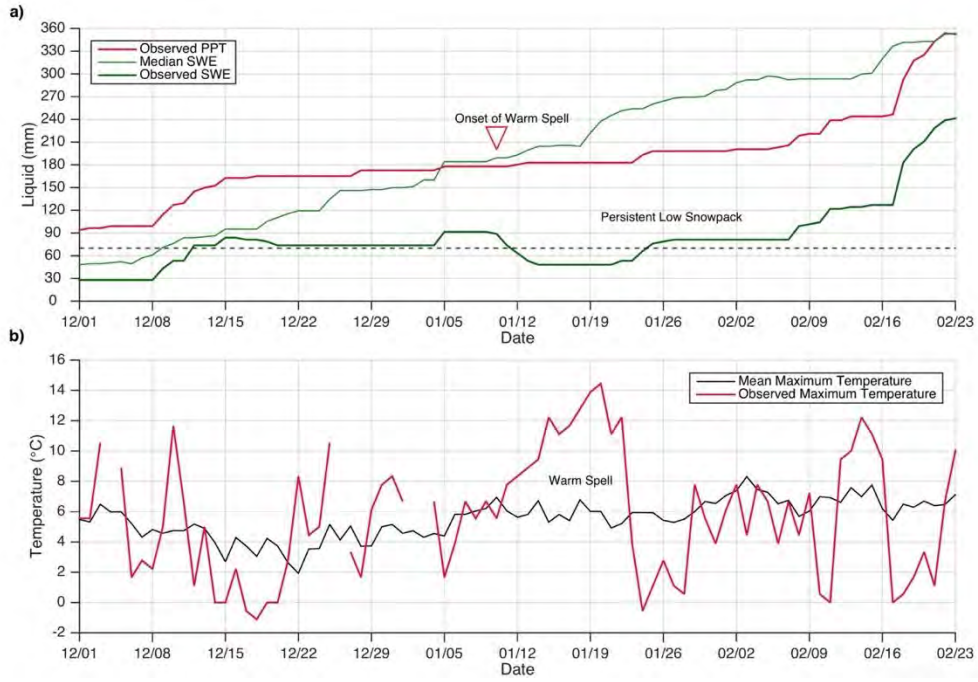

Figure 10: Example of SWE loss due to January warm spell Truckee, California. (a) Observed precipitation shown in red and observed SWE shown in dark green (1981-2010 median SWE is shown by the thin green line). (b) Observed (red) and mean 1981-2010 maximum temperature.

A final example of SWE depletion is provided in Figure 11 for the Tahoe City Cross SNOTEL station during the 2016 season. In this case, the purpose of this example is to demonstrate that rapid SWE loss can occur during late winter/early spring and result in poor OSV trailhead conditions at lower elevation areas. Throughout much of the year, both SWE (green line) and accumulated precipitation (dashed gold line) were well above normal (Figure 11). In mid-February (~day 120), SWE plummeted below normal and reached a value of 30 mm at the time of year (early March) when it normally achieves its maximum value. Persistent warm and dry conditions (note flat lines in accumulated precipitation that indicate periods of now precipitation in Figure 11) rapidly melted the snowpack during this time. This produced late onset snow drought conditions, where late in the season, accumulated precipitation is above average but SWE is below average due to early melting. Marginal recovery occurred during two storms in early and mid-March, but SWE quickly fell to 0 mm by the end of the month when normally 240 mm of SWE would be expected at this station. A spatial view of this example is provided using SNODAS output in section 4.6 (Figure 12c) and using Google Climate Engine remotely sensed observations in section 4.7 (Figure 15). This example demonstrates that OSV trailhead managers must remain vigilant throughout the season and continuously monitor weather and snowpack elevations at various elevations. Low elevation trailheads would likely have necessitated closures to protect natural resources during this period.

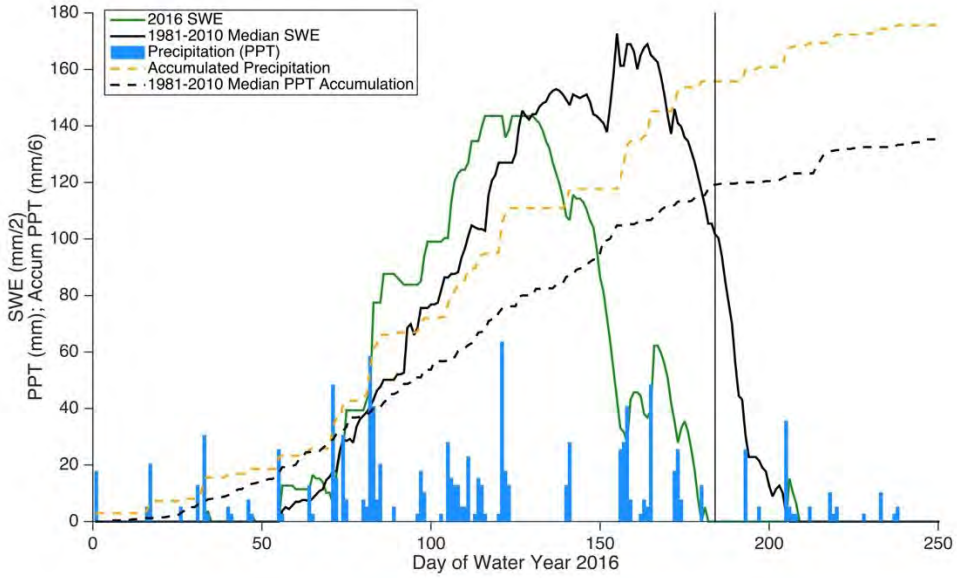

Figure 11: The spring loss of SWE at Tahoe City during 2016, indicative of the onset of late season snow drought. The black vertical line indicates April 1 2016 and the first day of the water year is October 1 2015.

4.5 SNODAS

Spatially distributed (1 km horizontal resolution) output from the process-based SNODAS model is available at daily resolution for much of North America and can be readily accessed online and manipulated to specific areas and output variables via the website listed in Section 2. The snow depth anomaly maps (Figures 12 and 13) are calculated by taking the snow depth output for a selected date and differencing these depths from the long-term (2003-2016) average, and may represent a useful tool for OSV trailhead managers. Figure 12 presents three examples of how SNODAS can be used to evaluate various scales of anomalous snow depths across the Sierra Nevada. Figure 13 shows the temporal evolution of how snow conditions changed over a one-month period in the Sierraville/Sierra City region.

Widespread dry snow drought conditions (well-below average precipitation and SWE; Hatchett and McEvoy, submitted) existed throughout the northern California region in January 2012 (Figure 12a). The greatest negative anomalies in snow depth (below average depths on the order of more than 24 in.) are found in the higher elevation regions of the Sierra Nevada. These findings are in agreement with satellite-based estimates of negative snow cover anomalies (Figure 14). During January of 2016, SNODAS demonstrates a strong depth anomaly gradient between the central and southern Sierra Nevada with positive anomalies to the north and negative anomalies to the south (Figure 12b). Interestingly, lower elevations have positive anomalies throughout while the High Sierra region exhibits below average depths. This may result from several possible combinations of weather conditions: 1) colder, dry storms with weaker orographic precipitation gradients that result in more snow (relative to average conditions) at lower elevations with less snow at higher elevations, 2) wind transport and 3) sublimation that can remove snow preferentially from higher elevations. Range-wide conditions following the late-season onset of snow drought (recall Section 4.4 and Figure 11) shows the continuation of the north-south gradient in snow depth anomalies (cf. Figure 13b and 13c). Figure 13c also demonstrates the low elevation anomalies throughout the Sierra Nevada that

resulted from the dry and warm conditions during February. These below average snow depth conditions were particularly extensive along the eastern (leeward) side of the Sierra Nevada.

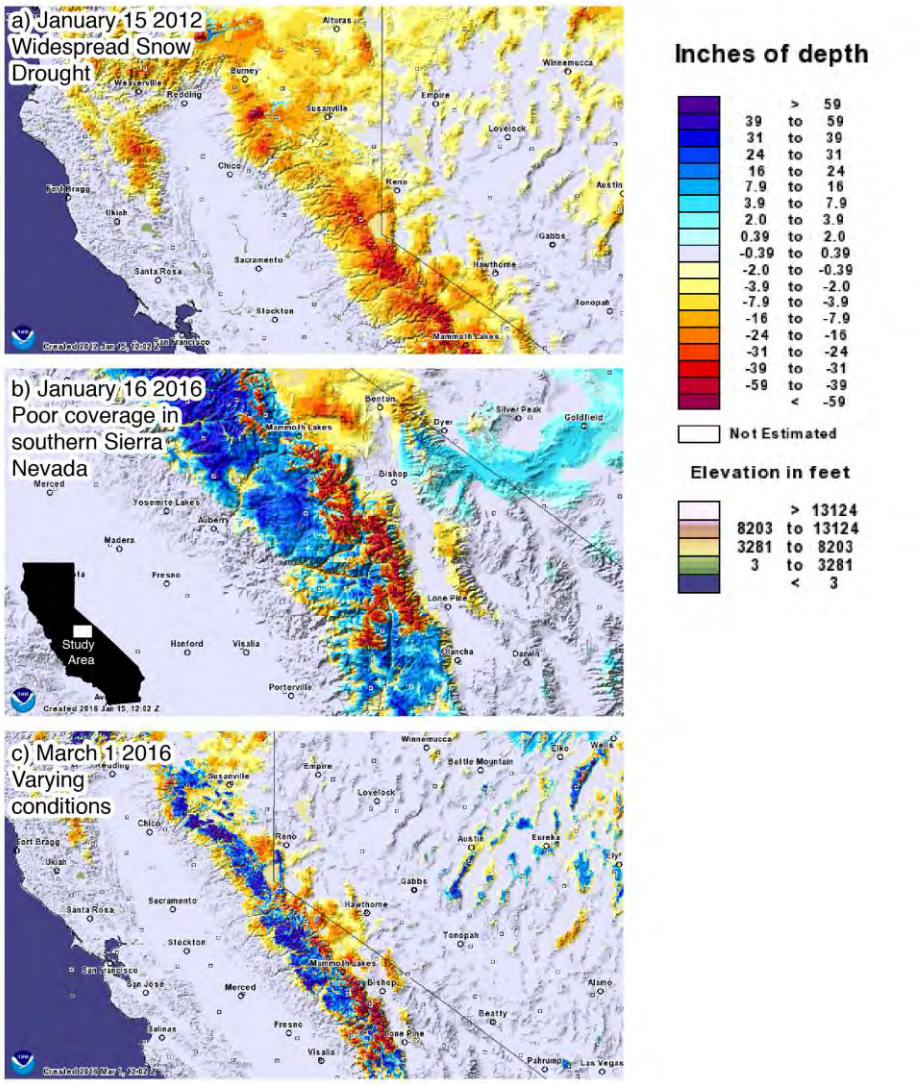

Figure 12: Examples of SNODAS snow depth anomalies (observed minus 2003-2016 averages) at various scales. (a) Northern California, (b) southern Sierra Nevada, and (c) near-entirety of the Sierra Nevada.

The relatively fine scale horizontal resolution (1 km) of SNODAS allows detailed examinations of complex terrain. During the wet snow drought period of December 2016-January 2017 (described in Section 4.4), the lower elevation northern Sierra Nevada underwent a dramatic transition from below average snow depths at most elevations in mid-December (Figure 13a) to marginal recovery in late December (Figure 13b) to being well-above normal in early January throughout the domain (Figure 13c). The precipitation events producing the recovery and towards plentiful (>40 in. anomalous depth) snow conditions are shown in Figure 9a. During December, Figures 13a-b indicate that many populated regions were 6 in. to more than 10 in. below average in terms of snow depth. If one assumes that such low elevation regions are likely near their climatological median (mid-December, cf. Figures 2a, 3, and 5a-b) for sufficient snow

depth (11 in.) under the SWE approximation, the SNODAS output suggests that widespread areas likely do not have enough snow for safe OSV operation. If OSV trailheads exist near areas of anomalous positive snow depths (Figure 13a), a manager would be able to make a more informed decision about keeping these trailheads open (e.g., northwest of Truckee; Figure 13a) while closing those elsewhere (e.g., north of Sierra City near Graeagle or southeast of Sierraville; Figure 13a). After a storm, SNODAS can aid in reassessment of closures and openings (e.g., opening Sierra City area trailheads but keeping the region southeast of Sierraville closed; Figure 13b). As I am not sure about whether OSV trailheads can actually undergo opening and closing throughout the season, these ideas are merely speculation as to potential management decisions. In such events, field visits to ground truth the SNODAS output at anomalous positive depth areas is recommended if resources allow.

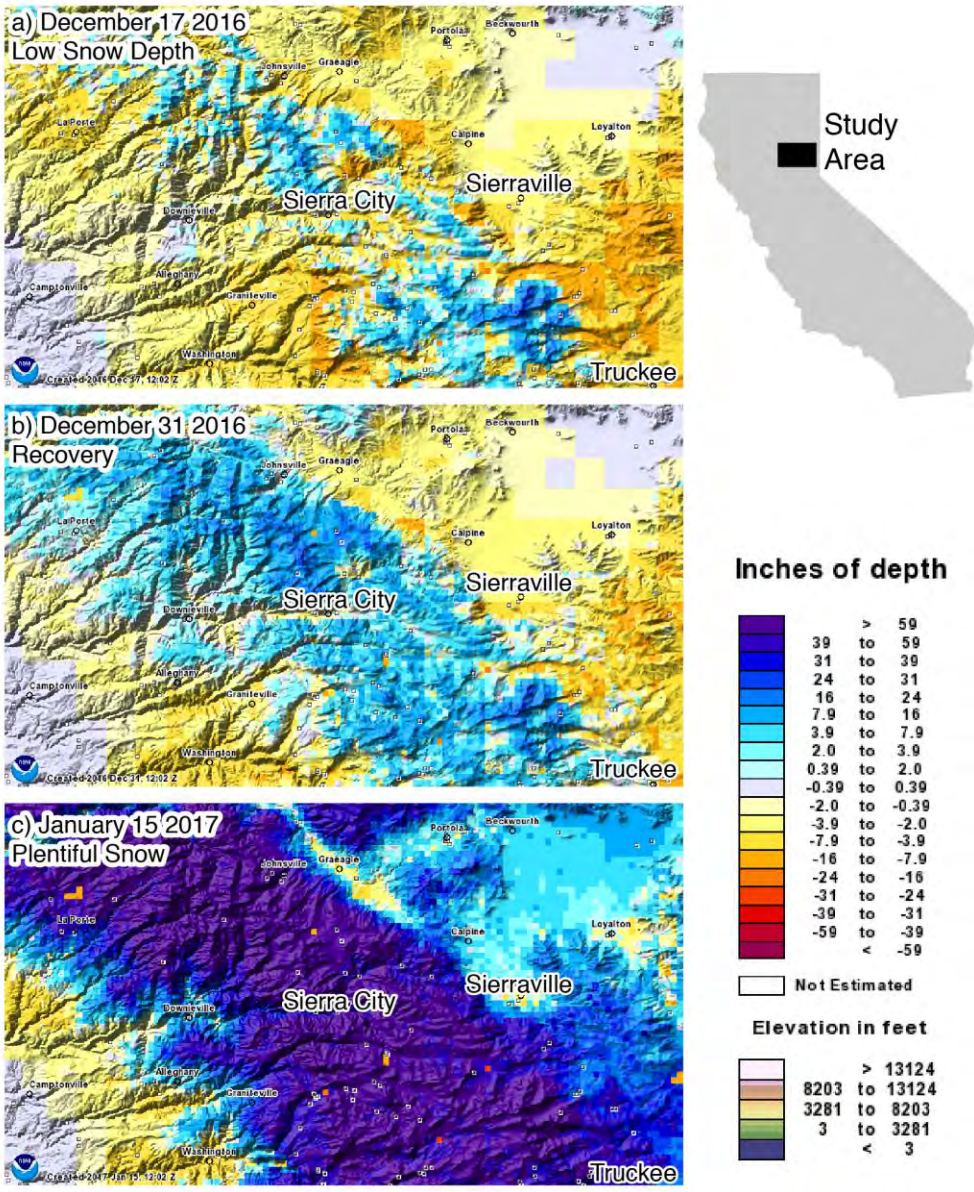

Figure 13: Evolution of the 2017 season in the northern Sierra Nevada through the snow depth anomaly (observed minus 2003-2016 averages) for (a) December 17 2016, (b) December 31 2016, and (c) January 15 2017.

The information provided by SNODAS will become substantially more useful once the citizen-science snow depth measuring program (with a protocol given in Appendix 1) has been implemented for several years. This project will provide independent depth information for specific areas of interest (OSV trailheads). Without independent depth measurements at the points of interest to compare against SNODAS output, little conclusive information or a robust empirical-statistical relationship can be developed between OSV trailheads and SNODAS estimates of snow depth. The acquisition of actual measurements will allow an estimation of SNODAS bias (too much or too little depth) for various times of the season and for various snow accumulation scenarios. This information will be useful in further constraining SNODAS estimates for OSV decision making and in providing feedback to the model development team in an effort to improve the model. Even more simply, such measurements will allow for a binary comparison to be made (presence/absence of snow). As it is a model that assimilates observed data, we can expect the uncertainty of SNODAS estimates to be larger in areas where few observations exist. In data-sparse regions and when field visits are not possible, SNODAS outputs of snow depth are recommended to be incorporated into OSV opening decision making provided that it is acknowledged that SNODAS likely represents a maximum estimate or upper bound of snow depth. A similar acknowledgement is nonetheless recommended in relatively data-rich regions such as the central and northern Sierra Nevada. Last, identification of below average snow depth conditions during the latter portions of winter seasons (e.g., Figure 12c) could be used to target regions for field studies to examine if damage to vegetation or soil compaction occurred under the shallow snow conditions with likely saturated soils.

4.6 Climate Engine

Google Climate Engine is a newly available web-based portal for accessing and visualizing climate and remote sensing data (climengine.appspot.com; Huntington et al. 2017). A screenshot of normalized differenced snow index (NDSI), or a satellite-based reflectance estimate of snow cover, for the period of early January 2012 (recall Figure 12a) is shown in Figure 14. The interface is user-friendly and offers a variety of calculations and the ability to download a geoTiff image file for use in ArcGIS or other analysis programs. Note the widespread negative values throughout California and Nevada indicating well-below average snow cover. While NDSI does not directly measure snow depth, its coverage is global, it is updated daily, and it has a horizontal grid resolution of 500 m. This allows it to be used to subjectively evaluate snow conditions (presence or absence and even degree of coverage) in remote regions that may not have data otherwise available. An example of this is provided in Figure 15, where low elevations around the Tahoe Basin underwent rapid snowmelt during a hot period in February 2016. Conditions at lower elevations rapidly deteriorated from above normal (Figure 15a) to below normal (Figure 15b), and observation stations tend to be sparse at these elevations. This situation could have severe negative impacts on OSV trailheads as users are still excited to ride but shallow conditions and saturated soils set up a favorable environment for compaction and disturbance. In this case, the Tahoe City Cross SNOTEL (Figure 16) did capture the melt out, but this may not be the case for other regions of the Sierra Nevada or elsewhere in the intermountain west. For these regions, Climate Engine can be used in conjunction with SNODAS to provide information on likely OSV trailhead snow depths (cf. Figure 13b and 13c). For example, if NDSI anomaly values are strongly negative and SNODAS also shows negative snow depth anomalies (cf. Figure 13b and Figure 15b, it would provide confidence in the

decision to limit OSV access at certain trailheads. On the other hand, if NDSI and SNODAS do not agree, the manager may want to inquire with locals or perform a field visit if possible. Either way, the combined use of these two web-based tools can aid in OSV trailhead decision making by providing additional guidance on the spatial distribution of anomalous positive (more) or negative (less) snow depths in their management areas. Furthermore, use of these tools in decision making allows the manager to provide evidence in support of their decision that can be communicated to the public via social media channels or on the web. A dialogue based upon data represents a better outcome than one that does not exist or rests solely upon what appears to be the opinion of a government official.

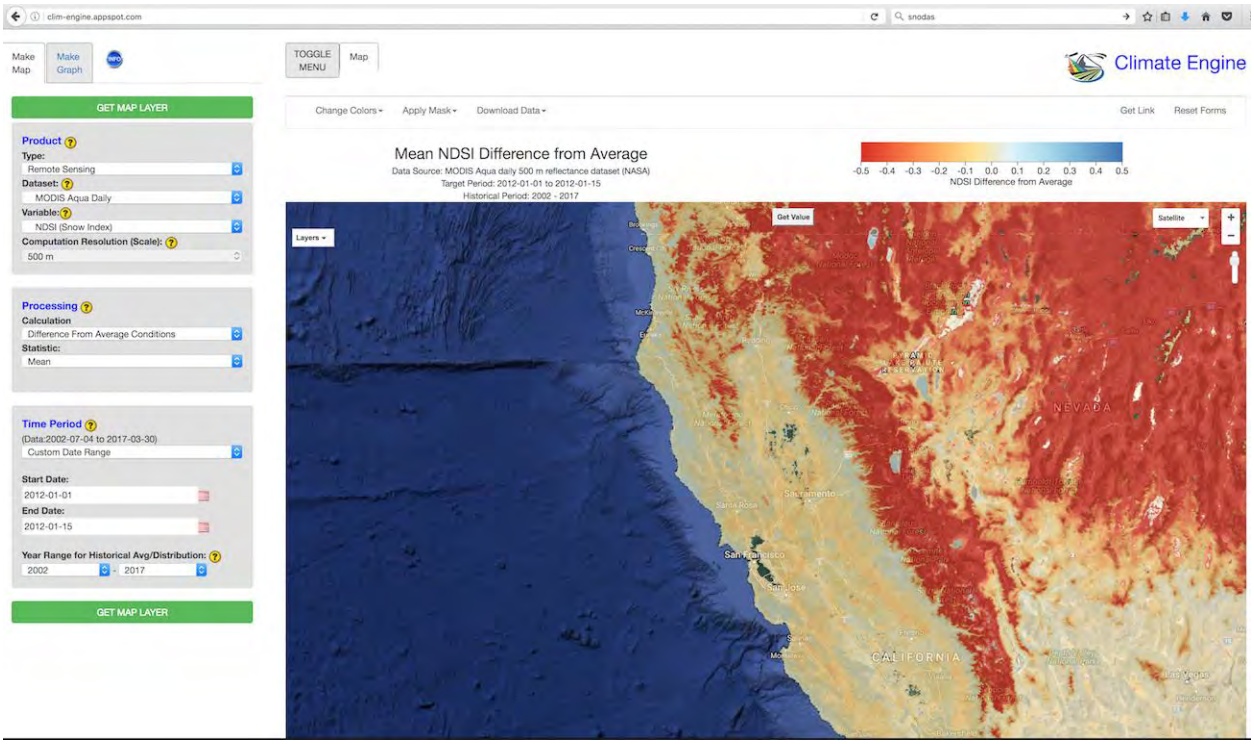

Figure 14: Screenshot example of the Google Climate Engine interface during the January 2012 low snow conditions (cf. Figure 12a).

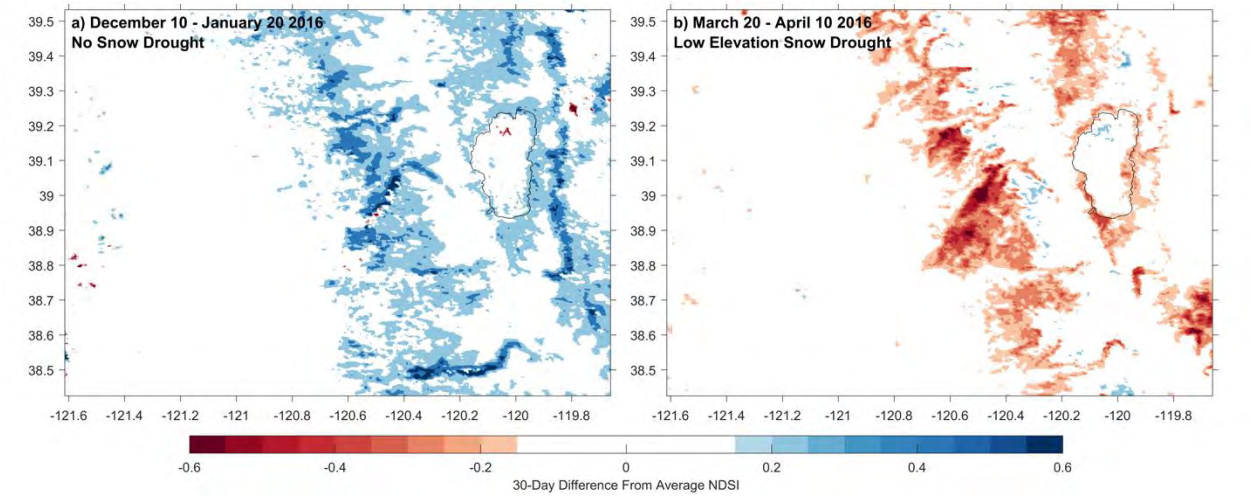

Figure 15: Onset of lower elevation snow drought in the Lake Tahoe region was determined by MODIS Aqua normalized differenced snow index anomalies (observed minus 2002-2017 average). (a) Anomalous positive NDSI (blue colors) during December-January resulted from above normal precipitation and snowfall at lower elevations. (b) Persistent warm and dry conditions during February (see also Figure 14) resulted in substantial snowpack decline at lower elevations and created negative NDSI (red colors) along the periphery of the Sierra Nevada. This would indicate that while sufficient snowpack exists at upper elevations for OSV usage, lower elevation trailheads may have become susceptible to disturbance.

5. Summary and Future Work

We have presented a pilot study focused on developing a better understanding of when specific locations attain sufficient snowpack conditions to allow safe over snow vehicle (OSV) usage. A station-based observational analysis of 38 remote snow sensors in the Sierra Nevada indicated median timing of achieving sufficient depth under a density assumption to allow OSV usage ranged from mid-October-late December as a function of elevation. Our analysis indicates that the median timing for opening trailheads for OSV operation increased by nearly three weeks during the past 37 years. Online snowpack models such as SNODAS and satellite-based data hosted and visualized through Google Climate Engine were shown to provide additional guidance in OSV trailhead opening decision making. Three types of weather regimes that can lead to snowpack decreases during the winter or early low elevation melt-out were demonstrated. Employing the citizen science-based protocol (see Appendix 1) during the early portion of subsequent winters will allow additional verification of the findings described herein as well as adjusting them as necessary to better inform decision makers on the timing of OSV trailhead opening.

Even simplistic predictive models of snow accumulation driven by inputs of precipitation and temperature at a point in space but distributed in time are not trivial to implement. The readily available output from SNODAS represents a physically realistic and reasonable method to estimate spatially distributed snowpack conditions (i.e., depth and SWE) given the knowledge that SNODAS represents a maximum estimate. Short of field visits and until several years of trailhead snow depth measurements have been performed, this study recommends the combined use of SNODAS with station data (if available and recognizing that SNODAS assimilates this

data) and NDSI from Google Climate Engine to inform OSV trailhead opening decision making. For OSV trailhead locations with nearby snow sensors, the simple, derived relationships explaining snow depth as a function of elevation (under the assumption of maritime snow density) are recommended when making trailhead opening decisions. In these regions, use of SNODAS and NDSI are still recommended. The continued implementation of the citizen science snow depth protocol is strongly encouraged in order to better constrain estimates of snow depth from observations and model output. A final recommendation is to perform a detailed evaluation of soil compaction effects of OSV usage under varying snow depth, snow density, and soil conditions. Such a study could be undertaken during the early winter season using a soil cone penetrometer, several snowmachines of varying characteristics, a snow density measurement kit, and a soil tamper. The results of this study would help quantify the minimum snow depth (under varying densities) required to avoid soil compaction from OSV use and could guide more robust travel management plans in National Forests.

Acknowledgements
The author gratefully acknowledges the support of Winter Wildlands Alliance in this research, the Natural Resource Conservation Service for providing access to the archived SNOTEL data, the National Snow and Ice Data Center for providing access to the SNODAS output, and the team at Google Climate Engine. David Reichel and Nathan Greenberg are thanked for putting Winter Wildlands Alliance in contact with the author to pursue this project. Hilary Eisen and Christopher Garner are thanked for helpful comments and suggestions that improved this report.

References

Baker, E. and Bithmann, E., 2005: Snowmobiling in the Adirondack Park: Environmental and Social Impacts. St. Lawrence University, Department of Biology.

California Department of Parks and Recreation, 2010: Over Snow Vehicle Program Final Environmental Impact Report: Program Years 20102-2010. State Clearinghouse # 2009042113. 156 pp. [Accessible at: http://www.parks.ca.gov/pages/25010/files/osv%20program%20final%20eir_complete%2020101217.pdf].

Fox, S. and Kiesse, M., 2004: Winter Recreation Effects on the Subnivean Environment of Five Sierra Nevada Meadows. Report to the Lake Tahoe Basin Management Unit. 31pp. [Accessible at: http://www.snowmobileinfo.org/snowmobile-access-docs/Winter-Rec-Effects-on-Subnivean-Enviro-of-5-Sierra-Nevada-Meadows.pdf]

Hatchett, B.J. and D. McEvoy: The Hydrometeorological Origins of Snow Droughts. Manuscript submitted to the *Bulletin of the American Meteorological Society*.

Huntington, J., Hegewisch, K., Daudert, B., Morton, C., Abatzoglou, J., McEvoy, D., and T., Erickson, 2017: Climate Engine: Cloud Computing of Climate and Remote Sensing Data for Enhanced Natural Resource Monitoring and Process Understanding. *Bulletin of the American Meteorological Society*, accepted.

Patterson, Glenn G., 2016: Trends in snow water equivalent in Rocky Mountain National Park and the northern front range of Colorado, USA, Ph.D. dissertation, Colorado State University Department of Geosciences, 136 p. [Accessible at: https://dspace.library.colostate.edu/bitstream/handle/10217/178945/Patterson_colostate_0053A_13989.pdf?sequence=1&isAllowed=y].

Rajagopal, S. and A.A. Harpold, 2016: Testing and Improving Temperature Thresholds for Snow and Rain Prediction in the Western United States. *Journal of the American Water Resources Association*, **52**(5), 1142-1154, doi: 10.1111/1752-1688.12443.

Stangl, J.T., 1999: Effects of Winter Recreation on Vegetation. National Park Service: Effects of Winter Recreation on Wildlife: 119-121.

Sturm, M., B. Taras, G.E. Liston, C. Derksen, T. Jonas, and J. Lea, 2010: Estimating Snow Water Equivalent Using Snow Depth Data and Climate Classes. *Journal of Hydrometeor.,* **11**, 1380–1394, doi: 10.1175/2010JHM1202.1.

Appendix I: Snow Sampling Protocol

Available online at:
[https://docs.google.com/document/d/1DTdkW7vJKchhpfMLFWUaGb_4w4kHFl86TaedLR2_G2k/edit]

Measuring snow depth at OSV trailheads

Primary goal: To develop a relationship between measured depth at a trailhead location and observed snow water equivalent (SWE) and/or depth from nearby snow pillows from the SNOwpack TELemetry (SNOTEL) or California Department of Water Resources stations and using the distributed SNOw Data ASsimilation (SNODAS) model. Doing so will improve the USFS' knowledge of when sufficient snow depth exists at Over Snow Vehicle (OSV) trailheads to open or close them.

Materials Required:

1. Probe with increments in centimeters (preferably) or inches.
2. Camera (a phone with a panorama camera function is ideal)
3. Rite in the Rain notebook or Mountain Hub App
4. Phone with Mountain Hub App (MHApp) installed (David Page will be able to help you set this up).

Steps in Measuring Depth:

1. Identify the trailhead location you would like to sample (e.g., Mount Rose Meadows, Yuba Pass, etc.) and travel to this area.
2. The MHApp will record details about the trailhead including: latitude and longitude, elevation, date and time of sampling, but feel free to note weather conditions (snowing, sunny), and any other relevant information ('very patchy snow cover', 'trailhead is a USFS road', etc.) using the MHApp. Alternatively, if you do not have a smartphone, record this information in your notebook and email it to a friend who has a smartphone with the MHApp when you get home. They will probably trade data entry for a favorite beverage or two.
3. From the parking area, use your camera to photograph a complete view of the trailhead. This can be done through incremental photographs along a constant horizon or best done using the panorama function on your phone's camera. If the trailhead is a road, this can be done with a single photo, but in the case of a trailhead like Mount Rose, a 180° panorama will be excellent. This step will provide useful information on the context of the trailhead in terms of topography, vegetation, and variability of snow coverage, how the area is used to stage OSVs, how the OSV traffic behaves at the trailhead (a few tracks confined to a road/trail or driving all over the place) among other things.
4. Note also the snow conditions, being as descriptive as necessary. This can range from 'uniform, consolidated, compacted, spring snow' to 'highly variable winter snow, ranging from untracked and still fresh to greatly compacted'. In the case of the latter, you can estimate the fraction of each (20% fresh, 50% compacted, 30% very compacted).
5. Identify and note the primary corridor, if one exists, of OSV usage/staging. This will be the area you want to sample. Make sure this area is captured in your study area photo in step 3. If you would like, take a screenshot of your study area and illustrate your primary corridor.
6. You will be sampling along a grid extending beyond the peripheries of the identified primary corridor (Figure 1). The sampling grid will be somewhat a function of the area and should include 20-30 measurements along a 5 x 4, 5 x 5, or 5 x 6 grid (length x width). A wider grid (7 x 3) works well for open areas while a narrower grid (4 x 5 or 3 x 7) would be useful for an area confined to a narrow trail or road. Note your grid setup and try to start at the skiers left corner of your grid nearest your starting point (bottom left in map view). Make a note of this ('SW corner, next to Highway 431').

7. Your grid measurement points should be equally spaced based upon the area you are sampling and should be no closer than 3 meters (~10 feet) and no further apart than 10 m (~30 feet). Ideally, a spacing of 5-7 meters (~20 feet) should be good and can be thought of as 5-7 strides on your skis.
8. Enter the grid dimensions in the MHApp as a note.
8.5. Add a photo for reference and illustration on each post on MHapp (see example image below).
9. If it turns out to be a major pain to enter each measurement in the MHApp (your feedback will be valuable in this regard), follow the same protocol listed in steps 6-8 and 10-11 (below) and use a notebook to record the values. Using your phone or computer at home, sum up the values and divide by the total number of samples to calculate the mean. Enter this in the MHApp, but save your data so we can do other calculations at a later time. [note: according to MHApp team, this may still be complicated with current version. “A work-around here if someone does not have a smartphone, is someone can still enter this information into their notebook in the field, but someone that DOES have a phone needs to transcribe this info into the mobile app and use the location adjuster in the app to record the location properly.”
10. Measure and record the snow depth to the nearest centimeter by inserting the probe vertically into the snow. It is usually best to repeat each measurement two-three times within a meter of where you are standing (think turn left, measure, reach out straight ahead, measure, and turn right, measure). If the measurements agree to within 5 cm, call it good. In shallower snow conditions, this will enable you to avoid erroneous depths due to rocks or logs and stumps. Stop when you feel some resistance. If you have to push hard, check the probe tip to see if it is muddy, indicating that you might be pushing in to saturated soil. If it is clean, you are probably breaking through a crust. Record each value.
11. Using a zig-zag pattern (Figure 3), continue sampling along your grid. If a boulder, creek, or some other impediment exists at a sample point, note this and either adjust your sample point accordingly or skip the point and enter X (so we can differentiate between 0 depth and an object);
12. Along the way, note (and photograph if you’d like!) any observations such as bare soil, vegetation damage, exposed soil that has been brought to the surface, creeks, or riparian areas. A major goal of this work is to keep trailheads open by helping to preventing damage when they should be closed. This comes from knowing something about the snow depth variability!
13. At home (or in the field if using the MHApp), input your measurements into Mountain Hub.
14. Repeat whenever you feel psyched!
15. In your spare time, it would be helpful if you put in locations where you know OSV’s are being staged. Make a note if these trailheads are official or unofficial. This will be very helpful for me in figuring out nearby weather stations.
16. Some things to keep in mind: This is a starting point to gain some basic data and is not a highly-controlled science experiment (yet). To get to that level, you would need to bring a measuring tape and sample over a randomized grid. The more notes and photos you take documenting your measurements, the better we can understand which trailheads will need the higher precision measurements and the better we can make the next iteration of this protocol. **Even just a few data points are better than none! If you only have time to make three measurements and report the average of them (sum them up and divide by three), that is way better than no data!**

Your feedback on this protocol is welcome and encouraged. Please let us know any issues or things that could be explained better.

Figure 1: Example photograph (mimicking a panorama but using Google Earth) showing a possible study area. On the map view, you can denote your primary area of study.

Location	Mount Rose		**Date/Time**	1-Jan-27, 2:15 pm	
Latitude	39.300°N	**Longitude**	119.921° W	**Elevation**	2622.0
Aspect	Flat with slight S exposure			**Grid Size**	5 x 4
Weather	Partly cloudy, light N wind, cold, 15 cm new snow two days ago				
Notes	50% moderately compacted, 40% untracked snow, 10% very compacted				

Grid	**Row**							
Point	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**
1	81							
2	77							
3	78	82						
4	77	80						
5	69	66						
6								
7								

Figure 2: Notebook layout (Excel spreadsheet) with data entry examples. If you don't use centimeters, make a note of that! Note that in Figure 3 the zig-zag path of sampling will cause you to fill out row B in reverse (starting from point 5 and working backwards).

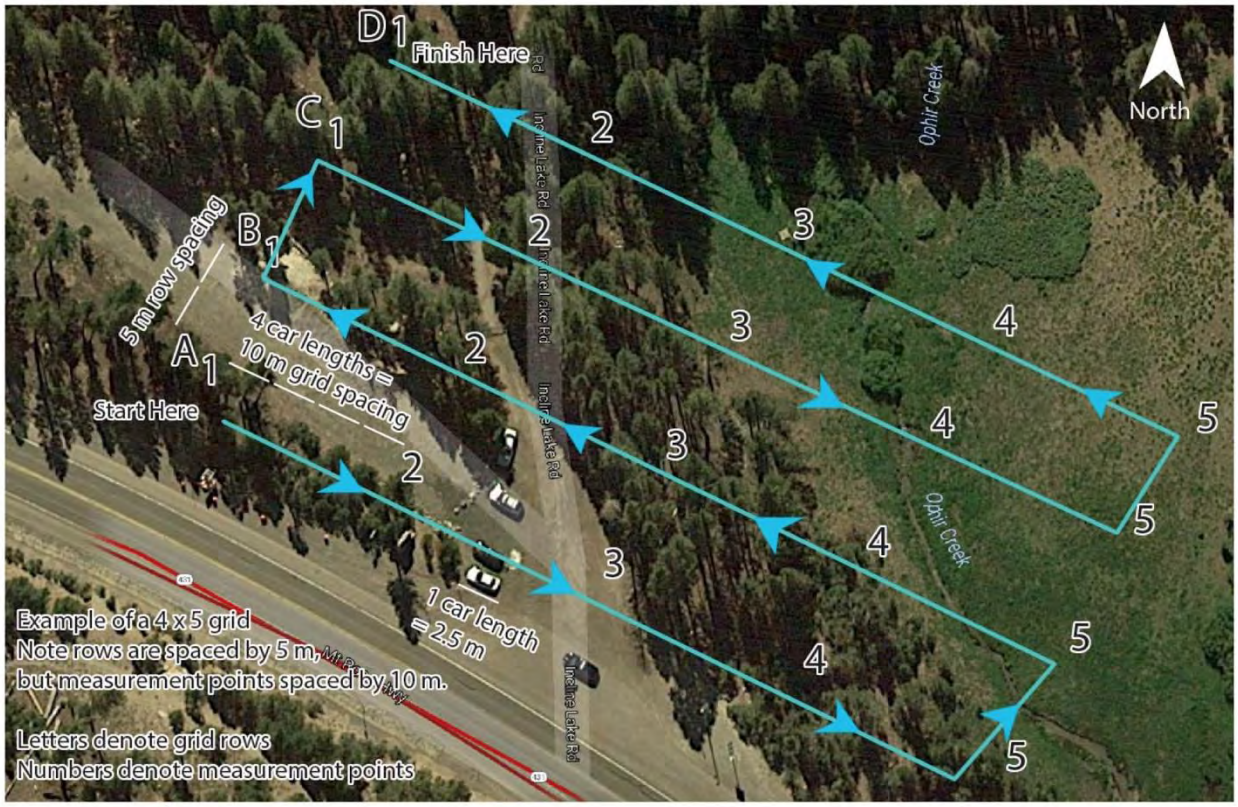

Figure 3: Map view of example sampling pattern. Note that rows are spaced 5 m apart, but measurement points along the row are spaced 10 m. Whatever works is fine as long as you make a note of how you did it! I picked this spacing here to show how you could cover the main staging area, two possible trails, plus a clearly sensitive riparian and meadow area. If you make a quick map for your sampling efforts, it will be helpful in evaluating your collected data.

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Modeling large-scale winter recreation terrain selection with implications for recreation management and wildlife

Lucretia E. Olson [a, *], John R. Squires [a], Elizabeth K. Roberts [b], Aubrey D. Miller [b, 1], Jacob S. Ivan [c], Mark Hebblewhite [d]

[a] Rocky Mountain Research Station, United States Forest Service, Missoula, MT 59801, USA
[b] White River National Forest, United States Forest Service, Glenwood Springs, CO, USA
[c] Colorado Parks and Wildlife, Fort Collins, CO 80526, USA
[d] Wildlife Biology Program, Department of Ecosystem and Conservation Sciences, College of Forestry and Conservation, University of Montana, Missoula, MT 59812, USA

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ABSTRACT

Winter recreation is a rapidly growing activity, and advances in technology make it possible for increasing numbers of people to access remote backcountry terrain. Increased winter recreation may lead to more frequent conflict between recreationists, as well as greater potential disturbance to wildlife. To better understand the environmental characteristics favored by winter recreationists, and thus predict areas of potential conflict or disturbance, we modeled terrain selection of motorized and non-motorized recreationists, including snowmobile, backcountry ski, and snowmobile-assisted hybrid ski. We used sports recorder Global Positioning System (GPS) devices carried by recreationists at two study areas in Colorado, USA, (Vail Pass and the San Juan Mountains), to record detailed tracks of each recreation type. For each recreation activity, we modeled selection of remotely-sensed environmental characteristics, including topography, vegetation, climate, and road access. We then created spatial maps depicting areas that recreation activities were predicted to select and combined these maps to show areas of potential ecological disturbance or interpersonal conflict between motorized and non-motorized activities. Model results indicate that motorized and non-motorized activities select different environmental characteristics, while still exhibiting some similarities, such as selection for ease of access, reflected in proximity to highways and densities of open forest roads. Areas predicted to have only motorized recreation were more likely to occur further from highways, with greater forest road densities, lower canopy cover, and smoother, less steep terrain, while areas with only non-motorized recreation were closer to highways, with lower forest road densities, more canopy cover and steeper terrain. Our work provides spatially detailed insights into terrain characteristics favored by recreationists, allowing managers to maintain winter recreation opportunities while reducing interpersonal conflict or ecological impacts to sensitive wildlife.

1. Introduction

The ecological impact of human recreation on the landscape is a rapidly growing concern for land-use managers, as centers of human population spread out into previously sparsely populated areas (Theobald, 2004). Winter recreation, including backcountry and downhill skiing, snowshoeing, and snowmobiling, is a popular use of public lands, as well as a primary economic driver to communities throughout the western United States (Bowker et al., 2012). Technological advances in motorized winter recreation, such as heliskiing, snow biking, more powerful snowmobiles, and snowmobile-assisted (hybrid) skiing, means that recreationists access increasingly remote areas. With greater numbers of recreationists seeking their own recreation experience on a shared landscape, ecological impacts of recreation as well as encounters between non-motorized and motorized recreationists are likely to increase (Gramann, 1982; Manning & Valliere, 2001).

Increases in the number of people using a recreation area or in

* Corresponding author.
E-mail address: lucretiaolson@fs.fed.us (L.E. Olson).
[1] School of Surveying, University of Otago, Dunedin 9054, New Zealand.

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the spatial extent of recreation can have negative ecological consequences, such as increased disturbance to wildlife. For instance, large-scale displacement of animal populations to areas of poorer habitat has been demonstrated in moose (*Alces alces*) due to disturbance from snowmobiles (Harris, Nielson, Rinaldi, & Lohuis, 2014) and mountain goats (*Oreamnos americanus*) due to the presence of ski areas (Richard & Côté, 2016). The challenge of managing recreation to both allow human use of public lands while also conserving ecosystems is intensified by a lack of detailed knowledge of the spatial and environmental characteristics of human recreation.

In addition to ecological implications, increased recreation also has the potential to exacerbate conflict or safety issues between different recreation user groups (Miller, Vaske, Squires, Olson, & Roberts, 2016; Thapa & Graefe, 2004; Vaske, Carothers, Donnelly, & Baird, 2000). Interpersonal conflict, in which direct or indirect contact between different types of recreationists aggravates users (Jacob & Schreyer, 1980; Vaske, Needham, & Cline Jr., 2007), is likely to depend on the environmental preferences of each type of activity, and the degree to which these preferences overlap. Vaske, Donnelly, Wittmann, and Laidlaw (1995) found low interpersonal conflict between hunters and non-hunters in a Colorado study due to their natural separation by topography, as well as management regulations that prevented interaction. To predict areas more likely to engender interpersonal conflict among recreation types, a better understanding of the terrain characteristics favored by different types of recreationists is needed (Kliskey, 2000; Snyder, Whitmore, Schneider, & Becker, 2008).

Most recreation studies rely heavily on the recreationist to self-report details about his/her movements and interactions with other recreationists (Brown & Raymond, 2014; D'Antonio et al., 2010; Tomczyk, 2011). This provides neither an objective nor complete depiction of the spatial and temporal movement patterns of a recreationist through a landscape (Cole & Daniel, 2003; Hallo, Manning, Valliere, & Budruck, 2004). In addition, self-reported interactions or conflicts with other users may be unconsciously biased by user perception, which may differ from realized interpersonal conflict. For instance, hikers in New Zealand who did not encounter mountain bikers had a more negative opinion of them than those that did (Cessford, 2003). A difference in perception versus realization of conflict could lead to inappropriate management practices in an attempt to reduce conflict where none exists. One way to overcome these methodological issues is to use Global Positioning System (GPS) devices to collect high-resolution spatial data, which can provide an objective depiction of recreationist movements (Beeco & Brown, 2013; Hallo et al., 2012; Lai, Li, Chan, & Kwong, 2007) and interactions.

We use GPS locations collected by recreationists in two locations in western Colorado, USA to model landscape-level recreation patterns. Like many areas in western USA, western Colorado is experiencing rapidly growing winter recreation on public lands, and also has a number of sensitive wildlife species that may be negatively affected by increasing recreation, including threatened Canada lynx (*Lynx canadensis*). We apply resource selection functions (RSFs) and step-selection functions (SSFs) to quantify the importance of a given set of environmental covariates to each recreation activity, as well as to provide a spatial depiction of predicted areas of use (Boyce, Vernier, Nielsen, & Schmiegelow, 2002; Manly, McDonald, Thomas, McDonald, & Erickson, 2002). Both types of models are frequently used in wildlife studies to quantify habitat selection, which is characterized by the environmental conditions at sites used by individuals compared to those same conditions at a set of randomly available locations (Manly et al., 2002). Here we use RSFs and SSFs in a novel way: to determine which environmental characteristics are selected by people taking part in different recreation activities. We quantify selection over the entire recreation study area using RSF models, and employ SSFs to determine selection at a finer scale, as each recreationist moves through the landscape.

The goals of our research were to: 1) use GPS technology to measure movement characteristics of motorized (snowmobile, hybrid ski) and non-motorized (backcountry ski), winter recreationists 2) use spatially-explicit models to predict environmental characteristics and spatial landscapes likely sought by winter recreationists, and 3) use these modeled understandings to determine characteristics of potential interpersonal conflict or ecological impact. Results from our analyses can be used to identify areas selected by different recreation activities to inform management decisions on recreation zoning or education programs to limit interpersonal conflict or reduce wildlife disturbance.

2. Methods

2.1. Study area

Our study area consisted of two broad locations in the Colorado Rocky Mountains, USA (Fig. 1). The Vail Pass site covers an area in the northern Sawatch and Mosquito Ranges, southern Gore Range and western Front Range (approximate centroid coordinates 106.30° W, 39.45°N) near the towns of Vail, Leadville, and Frisco, CO. Data were collected on public lands administered by the White River National Forest and the San Isabel National Forest. The San Juan site covers a large area in southwest Colorado in the San Juan mountain range near the towns of Silverton and Telluride (approximate centroid 107.88°W, 37.82°N). Data were collected on public lands administered by the San Juan National Forest, the Uncompahgre National Forest, and the Bureau of Land Management. Both sites experienced winter recreation between the end of December and early April in the sub-alpine and alpine zones with elevations between 2380 m and 4340 m and annual snowfall typically between 380 cm and 1000 cm (National Weather Service, 2017). Both sites had some level of recreation zoning, where motorized recreation was prohibited in certain designated areas.

The sites differed in terms of terrain and accessibility. Recreation in the Vail Pass site was largely influenced by proximity to major population centers, which are within a 1–2 h drive. Winter recreation was concentrated along Interstate 70 between Copper Mountain and Vail, CO in the fee-operated Vail Pass Winter Recreation Area (VPWRA) managed by the White River National Forest, as well as along Highway 6 over Loveland pass (non-motorized use only). Motorized recreation was heavily concentrated along a network of 50 miles of established groomed routes in the VPWRA. Non-motorized access to backcountry huts in the VPWRA also attract recreation to the area. The VPWRA sees roughly 35,000 fee-paying visitors per winter season, of whom approximately 11,000 are hut visitors (U.S.D.A. Forest Service, 2015). Hybrid use has increased sharply on the VPWRA, where backcountry skiers and snowboarders use snowmobiles or snow coaches to access terrain that would otherwise be inaccessible in a single day-trip. The majority of data collected was motorized or hybrid-use in the Vail Pass site.

Winter recreation in the San Juan site was more dispersed, with a greater number of access portals spread over a larger spatial extent than Vail. Access was highly dependent on the network of maintained roads, especially along U.S. Highway 550 and C.O. Highway 145 (see Fig. 1A), and there was no recreation fee area. The San Juan site was more isolated from major population centers (none within 2–3 h drive). While the majority of winter recreation in the Vail Pass study site was concentrated in fewer than 10 access portals, recreation in the San Juan site occurred from over 50 access

portals, and included over 250 km of established groomed routes. Due to steep terrain, motorized recreation in the San Juan site was more concentrated compared to non-motorized recreation. Taken together, the two study sites effectively capture the spectrum of winter recreation in the Colorado Rocky Mountains and thus provide a broad sample of recreation terrain in western Colorado.

2.2. Data collection

From January to March of 2010–2013, we stationed technicians at recreation access portals to distribute GPS units (Qstarz International Co., Ltd., model BT-Q1300, Position accuracy < 10 m). Technicians sampled recreationists by walking through a parking area and selecting every 4th vehicle (Vail Pass) or driving between access portals and approaching recreationists still at their vehicle (San Juans). For the latter approach, technicians began driving between access portals at approximately 10:00 h, and checked all known access portals (~50 portals) for recreationists at least once per day; technicians spent between 15 min and 1 h at each location, depending on the number of recreationists present, and did not vary the order in which they checked sites. Technicians gave a brief explanation of the project goals, informed recreationists that no personally identifiable information would be collected, and offered a map of the track made by the recreationist as an incentive for carrying the GPS unit. Participants then dropped the GPS unit into a collection bin at the end of the day, or returned it by mail. Technicians recorded the type of recreation activity engaged in and number of people in the group. If > 1 person was in the group, only one GPS unit was given to the group as a whole. While technicians did not sample the same people multiple times per day, it is possible that some recreationists carried a GPS unit more than once during the study. Given the large number (>35,000) of recreationists in our study areas, however, we do not believe that this happened frequently and thus assume independence of recreation tracks, which we define as a single user's, or group of users', daily travel pattern. We recorded snowmobile, backcountry ski or snowboard (hereafter backcountry ski), and hybrid recreation. Snowmobile included any motorized use, including snow-cats and motorized bikes. Hybrid use occurred when skiers or snowboarders were transported by a snowmobile or snow-cat, usually to a peak or ridge, and then skied down the slope.

We visually screened all recorded recreation tracks for erroneous points using ArcGIS (Environmental Systems Research Institute 2011, ArcGIS Desktop: Release 10. Redlands, CA). When screening data, we deleted points that were in areas where recreation was not taking place, such as in parking lots or on highways, as well as outliers that were obviously erroneous based on large distances between a given point and the points directly before and after it. Additionally, points were more prone to error immediately after GPS units were turned on, as the units searched for sufficient satellites to collect data; we closely examined the start of each recreation track and removed all inaccurate points until the locations visually became more consistent (Beeco & Hallo, 2014). For analysis, we divided the GPS points recorded by snowmobilers into those that occurred on groomed routes and those that took place in non-groomed areas (henceforth on- and off-trail, respectively) and hybrid GPS points into ski (non-motorized) and snowmobile (motorized) segments, since we expected terrain selection to differ between these categories. We used road and trail GIS layers provided by the U. S. Forest Service (White River NF, Uncompahgre NF, San Juan NF travel management GIS layer) and considered snowmobile tracks < 15 m to either side of a road or trail as “on-trail” and points > than 15 m as “off-trail” to account for spatial resolution of GPS data. We classified motorized hybrid data when the average speed was greater than or equal to 30 miles per hour (48 km/h) and the track was gaining elevation, or the point fell within 15 m of a trail, and non-motorized hybrid data otherwise.

GPS location data were recorded at 5 s intervals; if GPS units remained stationary, however, no location was collected until the device detected movement. Since recreation activities occurred at different speeds, this resulted in locations that ranged from 1 m to 40 m apart. To best assess conflict potential between recreation activities, we standardized spatial scales by sub-sampling recreation activities at approximately 140 m between points (20 s interval for snowmobiles, 25 s for hybrid snowmobiles, 60 s for hybrid skiers, 120 s for backcountry skiers). This represented a fine-scale perception distance at which both motorized and non-motorized recreationists might make movement decisions. We also used magnetic and infra-red trail counters as an independent assessment of recreation intensity and distribution throughout our study areas to verify the efficacy of our GPS sampling. Trail counters recorded the number of people passing by constricted trail segments used by various recreation activities. We visually compared the counts from trail counters to GPS recreation tracks to locate any areas that had recreation but were not being adequately sampled by GPS methods, and adjusted our sampling efforts accordingly. We also used trail counters to identify intense periods of use during the day and week to better inform our sampling effort. We summarized trail counter data to mean counter hits per day of week and hour of day at each study area.

2.3. Environmental variables

We considered 12 environmental covariates as potential predictors of recreation selection. Covariates were chosen based on factors that we believed were important to recreationists: topography, vegetation, climate, and access (Table 1). To account for the possibility that recreationists might consider these environmental covariates at different spatial scales when making land use decisions, we considered all variables at four spatial scales. We used ArcGIS to calculate the average of each covariate within 125 m, 500 m, 1250 m, and 2500 m radii, chosen to span both small and large-scale movements based on observed recreation travel distances. We standardized all covariates by subtracting the mean and dividing by the standard deviation to allow direct comparison between estimated model coefficients and for ease of model fitting.

2.4. Statistical analyses

To measure movement characteristics of recreation tracks, we calculated the total number of points recorded for each track, the total distance covered, the average movement speed, the length of time spent moving, and the minimum and maximum elevation reached along each track. We calculated the time and distance between two consecutive GPS points and used these to calculate average movement speed and length of time spent moving. We considered a point to be ‘moving’ if the speed was greater than 1 km/h. Total distance covered was calculated by summing the distance between consecutive GPS points. We used a digital elevation model (DEM; USGS National Elevation dataset) to determine difference between the points in each track with the minimum and maximum elevation. Once these characteristics were calculated for each track, they were summarized by taking the median over all tracks within each recreation activity. To summarize the environmental conditions that were available to each recreation type, as well as the conditions that each recreation type actually used (as compared to what they select, which is measured below and may differ from use), we also calculated the mean of all ‘used’ and ‘available’ points for each recreation activity for each of the 12 environmental covariates.

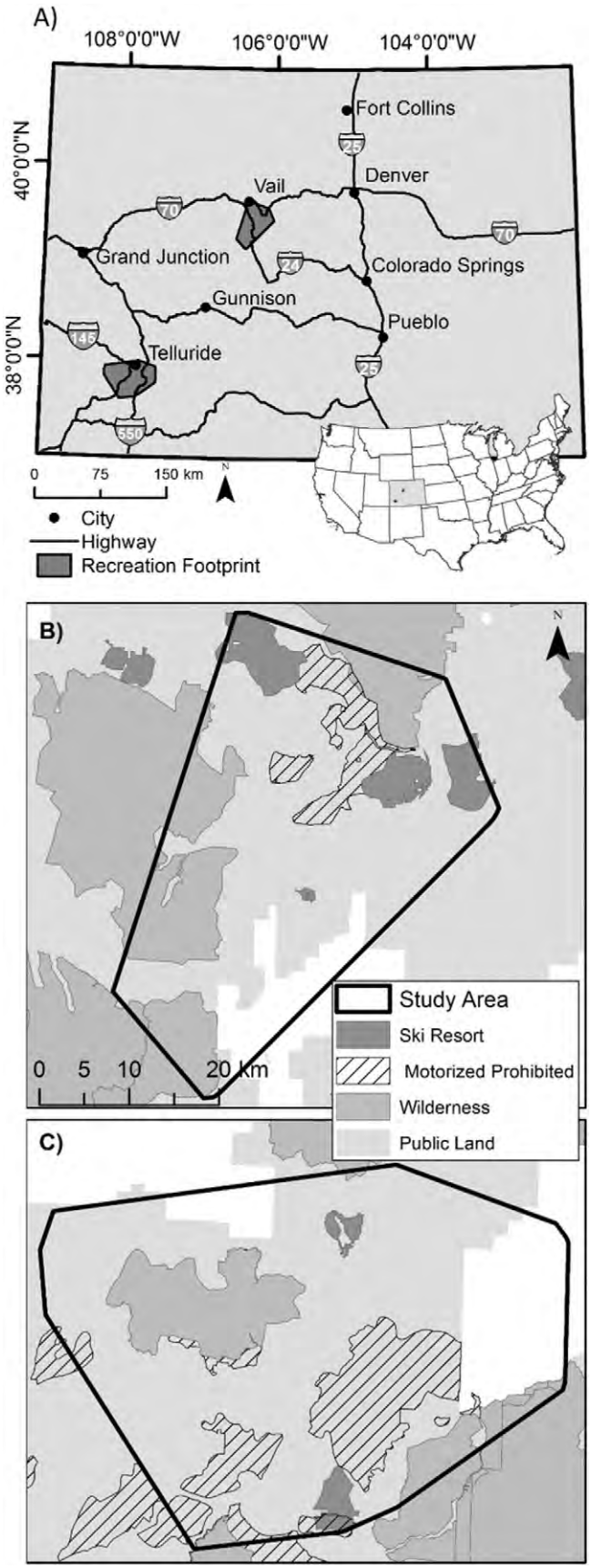

Fig. 1. Spatial extent of recreation used in this study at two locations in western CO, USA: the more northerly Vail Pass and the southerly San Juan Mountains (A); inset shows the position of Colorado within the USA. Panels B and C show areas that were closed to motorized recreation (gray wilderness areas and horizontally striped zoned areas) within the Vail (B) and San Juan (C) study areas.

We used both resource selection function (RSF) and step-selection function (SSF) models to characterize environmental selection of snowmobiles, hybrid skiers, and backcountry skiers. Both RSF and SSF functions compare environmental characteristics at actual GPS locations ('used' locations) to those same characteristics at locations randomly selected across a study area ('available' locations); environmental characteristics that are used disproportionately more than what is available are said to be selected. The area considered as available in the models was defined as a minimum convex polygon around all recreation locations at each study site (Fig. 1); this insured that inferences made from each model would be comparable for all recreation types. Within this boundary, we removed privately owned land not available to recreationists. For motorized models only, we also removed areas administratively closed to motorized recreation, such as wilderness or designated non-motorized areas (Fig. 1B&C).

We used a general linear mixed-effects model with a logit link function (logistic regression; Hosmer, Lemeshow, & Sturdivant, 2013) and individual recreation track ID as a random intercept to control for non-independence between points within a single track (Gillies et al., 2006) to estimate separate relative probability RSFs for backcountry ski, hybrid ski, hybrid snowmobile, snowmobile on-trail, and snowmobile off-trail recreation activities. We randomly generated 'available' points within the available areas defined above for a given recreation activity at a ratio of 1 'used' point to 5 'available' points so that available environmental characteristics were adequately sampled. Correlations among covariates within small (125 m and 500 m radii) and large (1250 m and 2500 m radii) spatial scales were often high. Thus, we initially fit univariate models with only one covariate at a given scale at a time to discard any covariates with poorer fit than a null model based on Akaike Information Criteria (AIC; Akaike, 1974), and to select one large and one small spatial scale per covariate. We included quadratic forms of covariates to investigate non-linear relationships if supported by AIC. We then used the selected covariates to construct all subsets of candidate models for multivariate analysis using the 'lme4' (Bates, Maechler, Bolker, & Walker, 2014) and 'MuMIn' packages (Barton, 2015) in R (R Core Team, 2015); covariates correlated at $|r| > 0.6$ were not allowed in the same model. We ranked multivariate models using AIC.

The SSF models that evaluated fine-scale selection by winter recreationists used conditional logistic regression to estimate relative probability of selection (Fortin et al., 2005; Thurfjell, Ciuti, & Boyce, 2014). At each 'used' GPS location, we compared 5 'available' GPS locations that were selected based on the known distribution of step lengths (straight-line distance from one GPS point to the next) and turn angles estimated from actual recreation data. Thus, each used point was compared directly to a set of available points that the recreationist could have chosen as they moved from point A to point B on a track. We used the same covariates as in the RSF, but limited scales to only 125 m and 250 m since the purpose of the SSF model was to evaluate selection decisions at a fine-scale as recreationists traverse landscapes. Variable selection and model fitting were performed as in the RSF models, except that models were fitted using the R package 'survival' (Therneau, 2015) to estimate conditional regression models.

To provide managers with a map that could be used to inform management decisions on recreation zoning or to identify areas selected by different recreation activities, we created maps of predicted relative probability of selection for each recreation type across western Colorado within an elevation zone delineated by

Table 1
Variable names, native resolution, source and description for all covariates used to model selection of environmental characteristics by recreationists in Colorado, USA.

Name	Resolution	Source	Description
Highway	Vector/ 30 m	Colorado Department of Transportation Online Transportation Information System	Euclidean distance to nearest highway (m)
Elevation	30 m	United States Geological Survey National Elevation Dataset	Elevation (m)
Canopy	30 m	National Land Cover Database (2011) Tree Canopy (Homer et al., 2015)	Percent tree canopy cover
Evergreen	30 m	National Land Cover Database (2011) Land Cover (Homer et al., 2015)	Percent conifer forest
North	30 m	ArcGIS Aspect Tool, Cosine transformation	Index of north-facing aspect
Precipitation	800 m	PRISM 1980–2010 Precipitation normals	Average annual precipitation (mm)
Slope	30 m	ArcGIS Slope Tool	Slope in degrees
Temperature	800 m	PRISM 1980–2010 Mean temperature normals	Mean annual temperature (°C)
Roughness	30 m	DEM Surface Tools (Jenness, 2013)	Index of terrain variability; 3D area divided by 2D area
TPI	30 m	Land Facet Corridor Tools (Jenness, Brost, & Beier, 2013)	Topographic position index, measure of landscape concavity or convexity
Road Density	Vector/ 30 m	National Forest travel management road layer, including only forest roads, not highways	Non-drivable forest roads that can be used as travel corridors; length of road per unit area, varying scales
Forest Edge	30 m	National Land Cover Database 2011 Landcover Type: Deciduous, Evergreen, and Mixed Forest (Homer et al., 2015)	Index of forest connectivity; length of forest/non-forest edge per unit area, varying scales

minimum and maximum elevation from all recreation data combined. We used the top-performing RSF model from each recreation type to predict relative probability of selection based on the environmental covariates across western Colorado. The used-available study design employed here produces a relative probability of selection since the number of sampled available points is arbitrary (Keating & Cherry, 2004). Thus, we used the equation

$$w(x) = \frac{\exp(\beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_k x_k)}{(1 + \exp(\beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_k x_k))}$$

where β is an estimated model coefficient and x is the value of k covariates, to estimate relative probability of selection rescaled from 0 to 1 (Manly et al., 2002).

2.5. Recreation overlap analysis

To determine what environmental conditions are present at areas of predicted spatial overlap between motorized and non-motorized forms of recreation, and thus what conditions may favor conflict between user groups, we performed the following analysis. We first created a binary depiction of each recreation type from each continuous relative probability surface generated above based on the maximum sum of sensitivity (true positives) and specificity (true negatives; Freeman & Moisen, 2008). This threshold optimizes the number of 'used' recreation locations correctly assigned into 'recreation area' and the number of 'available' locations correctly assigned into 'non-recreation area'. We then used the binary surfaces to identify areas of motorized activities only (snowmobile and hybrid-snowmobile), non-motorized activities only (backcountry ski and hybrid-ski), and areas with both motorized and non-motorized recreation. To generate a summary of environmental characteristics at these areas of predicted overlap compared to areas with only one predicted type of recreation, we averaged each of our 12 environmental variables (Table 1) across each of these areas. We also determined the degree to which each predicted continuous surface was similar to the others, using a Pearson correlation, to determine which types of recreation were more likely to select similar environmental characteristics.

2.6. Model validation

We used 5-fold cross validation to determine goodness of model fit. Recreation tracks were split into 5 equal sized groups, the model was re-estimated on 4 of the groups and used to predict the RSF values of the withheld 5th group; each group was withheld in turn. We predicted RSF values at all 'available' locations and binned these values into 10 quantiles. Predictions from 'used' locations were then grouped based on these quantiles, and the number of predicted used locations in each quantile was counted. We compared the predicted count of used locations to the quantile rank using a Spearman rank correlation (Boyce et al., 2002). Good model fit is indicated by a strong correlation between predicted values and quantile number. In addition, for RSF models, we performed a second independent validation using 100,000 withheld GPS points from each recreation type. The RSF value was predicted at each of these withheld points and then binned according to Boyce et al. (2002).

3. Results

3.1. Recreation summary

In January to March of 2010–2013, we recorded 2143 recreation tracks. We collected an average of 1306 (SD = 435) GPS points per track (Table 2; Fig. 2). The most tracks in our dataset came from backcountry skiing or snowboarding (52%), followed by snowmobile (32%). Snowmobiles traveling on trails or groomed routes traveled the fastest, with a median speed of 30.6 km/h, while back-country ski was slowest, at a median 4.3 km/h (Table 3). Hybrid recreationists traveled greatest distances, with median track length 41.0 km, while back-country skiers traveled shortest, 5.2 km. Within hybrid recreation tracks, approximately 4.8 km, or 12% of total distance, was spent skiing. Snowmobiles averaged 35.2 km tracks, of which a median 4.9 km (approximately 13%) were spent off-trail (Table 3). The duration of trips was similar among hybrid, backcountry skiers, and snowmobiles, at approximately 4 h. Of this time, each recreation type also spent approximately 2.5 h in active movement. Snowmobilers had the biggest change from minimum

Table 2
Summary of the number of tracks collected for each winter recreation activity in Colorado, 2010–2013. The total number of GPS points originally recorded at 5 s intervals, as well as the average and standard deviation of GPS points per track, are given.

Recreation Mode	# Tracks	Total # of points	Mean pts/track	SD
Snowmobile	686	889,674	1297	827
Hybrid	346	604,223	1746	1203
Backcountry Ski	1111	973,163	876	921
Total	2143	2,467,060	1306	435

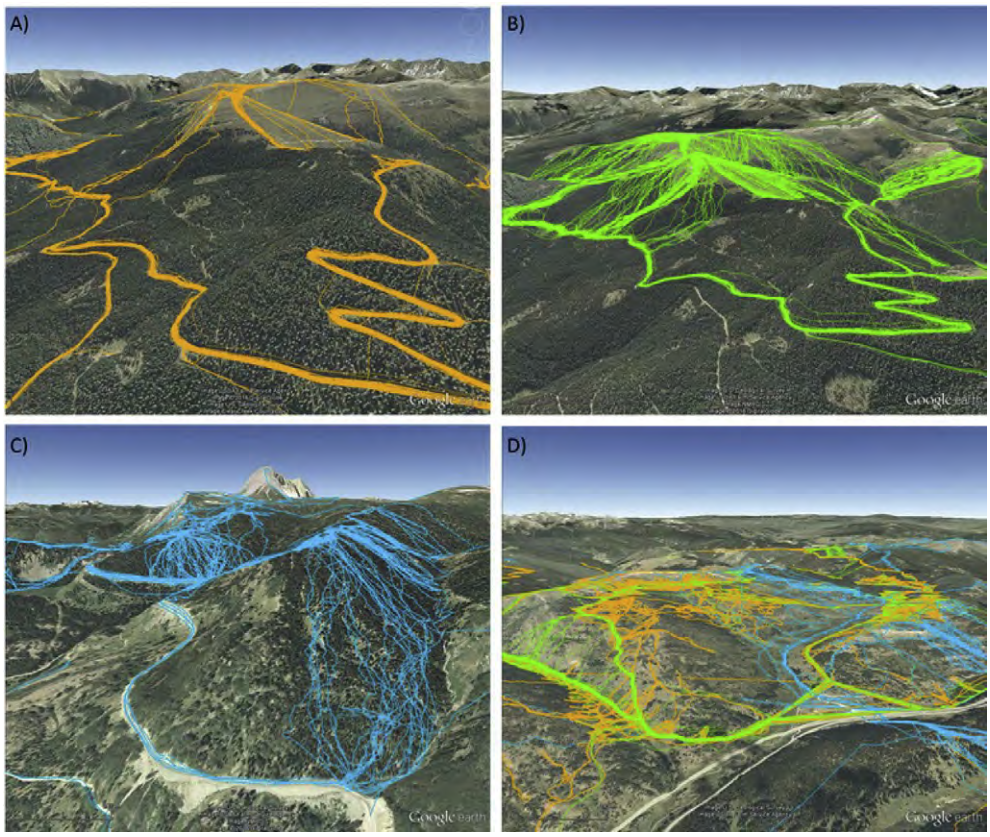

Fig. 2. Examples of recreation tracks recorded with GPS units during the study in western Colorado, 2010–2013. Panel A) snowmobile tracks primarily on trails in the Vail study area, B) hybrid skiing in the Vail study area; thick lines near the bottom of the picture show snowmobile travel, while thinner dispersed lines further back show skiing, C) backcountry ski recreation in the San Juans study area, and D) a combination of all three recreation types at the Vail study area, showing areas of overlap as well areas used primarily by one recreation type. Image credit: Google, DigitalGlobe.

Table 3
Median movement characteristics for all snowmobiles (Snmb), snowmobiles on trails (Snmb on-tr), snowmobiles off trails (Snmb off-tr), all hybrid (Hybrid), hybrid snowmobile (Hyb snmb), hybrid ski (Hyb ski), and backcountry ski (BC ski) recreation types studied in western CO, 2010–2013. The median and bootstrapped 95% lower confidence interval (LCI) and upper confidence interval (UCI) for movement speed (km/hr), total track distance (km), time spent actively moving (hr), total recorded trip time (hr), and total elevation change (m) is given.

		Snmb	Snmb on-tr	Snmb off-tr	Hybrid	Hybr snmb	Hyb ski	BC ski
Movement Speed (km/h)	Median	24.5	30.6	22.4	27.6	28.3	14.0	4.3
	95% LCI	24.0	29.7	21.9	26.8	27.6	13.0	4.2
	95% UCI	25.2	31.4	22.9	28.4	28.8	14.8	4.4
Track Distance (km)	Median	35.2	33.2	4.9	41.0	35.5	4.8	5.2
	95% LCI	32.9	31.3	4.1	38.4	33.6	4.4	5.0
	95% UCI	37.0	35.2	5.6	44.1	37.3	5.5	5.4
Active move time (hr)	Median	2.4	1.8	0.4	2.5	2.6	0.7	2.0
	95% LCI	2.3	1.7	0.4	2.2	2.3	0.6	1.9
	95% UCI	2.5	1.9	0.5	2.7	2.8	0.7	2.1
Total trip time (hr)	Median	3.8	2.5	0.7	4.6	3.5	1.0	3.6
	95% LCI	3.6	2.4	0.6	4.3	3.5	0.9	3.5
	95% UCI	4.0	2.6	0.8	4.8	3.7	1.1	3.8
Total Elevation Change (m)	Median	660.0	557.0	321.5	498.0	490.0	375.0	382.0
	95% LCI	557.0	538.0	293.0	489.0	482.0	369.0	371.0
	95% UCI	715.0	643.0	345.0	516.0	501.5	386.0	395.0

to maximum elevation within tracks, with a median difference of 660 m. Back-country ski had the least elevation change, of 382 m (Table 3).

Based on the mean of used GPS points, the covariates that indexed distance to highway, road density, percent canopy cover, and slope showed the greatest differences between winter-recreation types (Appendix A: Table A.1, Fig A.1). Hybrid skiers used areas that were farthest from highways (as averaged over all used GPS points; 4.61 km), followed by hybrid snowmobiles (4.05 km); snowmobiles on-trail (3.41 km) and off-trail (3.38 km) were next and did not differ from each other, and backcountry skiers remained nearest to major roads (2.46 km; Appendix A: Table A.1). On-trail snowmobiles and hybrid snowmobiles used areas with greater forest road density (1.19 km/km^2 and 0.92 km/km^2, respectively), while off-trail snowmobiles and backcountry skiers used the least (0.65 km/km^2 and 0.62 km/km^2, respectively;

Appendix A: Table A.1). Snowmobilers both on- and off-trail had the greatest mean percent canopy cover at used GPS locations (37.88% and 35.25%, respectively), followed by hybrid snowmobiles (33.88%) and backcountry skiers (31.26%). Backcountry skiers and hybrid skiers used steeper slopes than other recreationists (18.31° and 17.26°, respectively), while off-trail snowmobiles used the shallowest (14.7°; Appendix A: Table A.1, Fig A.1).

We deployed 140 trail counters at 95 locations over both study areas from 2010 to 2013. Trail counters confirmed higher concentrated levels of use in the Vail area than in the more dispersed San Juan Mountains, with average seasonal counts approximately 5 times greater (average Vail 2010–2011: 73,967; average San Juans 2011–2013: 14,994 counter hits per year). Counter data also indicated greater recreation intensity during weekends (Saturday and Sunday, Vail: 55.9, SD = 84.1; San Juans: 25.0, SD = 34.9 counter hits per day) then during weekdays (Vail: 33.0, SD = 46.6; San Juans: 13.2, SD = 20.6 counter hits per day), a pattern consistent across study areas (Fig. 3). Hourly counts indicated virtually no recreation took place after dark: 96% of trail counter hits occurred between 0800 and 1700 h. Peak use occurred between 1000 and 1500 h, with an average of 5.3 (SD = 11.1) hits per hour during this time in Vail Pass and 2.3 (SD = 5.5) hits per hour in the San Juans (Fig. 3).

3.2. Reponses of winter recreationists to environmental features

Top performing RSF models for all winter recreation activities indicated the importance of topography, access, and climate when making landscape-scale selection choices. All top models were >Δ4 AIC better than the next performing model (Appendix B: Tables B.1-B.5). Based on coefficient confidence interval overlap with 0, all parameters in the top model for each recreation type were significant predictors of selection (except canopy cover for hybrid snowmobiles and backcountry ski, which did overlap 0). For brevity, we mention the top three contributing covariates for each model here, based on the strength of standardized beta coefficients, but all contributing covariates are presented in Table 4. Snowmobiles on trails selected areas that had greater forest road density, moderate annual precipitation, and lower terrain variability (Table 4; Fig. 4). Off-trail snowmobiles selected moderate levels of snow, shallow slopes, and higher elevation (Table 4). Hybrid recreationists selected shallow slopes, intermediate distances from highways, and greater annual precipitation while on snowmobiles (Table 4), and moderate north-facing slopes with greater precipitation while on skis (Table 4; Fig. 4). Backcountry skiers selected areas that were closer to highways, had greater annual precipitation, and higher forest road density (Table 4; Fig. 4). Maps of predicted probabilities of landscape selection generated from top-performing RSF models for each type of recreation across western Colorado are shown in Appendix C: Figs C.1-C.5.

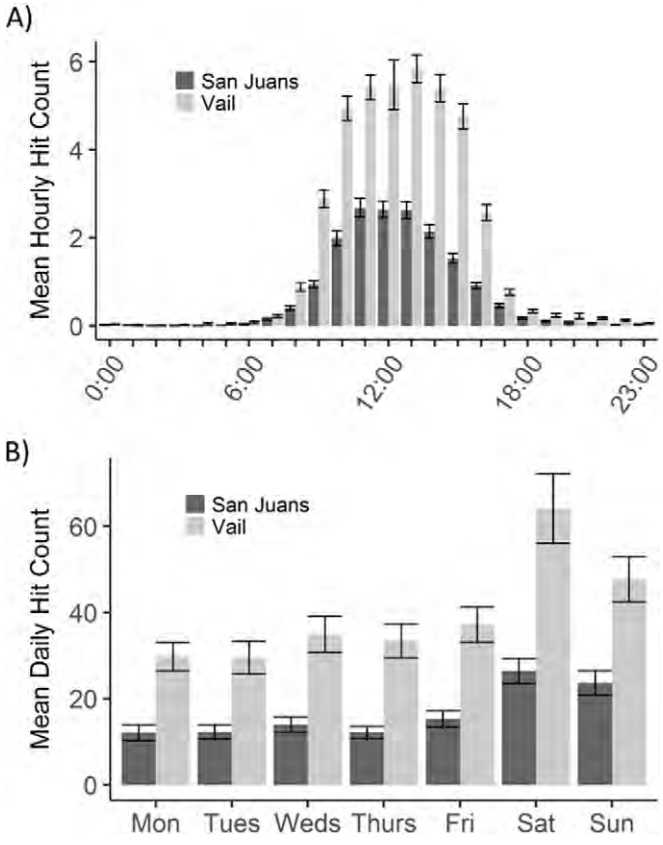

Fig. 3. Mean hourly (A) and daily (B) count of recreationists from 140 magnetic and infrared trail counters deployed in Vail Pass (light gray) and San Juan (dark gray) study areas, western CO, USA.

At a fine-scale, winter recreationists were sensitive to access, topography and vegetation when making movement decisions, again as determined by the size of standardized coefficients in top-performing SSF models. There was some SSF model uncertainty, with between one and four models within >Δ4 AIC of the top-performing model (Appendix D: Tables D.1-D.5). However, models within >Δ4 AIC differed from the top-performing model by only one term, indicating that the extra parameters were non-informative, and thus we took the top-ranked, most parsimonious, model. All parameters in the top model for each recreation type were significant predictors of selection, based on coefficient confidence interval overlap with 0; for brevity, we mention the top three contributing covariates for each model here, but all contributing covariates are presented in Table 5. Snowmobiles, while on trails, selected movement paths with moderate forest road density, moderate canopy cover, and higher elevation, while off-trail, they selected movement paths closer to the highway with moderate canopy cover and low terrain variability (Table 5). Hybrid recreationists, while snowmobiling, selected movement paths with moderate canopy cover, greater annual precipitation, and greater distances from highways, while on skis they selected warmer temperatures and greater annual precipitation, and avoided level terrain (Table 5). Backcountry skiers selectively moved through areas that were intermediate distances from highways, at middle elevations, and with greater forest road density (Table 5).

3.3. Recreation overlap

The minimum and maximum elevation from all recreation points combined was 2300 m–4250 m; thus, we created predicted binary surfaces of winter recreation within this zone across western Colorado, a total area of 3123 km^2. Using the binary motorized and non-motorized recreation maps we predicted that at least one type of recreation would occur on 590 km^2 (18.9%). In areas with at least one type of recreation, motorized-only was predicted to occur on 35.2%, non-motorized recreation on 27.3%, and both activities were predicted to occur on 37.5% of this area (Fig. 5). Areas predicted to have both types of recreation were characterized by closer proximity to highways, high forest road density, high elevation, greater annual precipitation, and patchier forest, as well as intermediate levels of canopy cover, slope, TPI, and roughness, as compared to motorized or non-motorized only areas (Fig. 6). Winter recreationists with highest potential conflict based on predicted selection probabilities were backcountry skiers and hybrid skiers, with a

Table 4
Model coefficients and standard errors, as well as the scale of the covariate (m), from general linear mixed models (resource selection functions) of landscape-scale recreation terrain selection in western CO, USA; variance of the random effect (individual track) is also given. All covariates (except canopy cover for hybrid snowmobile and backcountry ski) were significant predictors of recreation selection, based on confidence interval overlap with 0. A superscript 2 indicates covariates that were fitted as a quadratic function.

Covariate	Snowmobile On-Trail			Snowmobile Off-Trail			Hybrid Snowmobile			Hybrid Ski			Backcountry Ski		
	Scale	β	SE	Scale	β	SE	Scale	β	SE	Scale	β	SE	Scale	β	SE
Highway	2500	−0.87	0.01	2500	−0.85	0.02	1250	1.11	0.02	1250	1.25	0.06	2500	−1.73	0.02
Highway^2							1250	−1.72	0.02	1250	−1.26	0.05			
Elevation				125	1.57	0.03									
Elevation^2				125	−0.11	0.02									
Forest Edge	125	0.16	0.01	2500	0.46	0.02	125	−0.13	0.01	2500	0.64	0.05	2500	0.64	0.01
Canopy	125	−0.5	0.01	2500	1.49	0.02	2500	−0.02	0.02	125	−0.96	0.04	2500	−0.02	0.02
Canopy^2	125	0.05	0.01	2500	−0.29	0.02	2500	−0.55	0.01				2500	−0.16	0.01
Evergreen	2500	0.32	0.01	125	−0.68	0.02	125	−1.29	0.01				500	0.08	0.01
Evergreen^2	2500	−0.65	0.01	125	−0.65	0.02							500	−0.49	0.01
North	500	−0.12	0.01	2500	0.34	0.02	2500	−1.2	0.02	2500	−2.12	0.13	500	−0.16	0.01
Precipitation		1.22	0.01		2.36	0.03		1.32	0.01		1.82	0.06		1.12	0.02
Precipitation^2		−0.47	0.01		−0.61	0.02									
Road Density	125	1.84	0.01	125	0.35	0.01	125	1.03	0.01	1250	1.15	0.04	125	0.9	0.01
Slope	1250	−0.79	0.01	125	−1.6	0.02	1250	−1.97	0.01	125	1.96	0.08			
Slope^2	1250	−0.27	0.01							125	−2.22	0.07			
Roughness	500	−0.9	0.01	2500	−0.87	0.02	2500	−1.01	0.02	2500	−0.53	0.04	125	−0.74	0.01
Temperature		0.29	0.01					0.18	0.02		−0.22	0.07		−0.78	0.02
Temperature^2								−0.95	0.01		−1.28	0.05		−0.62	0.01
TPI	500	−0.54	0.01	500	−0.58	0.02	2500	−0.3	0.01	2500	−0.11	0.04	125	0.14	0.01
Random effect		0.5	0.71		2.16	1.47		0.79	0.89		1.16	1.08		0.72	0.85

Table 5
Coefficients and standard errors from conditional logistic regression (step selection function) models of fine-scale recreation terrain selection in western CO, USA. All covariates were significant predictors of recreation selection, based on confidence interval overlap with 0. A superscript 2 indicates covariates that were fitted as a quadratic function.

Covariate	Snmb On-Trail		Snmb Off-Trail		Hybrid Snmb		Hybrid Ski		Backcountry Ski	
	β	SE	β	SE	β	SE	β	SE	β	SE
Highway			−0.53	0.17	0.49	0.06			−0.64	0.07
Highway ^{2}									0.13	0.03
Elevation	0.38	0.05	0.28	0.09					−0.59	0.05
Elevation^2									−0.22	0.02
Forest Edge	0.02	0.01	0.05	0.01	−0.23	0.01	−0.09	0.02	0.06	0.02
Canopy	−0.40	0.01	−0.39	0.02	−0.68	0.01	0.08	0.03	0.21	0.03
Canopy^2	−0.10	0.01	−0.20	0.01	−0.28	0.01	−0.32	0.03	−0.24	0.02
Evergreen									−0.18	0.01
Evergreen^2									−0.10	0.01
North	0.01	0.00	−0.03	0.01	0.12	0.01	0.14	0.03		
Precipitation					0.50	0.07	1.01	0.18		
Road Density	0.77	0.01	0.24	0.01	0.34	0.01	−0.08	0.04	0.37	0.01
Road Density^2	−0.13	0.00			−0.04	0.00				
Slope	−0.08	0.03	−0.14	0.04	−0.37	0.02	−0.27	0.05		
Roughness	−0.26	0.01	−0.31	0.01	−0.48	0.01	−0.45	0.03	−0.31	0.01
Roughness^2					0.04	0.00	0.13	0.01		
Temperature					−0.34	0.04	1.87	0.09		
TPI	−0.23	0.01	−0.23	0.02	0.03	0.01	−0.49	0.03	0.08	0.01
TPI^2					0.31	0.01	0.23	0.02	0.07	0.01

Pearson correlation coefficient of 0.25. Recreationists with the least potential conflict were hybrid snowmobiling and off-trail snowmobiles with a correlation of 0.07 (Appendix E).

3.4. Validation

Cross-validation indicated excellent RSF model fit for all recreation types, with Spearman rank correlations of 0.98 for off-trail snowmobile, on-trail snowmobile, hybrid ski, and hybrid snowmobile, and 1.0 for backcountry ski. Our independent validation of withheld points also indicated strong model performance, with Spearman rank correlations of 0.99 for off-trail snowmobile, 1.0 for on-trail snowmobile, 0.95 for hybrid ski, 0.99 for hybrid snowmobile, and 1.0 for backcountry ski. Good predictive ability is indicated when independent recreation data have high predicted RSF values and Spearman correlations are closer to 1.

4. Discussion

This study provides a measure of winter recreation at a spatial scale and magnitude of data collection which has not, to our knowledge, been previously accomplished in the literature. We recorded approximately 2100 unique GPS tracks of recreationists and demonstrated the efficacy of resource selection models to better understand winter recreation. Our analysis is unique in its application of a modeled understanding of environmental selection to winter recreation, using the actual locations of recreationists rather than metrics inferred by surveys, parking lot counts, or track evidence. We found differences in modeled terrain selection between motorized and non-motorized forms of recreation: areas predicted to be selected only by motorized users were farther from highways, with greater forest road densities, more open canopy, and shallower slopes, while areas predicted to be used only by non-

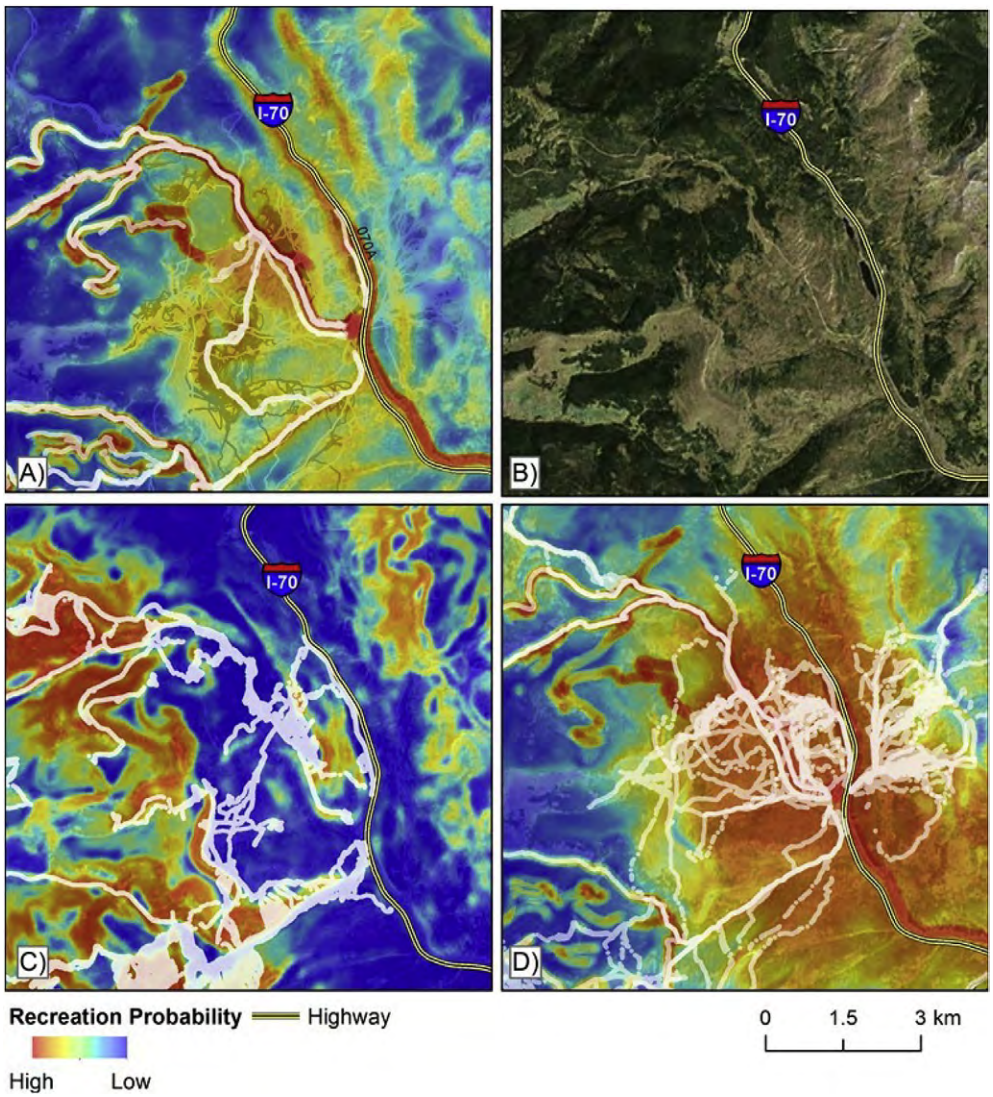

Fig. 4. Example of spatial predictions from top-performing RSF recreation models at the Vail study area in Colorado, USA. Warm colors indicate greater probability of selection by each recreation type; white tracks are actual GPS locations from recreationists. All panels show same spatial extent in the area of Vail Pass Winter Recreation Area; panel A is on-trail snowmobile, B shows an aerial image of the actual terrain, C is hybrid ski, and D is backcountry ski. Image credit: Esri software. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

motorized users tended to be closer to highways, in denser canopy cover, with more terrain variability and steeper slopes (Fig. 6). These results can help identify areas where interpersonal recreation conflict between different user groups is likely to occur as well as ecologically sensitive areas that may be more susceptible to disturbance from a given type of recreation.

4.1. Environmental characteristics of recreation

Few studies have similarly examined the land use patterns of winter recreationists. Braunisch, Patthey, and Arlettaz (2011) used snow track data and found a preference by skiers for smooth terrain, though the study was conducted only on areas near ski resorts and ski-lifts in Switzerland. In a study using surveys in British Columbia, Canada, Kliskey (2000) found preferences of snowmobilers for low canopy closure and less steep slopes. Rupf et al. (2011) sampled 303 individuals with GPS data loggers and found a tendency for skiers and snowboarders to be peak-oriented, although their study was focused on wildlife and not recreation. While we found differences in the selection of environmental characteristics for each type of recreation, in general, certain environmental characteristics were consistently important to all types of winter recreation at a landscape scale. Access to recreation areas was important to both motorized and non-motorized recreationists; snowmobilers and skiers selected areas that were close to highways and all recreation types selected greater density of forest roads, indicating the importance of accessibility over other environmental characteristics.

A key finding from this study is the importance of roads to all types of winter recreation. The presence of paved highways enables recreationists to quickly reach areas open to recreation, while the presence of forest roads allows them to permeate forested backcountry areas more easily. Recreation is predicted to increase with increases in the extent of highways or the density and extent of forest roads, supporting the idea that recreation is an emergent property of roads on the landscape. Westcott and Andrew (2015) similarly showed that road proximity was one of the most important predictors when modeling the environmental associations of

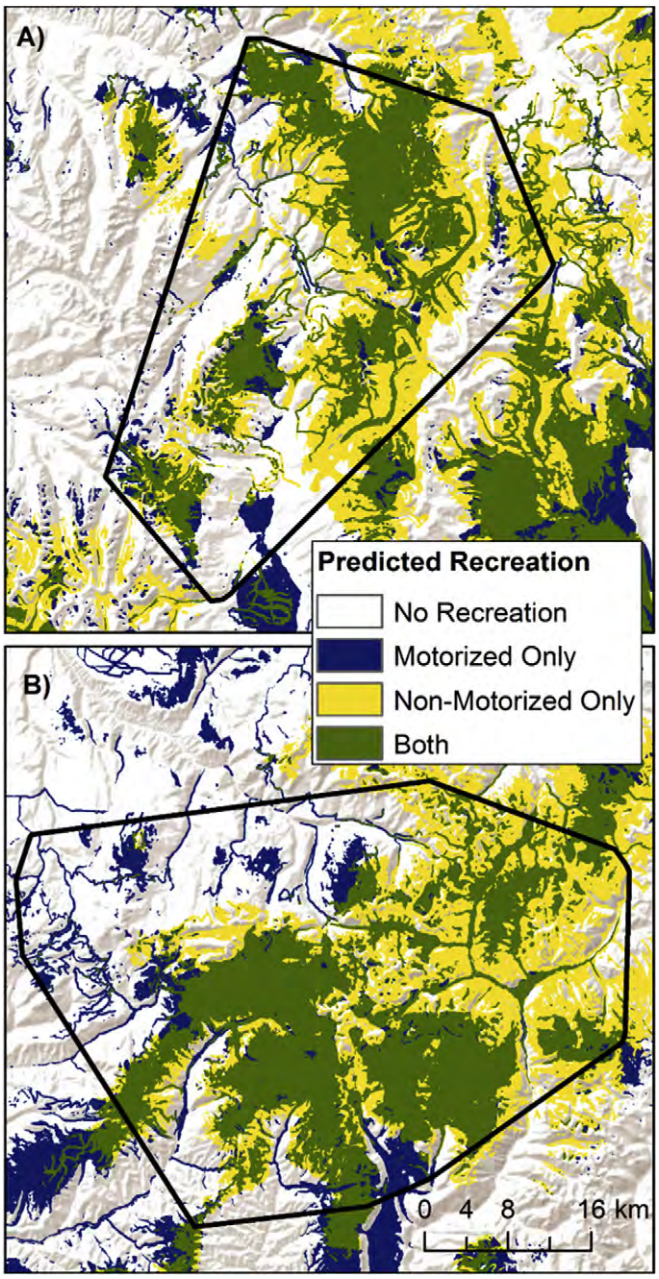

Fig. 5. The distribution of predicted areas of potential overlap between motorized and non-motorized recreation activities within the Vail (A) and San Juan (B) study areas (thick black line denotes study area boundary). Green indicates areas predicted to be selected by both types of recreation, yellow is non-motorized only, and blue indicates motorized recreation. Background image credit: Esri software. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

off-road vehicle recreation. Indeed, the preferences of recreationists for certain environmental characteristics may be outweighed in practice by accessibility, with areas considered less suitable receiving more actual use due to the presence of ample parking areas and road access (Beeco, Hallo, & Brownlee, 2014; Brabyn & Sutton, 2013). Our models showed that areas greater than 11 km from a highway were predicted to have virtually no recreation at all, while areas predicted to have the highest recreation use, both motorized and non-motorized, were nearest highways. This has implications for forest and recreation management, since recreationists are likely to use forest roads to access the backcountry even if these roads are closed to vehicles (Havlick, 2002). Through the creation of forest roads, whether through logging operations, as part of fire reduction or suppression activities, or for access to human developments, recreation is likely to show a corresponding increase as well.

Differences in the results of the RSF and SSF models provide information on the importance of environmental characteristics to recreationists when first selecting where to recreate, and then deciding how to move through the landscape once there. Topographic features, such as low to moderate slope, low terrain variability, and selection for drainages (except for skiers who selected ridges), were consistent predictors of recreation selection at a landscape scale, while vegetation characteristics were generally not among the top contributing covariates. Fine-scale movement models, conversely, were most strongly influenced by access and vegetation characteristics, and were more variable between different types of recreation. A stronger response to vegetation covariates at a small scale suggests that recreationists select areas in which to recreate at a hierarchical scale, with road access and large topographic features dictating an initial area selection, and finer scale features such as forest density determining where to move within this area. The greater influence of vegetation at a small spatial scale may be related to the differences in movement speed and maneuverability of the different recreation types, since non-motorized recreationists may be better able to safely move through dense trees, while motorized recreationists may select open areas for play and fast travel.

Temporally, recreationists exhibited clear patterns of use with respect to time of day and day of the week. Nearly all recreation occurred during daylight hours, and dropped off to almost nothing after dark. Recreation was also markedly higher on weekends, particularly Saturdays, as compared to the rest of the week (Fig. 3). Thus, the ecological impact of winter recreation may decrease for species that are crepuscular or nocturnal, which will be active in times when little or no recreation is present. Similarly, weekdays may have a lower ecological impact than weekends, so that if management were undertaken to reduce or cap the number of users in an area, it may only need implementation during weekends.

4.2. Conflict and ecological implications

The predictions from our landscape scale selection models made possible a spatially resolute depiction of areas which motorized and non-motorized recreation were likely to select, and thus where interpersonal conflict may be more likely (Miller, 2016; Vaske et al., 2000). In a related survey study focused only on the Vail Pass area, Miller et al. (2016) found greater interpersonal conflict in areas of shared-use. Managers often employ spatial or temporal closures of areas to motorized or non-motorized activities in an attempt to limit shared-use and minimize conflict (Albritton & Stein, 2011; Leung & Marion, 1999). This is often an asymmetrical solution, however, with non-motorized users reporting increased satisfaction while motorized users are dissatisfied with increased restrictions (Jackson, Haider, & Elliot, 2003). Our model indicates that while zoning is a useful tool in some areas, it may be unnecessary in others. The environmental characteristics at areas predicted to have both types of recreation tended to differ from areas with either type alone (Fig. 6). Areas of overlap were closer to roads, had moderate slopes, and were in areas of patchier or more fragmented forest. This pattern may result from the use by both motorized and non-motorized recreation of areas that are logistically necessary but not preferred, such as areas near parking lots and large groomed travel corridors. Thus, managers may be able to limit zoning to

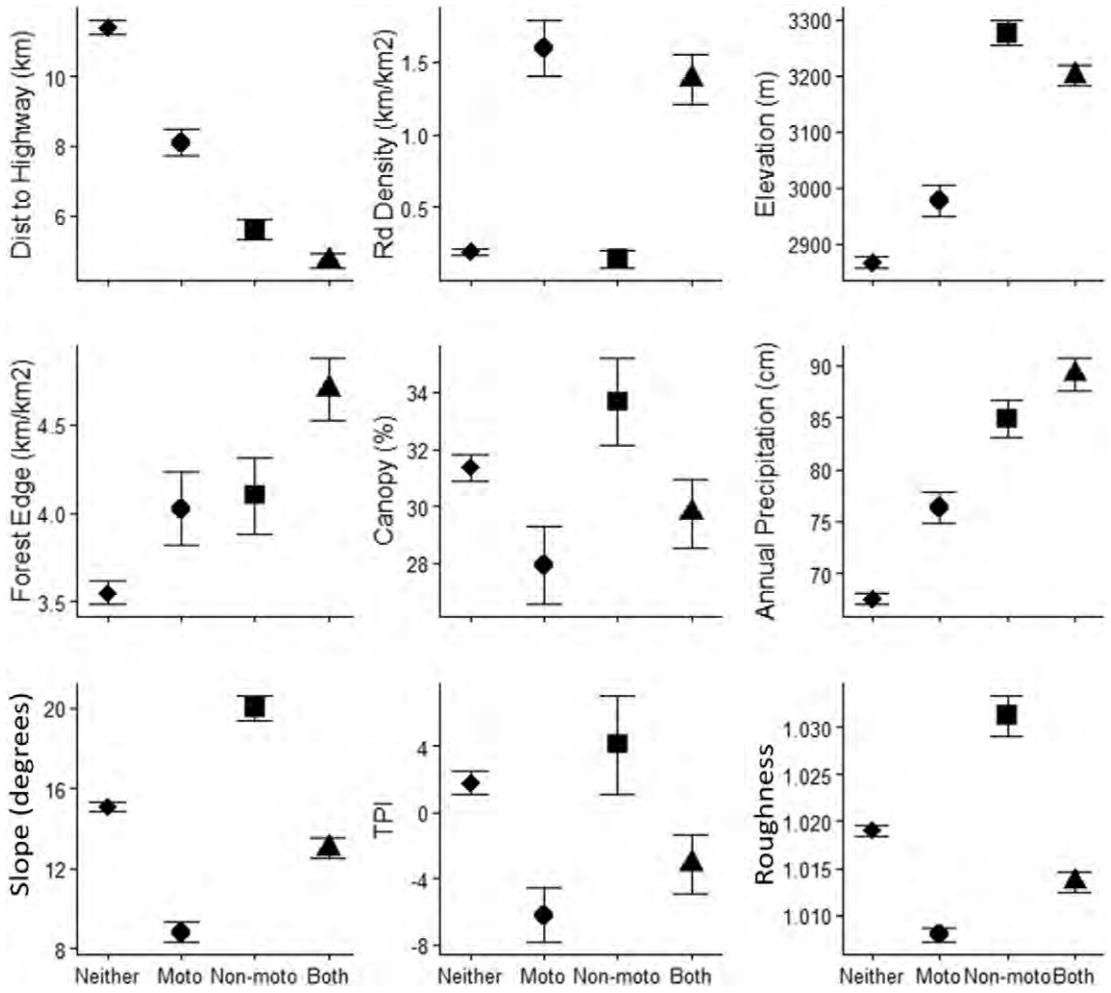

Fig. 6. Mean of environmental characteristics summarized in areas predicted across western Colorado to be selected by either motorized (Moto, circle) or non-motorized (Non-moto, square) winter recreation only, or both (triangle) or neither (diamond).

these areas of forced co-occurrence, while allowing recreationists more liberty outside these areas, where terrain selection should diverge.

Outside of overlap areas, motorized and non-motorized forms of recreation show distinct separation in many environmental traits. Motorized recreationists tend to select drainages with low slope and low terrain variability, in lower elevation areas with more open canopy and less precipitation. This suite of characteristics probably favors fast, long-distance movements, which our results show are characteristic of snowmobiles. Non-motorized recreationists, alternatively, select ridges with steeper slope and greater terrain variability, at higher elevations and with less open canopy and more snow (Fig. 6), traits consistent with skiing down steep, treed slopes. Differences in environmental characteristics used by each recreation type may provide useful guidelines on determining whether to zone certain areas for motorized or non-motorized use only, while still providing each type of recreation the environmental characteristics they prefer. Areas of steep slope, for instance, may be set aside for backcountry skiers or hybrid-skiers with little effect to snowmobilers, since they prefer more flat terrain.

Modeled areas of overlap also have implications for conflict between recreation and species of conservation concern. Motorized winter recreation creates increased noise and engine emissions which can negatively impact wildlife (Shively et al., 2008; Zielinski, Slauson, & Bowles, 2008), while non-motorized forms may displace wildlife (Krebs, Lofroth, & Parfitt, 2007; Reimers, Eftestøl, & Colman, 2003) or contribute to habitat loss through the construction of recreation infrastructure (Sato, Wood, & Lindenmayer, 2013). Wildlife may also respond differently to motorized versus non-motorized types of winter recreation (Larson, Reed, Merenlender, & Crooks, 2016); Reimers et al. (2003) found that reindeer (*Rangifer tarandus tarandus*) detected snowmobiles sooner than skiers, but responded to skiers by moving greater distances than from snowmobiles, and Seip, Johnson, and Watts (2007) found threatened woodland caribou strongly avoided motorized snowmobile recreation over huge areas. The spatial depiction of relative recreation probability (Appendix C: Figs C.1-C.5) generated by our models provides detailed maps which can be used to determine the likelihood of motorized or non-motorized forms of recreation in a given area. The use of a modeled RSF allows managers to consider the relative probability of a specific type of recreation co-occurring with a given species, and thus will allow decisions to be tailored for species that differ in sensitivity to different types of recreation.

5. Conclusions

The sharp increase in the extent and popularity of winter recreation presents a challenge to land managers responsible for multiple-use lands (Bowker et al., 2012), with associated concern as to its impact on wildlife and the environment (Arlettaz et al., 2015;

Braunisch et al., 2011; Patthey, Wirthner, Signorell, & Arlettaz, 2008). Thus, managers face multiple challenges of reducing impacts to the environment and wildlife while also minimizing interpersonal conflict and still providing winter recreation opportunities. One way in which the likelihood of interpersonal conflict may be minimized is to reduce the time that motorized and non-motorized users are funneled into a single shared-use access area or travel corridor, since our results show that the conditions that motorized and non-motorized users select are fairly distinct, and thus recreationists may self-select areas that reduce co-occurrence between the two types. Alternatively, if active zoning is required to separate users to reduce conflict or for safety, the conditions that each recreation type favors should be considered. Our results underscore the importance of road and road-access management in affecting the spatial footprint of winter recreation. Decisions about the placement or density of roads need careful assessment as they can influence the movements of winter recreationists relative to wildlife or each other. Management practices that lower tree density and increase forest patchiness will also influence motorized and non-motorized recreation at fine spatial scales.

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Appendix A. Table A.1

The mean and 95% confidence intervals of all used and available GPS points for each environmental covariate (see Table 1 in manuscript for more covariate information) at the 2500 m scale used to model winter recreation selection in western Colorado, USA, from 2010 to 2013. Summaries for each winter recreation activity, on-trail snowmobile (Snmb On-Tr), off-trail snowmobile (Snmb Off-Tr), snowmobile segments of snowmobile-assisted hybrid skiing (Hybrid Snmb), ski segments of snowmobile-assisted hybrid skiing (Hybrid Ski), and back-country ski or snowboard (Ski), are provided to allow comparison between recreation types within a given covariate.

Covariate	Activity	Used Points		Available Points	
		Mean	95% CI	Mean	95% CI
Distance to Highway (km)	Snmb On-Tr	3.41	3.19–3.62	4.35	4.05–4.65
	Snmb Off-Tr	3.38	3.19–3.57	4.37	4.07–4.67
	Hybrid Snmb	4.05	3.9–4.21	3.59	3.28–3.9
	Hybrid Ski	4.61	4.48–4.74	3.58	3.27–3.89
	Ski	2.46	2.35–2.56	4.95	4.7–5.19
Elevation (m)	Snmb On-Tr	3208.27	3190.77–3225.77	3246.61	3222.78–3270.45
	Snmb Off-Tr	3395.73	3383.01–3408.45	3246.23	3222.29–3270.18
	Hybrid Snmb	3408.50	3399.38–3417.61	3278.60	3254.29–3302.91
	Hybrid Ski	3425.94	3417.01–3434.86	3279.75	3255.34–3304.17
	Ski	3375.08	3366.35–3383.82	3298.73	3282.91–3314.55
Forest Edge (km/km^2)	Snmb On-Tr	3.77	3.68–3.86	3.22	3.13–3.32
	Snmb Off-Tr	4.11	4.03–4.18	3.22	3.13–3.32
	Hybrid Snmb	3.57	3.47–3.66	3.26	3.14–3.38
	Hybrid Ski	3.35	3.28–3.43	3.26	3.14–3.39
	Ski/Board	3.98	3.92–4.04	3.16	3.09–3.23
Percent Canopy Cover	Snmb On-Tr	37.88	37.17–38.58	34.12	33.15–35.09
	Snmb Off-Tr	35.25	34.58–35.92	34.03	33.06–35
	Hybrid Snmb	33.88	32.99–34.78	36.34	35.11–37.58
	Hybrid Ski	32.48	31.51–33.44	36.31	35.08–37.54
	Ski/Board	31.26	30.7–31.83	33.50	32.75–34.25
Percent Evergreen Forest	Snmb On-Tr	51.54	50.23–52.85	46.92	45.12–48.73
	Snmb Off-Tr	51.08	49.82–52.35	46.73	44.92–48.53
	Hybrid Snmb	50.84	49.61–52.07	53.33	51.03–55.63
	Hybrid Ski	51.31	49.97–52.66	53.30	51–55.6
	Ski/Board	44.58	43.56–45.59	46.01	44.63–47.39
Average Annual Precipitation (mm)	Snmb On-Tr	82.77	81.75–83.8	79.00	77.44–80.56
	Snmb Off-Tr	90.49	89.58–91.4	79.18	77.61–80.75
	Hybrid Snmb	84.65	83.84–85.46	71.93	70.4–73.45
	Hybrid Ski	84.94	84.04–85.84	71.98	70.45–73.5
	Ski/Board	90.17	89.14–91.21	84.04	82.77–85.3
Forest Road Density (km/km^2)	Snmb On-Tr	1.19	1.12–1.26	0.52	0.47–0.58
	Snmb Off-Tr	0.65	0.6–0.71	0.52	0.47–0.58
	Hybrid Snmb	0.92	0.87–0.97	0.63	0.59–0.67
	Hybrid Ski	0.91	0.86–0.95	0.63	0.59–0.67
	Ski/Board	0.62	0.6–0.65	0.54	0.5–0.57
Slope (degrees)	Snmb On-Tr	15.97	15.67–16.27	18.00	17.56–18.45
	Snmb Off-Tr	14.70	14.46–14.95	18.03	17.58–18.48
	Hybrid Snmb	16.28	15.99–16.57	16.71	16.22–17.2

(continued on next page)

(*continued*)

Covariate	Activity	Used Points		Available Points	
		Mean	95% CI	Mean	95% CI
	Hybrid Ski	17.26	16.99–17.53	16.74	16.25–17.23
	Ski/Board	18.31	17.98–18.64	18.88	18.54–19.22
Roughness[a]	Snmb On-Tr	1.003	1.002–1.003	1.004	1.004–1.004
	Snmb Off-Tr	1.001	1.001–1.002	1.004	1.004–1.004
	Hybrid Snmb	1.001	1.001–1.002	1.003	1.003–1.004
	Hybrid Ski	1.002	1.002–1.002	1.003	1.003–1.004
	Ski/Board	1.003	1.003–1.003	1.004	1.004–1.005
Mean Annual Temperature (°C)	Snmb On-Tr	1.59	1.5–1.68	1.25	1.13–1.36
	Snmb Off-Tr	0.69	0.61–0.77	1.25	1.13–1.37
	Hybrid Snmb	0.48	0.4–0.55	0.93	0.79–1.07
	Hybrid Ski	0.29	0.21–0.36	0.92	0.78–1.06
	Ski/Board	1.06	1.01–1.11	1.20	1.11–1.3
Topographic Position Index (TPI[b])	Snmb On-Tr	−50.08	−60.07–−40.09	−9.44	−20.55–1.67
	Snmb Off-Tr	28.52	21.27–35.78	−9.83	−20.97–1.32
	Hybrid Snmb	11.94	−1.89–25.76	−10.32	−23.97–3.33
	Hybrid Ski	63.15	49.91–76.39	−9.54	−23.21–4.13
	Ski/Board	−18.06	−27.13–−8.99	1.11	−7.98–10.2

[a] Higher values represent greater terrain variability.
[b] Negative values indicate drainages, positive indicate ridges.

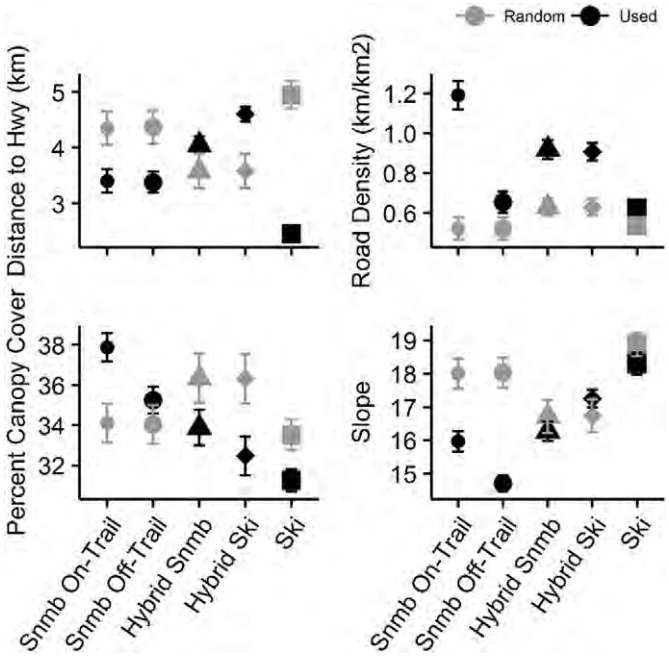

Fig A.1. Mean and 95% CI summaries of environmental characteristics at used and random locations of each recreation activity at both study areas in Colorado, USA. Plots shown are distance to highway (km), road density (km/km^2), percent canopy closure (%), and slope (degrees).

Appendix B. Model selection results showing the top 10 models from resource selection functions (RSF) for each recreation type studied in western Colorado, USA from 2010 to 2013.

Table B.1
Model selection table for on-trail snowmobile RSF models showing habitat selection of winter recreationists driving snowmobiles on trails. Only the top 10 models are shown. K is the number of model parameters, LL is model log likelihood. The scale at which the covariate was measured (in meters) is given in subscript numbers; covariates included as quadratics are indicated with a superscript '2'. Further information on environmental covariates is given in Table 1 of the manuscript.

Model covariates	K	AIC	Δ AIC	AIC Wt	LL
$Highway_{2500} + ForestEdge_{125} + Canopy_{125} + Canopy_{125}^2 + Evergreen_{2500} + Evergreen_{2500}^2 + North_{500} + Precip + Precip^2 + RdDensity_{125} + Slope_{1250} + Slope_{1250}^2 + Roughness_{500} + Temp + TPI_{500}$	17	212,588.3	0	1	−106277
$Highway_{2500} + ForestEdge_{125} + Canopy_{125} + Evergreen_{2500} + Evergreen_{2500}^2 + North_{500} + Precip + Precip^2 + RdDensity_{125} + Slope_{1250} + Slope_{1250}^2 + Roughness_{500} + Temp + TPI_{500}$	16	212,617.5	29.19	0	−106293
$Highway_{2500} + ForestEdge_{125} + Canopy_{125} + Canopy_{125}^2 + Evergreen_{2500} + Evergreen_{2500}^2 + North_{2500} + Precip + Precip^2 + RdDensity_{125} + Slope_{1250} + Slope_{1250}^2 + Roughness_{500} + Temp + TPI_{500}$	17	212,749.7	161.46	0	−106358
$Highway_{2500} + ForestEdge_{125} + Canopy_{125} + Evergreen_{2500} + Evergreen_{2500}^2 + North_{2500} + Precip + Precip^2 + RdDensity_{125} + Slope_{1250} + Slope_{1250}^2 + Roughness_{500} + Temp + TPI_{500}$	16	212,762.1	173.85	0	−106365
$Highway_{2500} + ForestEdge_{125} + Canopy_{125} + Canopy_{125}^2 + Evergreen_{2500} + Evergreen_{2500}^2 + Precip + Precip^2 + RdDensity_{125} + Slope_{1250} + Slope_{1250}^2 + Roughness_{500} + Temp + TPI_{500}$	16	212,877.4	289.12	0	−106423
$Highway_{2500} + ForestEdge_{125} + Canopy_{125} + Evergreen_{2500} + Evergreen_{2500}^2 + Precip + Precip^2 + RdDensity_{125} + Slope_{1250} + Slope_{1250}^2 + Roughness_{500} + Temp + TPI_{500}$	15	212,889.9	301.58	0	−106430
$Highway_{2500} + Elevation_{2500} + Elevation_{2500}^2 + ForestEdge_{125} + Canopy_{125} + Canopy_{125}^2 + Evergreen_{2500} + Evergreen_{2500}^2 + North_{500} + Precip + Precip^2 + RdDensity_{125} + Slope_{1250} + Slope_{1250}^2 + Roughness_{500} + TPI_{500}$	18	213,091.4	503.11	0	−106528
$Highway_{2500} + Elevation_{2500} + Elevation_{2500}^2 + ForestEdge_{125} + Canopy_{125} + Evergreen_{2500} + Evergreen_{2500}^2 + North_{500} + Precip + Precip^2 + RdDensity_{125} + Slope_{1250} + Slope_{1250}^2 + Roughness_{500} + TPI_{500}$	17	213,110.5	522.24	0	−106538
$Highway_{2500} + Canopy_{125} + Canopy_{125}^2 + Evergreen_{2500} + Evergreen_{2500}^2 + North_{500} + Precip + Precip^2 + RdDensity_{125} + Slope_{1250} + Slope_{1250}^2 + Roughness_{500} + Temp + TPI_{500}$	16	213,128.7	540.46	0	−106548
$Highway_{2500} + ForestEdge_{2500} + Canopy_{125} + Canopy_{125}^2 + Evergreen_{2500} + Evergreen_{2500}^2 + North_{500} + Precip + Precip^2 + RdDensity_{125} + Slope_{1250} + Slope_{1250}^2 + Roughness_{500} + Temp + TPI_{500}$	17	213,131.1	542.83	0	−106549

Table B.2
Model selection table for off-trail snowmobile RSF models showing habitat selection of winter recreationists driving snowmobiles on off-trail play areas. Only the top 10 models are shown. K is the number of model parameters, LL is model log likelihood. The scale at which the covariate was measured (in meters) is given in subscript numbers; covariates included as quadratics are indicated with a superscript '2'. Further information on environmental covariates is given in Table 1 of the manuscript.

Model Covariates	K	AIC	Δ AIC	AIC Wt	LL
$Highway_{2500} + Elevation_{125} + Elevation^2_{125} + ForestEdge_{2500} + Canopy_{2500} + Canopy^2_{2500} + Evergreen_{125} + Evergreen^2_{125} + North_{2500} + Precip + Precip^2 + RdDensity_{125} + Slope_{125} + Roughness_{2500} + TPI_{500}$	17	52,437.11	0	1	−26201.6
$Highway_{2500} + Elevation_{125} + ForestEdge_{2500} + Canopy_{2500} + Canopy^2_{2500} + Evergreen_{125} + Evergreen^2_{125} + North_{2500} + Precip + Precip^2 + RdDensity_{125} + Slope_{125} + Roughness_{2500} + TPI_{500}$	16	52,484.34	47.23	0	−26226.2
$Highway_{2500} + Elevation_{125} + Elevation^2_{125} + ForestEdge_{500} + Canopy_{2500} + Canopy^2_{2500} + Evergreen_{125} + Evergreen^2_{125} + North_{2500} + Precip + Precip^2 + RdDensity_{125} + Slope_{125} + Roughness_{2500} + TPI_{500}$	17	52,530.61	93.49	0	−26248.3
$Highway_{2500} + Elevation_{125} + Elevation^2_{125} + ForestEdge_{2500} + Canopy_{2500} + Canopy^2_{2500} + Evergreen_{125} + Evergreen^2_{125} + North_{2500} + Precip + Precip^2 + RdDensity_{2500} + Slope_{125} + Roughness_{2500} + TPI_{500}$	17	52,581.75	144.64	0	−26273.9
$Highway_{2500} + Elevation_{125} + ForestEdge_{500} + Canopy_{2500} + Canopy^2_{2500} + Evergreen_{125} + Evergreen^2_{125} + North_{2500} + Precip + Precip^2 + RdDensity_{125} + Slope_{125} + Roughness_{2500} + TPI_{500}$	16	52,615.75	178.64	0	−26291.9
$Highway_{2500} + Elevation_{125} + ForestEdge_{2500} + Canopy_{2500} + Canopy^2_{2500} + Evergreen_{125} + Evergreen^2_{125} + North_{2500} + Precip + Precip^2 + RdDensity_{2500} + Slope_{125} + Roughness_{2500} + TPI_{500}$	16	52,619.33	182.22	0	−26293.7
$Highway_{2500} + Elevation_{125} + Elevation^2_{125} + ForestEdge_{500} + Canopy_{2500} + Canopy^2_{2500} + Evergreen_{125} + Evergreen^2_{125} + Precip + Precip^2 + RdDensity_{125} + Slope_{125} + Roughness_{2500} + TPI_{500}$	16	52,681.12	244	0	−26324.6
$Highway_{2500} + Elevation_{125} + Elevation^2_{125} + ForestEdge_{500} + Canopy_{2500} + Canopy^2_{2500} + Evergreen_{125} + Evergreen^2_{125} + North_{500} + Precip + Precip^2 + RdDensity_{125} + Slope_{125} + Roughness_{2500} + TPI_{500}$	17	52,681.75	244.63	0	−26323.9
$Highway_{2500} + Elevation_{125} + Elevation^2_{125} + ForestEdge_{500} + Canopy_{2500} + Canopy^2_{2500} + Evergreen_{125} + Evergreen^2_{125} + North_{2500} + Precip + Precip^2 + RdDensity_{2500} + Slope_{125} + Roughness_{2500} + TPI_{500}$	17	52,685.36	248.25	0	−26325.7
$Highway_{2500} + Elevation_{125} + ForestEdge_{500} + Canopy_{2500} + Canopy^2_{2500} + Evergreen_{125} + Evergreen^2_{125} + North_{2500} + Precip + Precip^2 + RdDensity_{2500} + Slope_{125} + Roughness_{2500} + TPI_{500}$	16	52,758.39	321.28	0	−26363.2

Table B.3
Model selection table for hybrid snowmobile RSF models showing habitat selection of winter recreationists driving snowmobiles while engaging in hybrid-assisted skiing. Only the top 10 models are shown. K is the number of model parameters, LL is model log likelihood. The scale at which the covariate was measured (in meters) is given in subscript numbers; covariates included as quadratics are indicated with a superscript '2'. Further information on environmental covariates is given in Table 1 of the manuscript.

Model Covariates	K	AIC	Δ AIC	AIC Wt	LL
$Highway_{1250} + Highway^2_{1250} + ForestEdge_{125} + Canopy_{2500} + Canopy^2_{2500} + Evergreen_{125} + North_{2500} + Precip + RdDensity_{125} + Slope_{1250} + Roughness_{2500} + Temp + Temp^2 + TPI_{2500}$	16	95,901.39	0	1	−47934.7
$Highway_{1250} + Highway^2_{1250} + ForestEdge_{2500} + Canopy_{2500} + Canopy^2_{2500} + Evergreen_{125} + North_{2500} + Precip + RdDensity_{125} + Slope_{1250} + Roughness_{2500} + Temp + Temp^2 + TPI_{2500}$	16	96,122.37	220.98	0	−48045.2
$Highway_{1250} + Highway^2_{1250} + Canopy_{2500} + Canopy^2_{2500} + Evergreen_{125} + North_{2500} + Precip + RdDensity_{125} + Slope_{1250} + Roughness_{2500} + Temp + Temp^2 + TPI_{2500}$	15	96,129.87	228.48	0	−48049.9
$Highway_{1250} + Highway^2_{1250} + ForestEdge_{125} + Canopy_{2500} + Canopy^2_{2500} + Evergreen_{125} + North_{2500} + Precip + RdDensity_{125} + Slope_{1250} + Roughness_{2500} + Temp + Temp^2 + TPI_{500}$	16	96,376.94	475.55	0	−48172.5
$Highway_{1250} + Highway^2_{1250} + ForestEdge_{2500} + Canopy_{2500} + Canopy^2_{2500} + Evergreen_{125} + North_{2500} + Precip + RdDensity_{125} + Slope_{1250} + Roughness_{2500} + Temp + Temp^2 + TPI_{500}$	16	96,519.77	618.38	0	−48243.9
$Highway_{1250} + Highway^2_{1250} + Canopy_{2500} + Canopy^2_{2500} + Evergreen_{125} + North_{2500} + Precip + RdDensity_{125} + Slope_{1250} + Roughness_{2500} + Temp + Temp^2 + TPI_{500}$	15	96,534.58	633.19	0	−48252.3
$Highway_{1250} + Highway^2_{1250} + ForestEdge_{125} + Canopy_{2500} + Canopy^2_{2500} + Evergreen_{125} + North_{2500} + Precip + RdDensity_{125} + Slope_{1250} + Roughness_{2500} + Temp + Temp^2$	15	96,558.35	656.96	0	−48264.2
$Highway_{1250} + Highway^2_{1250} + ForestEdge_{2500} + Canopy_{2500} + Canopy^2_{2500} + Evergreen_{125} + North_{2500} + Precip + RdDensity_{125} + Slope_{1250} + Roughness_{2500} + Temp + Temp^2$	15	96,645.06	743.67	0	−48307.5
$Highway_{1250} + Highway^2_{1250} + Canopy_{2500} + Canopy^2_{2500} + Evergreen_{125} + North_{2500} + Precip + RdDensity_{125} + Slope_{1250} + Roughness_{2500} + Temp + Temp^2$	14	96,656.74	755.35	0	−48314.4
$Highway_{1250} + Highway^2_{1250} + ForestEdge_{2500} + Canopy_{2500} + Evergreen_{125} + North_{2500} + Precip + RdDensity_{125} + Slope_{1250} + Roughness_{2500} + Temp + Temp^2$	14	98,926.79	3025.4	0	−49449.4

Table B.4
Model selection table for hybrid ski RSF models showing habitat selection of winter recreationists skiing downhill while engaging in hybrid-assisted skiing. Only the top 10 models are shown. K is the number of model parameters, LL is model log likelihood. The scale at which the covariate was measured (in meters) is given in subscript numbers; covariates included as quadratics are indicated with a superscript '2'. Further information on environmental covariates is given in Table 1 of the manuscript.

Model Covariates	K	AIC	Δ AIC	AIC Wt	LL
$Highway_{1250} + Highway^2_{1250} + ForestEdge_{2500} + Canopy_{125} + North_{2500} + Precip + RdDensity_{1250} + Slope_{125} + Slope^2_{125} + Roughness_{2500} + Temp + Temp^2 + TPI_{2500}$	15	10,971.81	0.00	0.96	−5470.90
$Highway_{1250} + Highway^2_{1250} + ForestEdge_{2500} + Canopy_{125} + North_{2500} + Precip + RdDensity_{1250} + Slope_{125} + Slope^2_{125} + Roughness_{2500} + Temp + Temp^2$	14	10,978.98	7.18	0.03	−5475.49
$Highway_{1250} + Highway^2_{1250} + ForestEdge_{2500} + Canopy_{125} + North_{2500} + Precip + RdDensity_{1250} + Slope_{125} + Slope^2_{125} + Roughness_{2500} + Temp + Temp^2 + TPI_{500}$	15	10,980.81	9.00	0.01	−5475.40
$Highway_{1250} + Highway^2_{1250} + ForestEdge_{2500} + Evergreen_{125} + North_{2500} + Precip + RdDensity_{1250} + Slope_{125} + Slope^2_{125} + Roughness_{2500} + Temp + Temp^2 + TPI_{500}$	15	11,015.75	43.94	0.00	−5492.88
$Highway_{1250} + Highway^2_{1250} + ForestEdge_{500} + Canopy_{125} + North_{2500} + Precip + RdDensity_{1250} + Slope_{125} + Slope^2_{125} + Roughness_{2500} + Temp + Temp^2 + TPI_{500}$	15	11,035.22	63.41	0.00	−5502.61
$Highway_{1250} + Highway^2_{1250} + ForestEdge_{2500} + Evergreen_{125} + North_{2500} + Precip + RdDensity_{1250} + Slope_{125} + Slope^2_{125} + Roughness_{2500} + Temp + Temp^2$	14	11,037.28	65.47	0.00	−5504.64
$Highway_{1250} + Highway^2_{1250} + ForestEdge_{2500} + Evergreen_{125} + North_{2500} + Precip + RdDensity_{1250} + Slope_{125} + Slope^2_{125} + Roughness_{2500} + Temp + Temp^2 + TPI_{2500}$	15	11,037.46	65.65	0.00	−5503.73
$Highway_{125} + Highway^2_{125} + Highway_{1250} + Highway^2_{1250} + ForestEdge_{2500} + Canopy_{125} + North_{2500} + Precip + RdDensity_{1250} + Slope_{125} + Slope^2_{125} + Roughness_{2500} + Temp + Temp^2 + TPI_{2500}$	15	11,045.83	74.02	0.00	−5507.92
$Highway_{1250} + Highway^2_{1250} + ForestEdge_{500} + Canopy_{125} + North_{2500} + Precip + RdDensity_{1250} + Slope_{125} + Slope^2_{125} + Roughness_{2500} + Temp + Temp^2$	14	11,049.88	78.07	0.00	−5510.94
$Highway_{1250} + Highway^2_{1250} + ForestEdge_{500} + Canopy_{125} + North_{2500} + Precip + RdDensity_{1250} + Slope_{125} + Slope^2_{125} + Roughness_{2500} + Temp + Temp^2 + TPI_{2500}$	15	11,050.23	78.42	0.00	−5510.12

Table B.5
Model selection table for backcountry ski RSF models showing habitat selection of winter recreationists engaged in backcountry skiing or snowboarding. Only the top 10 models are shown. K is the number of model parameters, LL is model log likelihood. The scale at which the covariate was measured (in meters) is given in subscript numbers; covariates included as quadratics are indicated with a superscript '2'. Further information on environmental covariates is given in Table 1 of the manuscript.

Model Covariates	K	AIC	Δ AIC	AIC Wt	LL
$Highway_{2500} + ForestEdge_{2500} + Canopy_{2500} + Canopy^2_{2500} + Evergreen_{500} + Evergreen^2_{500} + North_{500} + Precip + RdDensity_{125} + Roughness_{125} + Temp + Temp^2 + TPI_{125}$	15	90,376.84	0	1	−45173.4
$Highway_{2500} + ForestEdge_{2500} + Evergreen_{500} + Evergreen^2_{500} + North_{500} + Precip + RdDensity_{125} + Roughness_{125} + Temp + Temp^2 + TPI_{125}$	13	90,522.59	145.75	0	−45248.3
$Highway_{2500} + ForestEdge_{2500} + Canopy_{2500} + Evergreen_{500} + Evergreen^2_{500} + North_{500} + Precip + RdDensity_{125} + Roughness_{125} + Temp + Temp^2 + TPI_{125}$	14	90,523.19	146.35	0	−45247.6
$Highway_{2500} + ForestEdge_{2500} + Canopy_{2500} + Canopy^2_{2500} + Evergreen_{500} + Evergreen^2_{500} + North_{1250} + Precip + RdDensity_{125} + Roughness_{125} + Temp + Temp^2 + TPI_{125}$	15	90,525.74	148.9	0	−45247.9
$Highway_{2500} + ForestEdge_{2500} + Canopy_{2500} + Canopy^2_{2500} + Evergreen_{500} + Evergreen^2_{500} + Precip + RdDensity_{125} + Roughness_{125} + Temp + Temp^2 + TPI_{125}$	14	90,573.21	196.37	0	−45272.6
$Highway_{2500} + ForestEdge_{2500} + Canopy_{2500} + Canopy^2_{2500} + Evergreen_{500} + Evergreen^2_{500} + North_{500} + Precip + RdDensity_{125} + Roughness_{125} + Temp + Temp^2 + TPI_{2500}$	15	90,626.04	249.2	0	−45298
$Highway_{2500} + ForestEdge_{2500} + Evergreen_{1250} + Evergreen^2_{1250} + North_{500} + Precip + RdDensity_{125} + Roughness_{125} + Temp + Temp^2 + TPI_{125}$	13	90,640.83	263.98	0	−45307.4
$Highway_{2500} + ForestEdge_{2500} + Canopy_{2500} + Canopy^2_{2500} + Evergreen_{500} + Evergreen^2_{500} + North_{500} + Precip + RdDensity_{125} + Roughness_{125} + Temp + Temp^2$	14	90,651.89	275.05	0	−45312
$Highway_{2500} + ForestEdge_{2500} + Canopy_{2500} + Canopy^2_{2500} + Evergreen_{500} + Evergreen^2_{500} + North_{1250} + Precip + RdDensity_{125} + Roughness_{125} + Temp + Temp^2 + TPI_{2500}$	15	90,764.08	387.24	0	−45367
$Highway_{2500} + ForestEdge_{2500} + Canopy_{2500} + Canopy^2_{2500} + Evergreen_{500} + Evergreen^2_{500} + North_{1250} + Precip + RdDensity_{125} + Roughness_{125} + Temp + Temp^2$	14	90,784.79	407.95	0	−45378.4

Appendix C. Mapped spatial predictions of selection for each type of winter recreation modeled with resource selection functions within the elevation range of winter recreation (2300 m–4250 m) in western Colorado, 2010–2013.

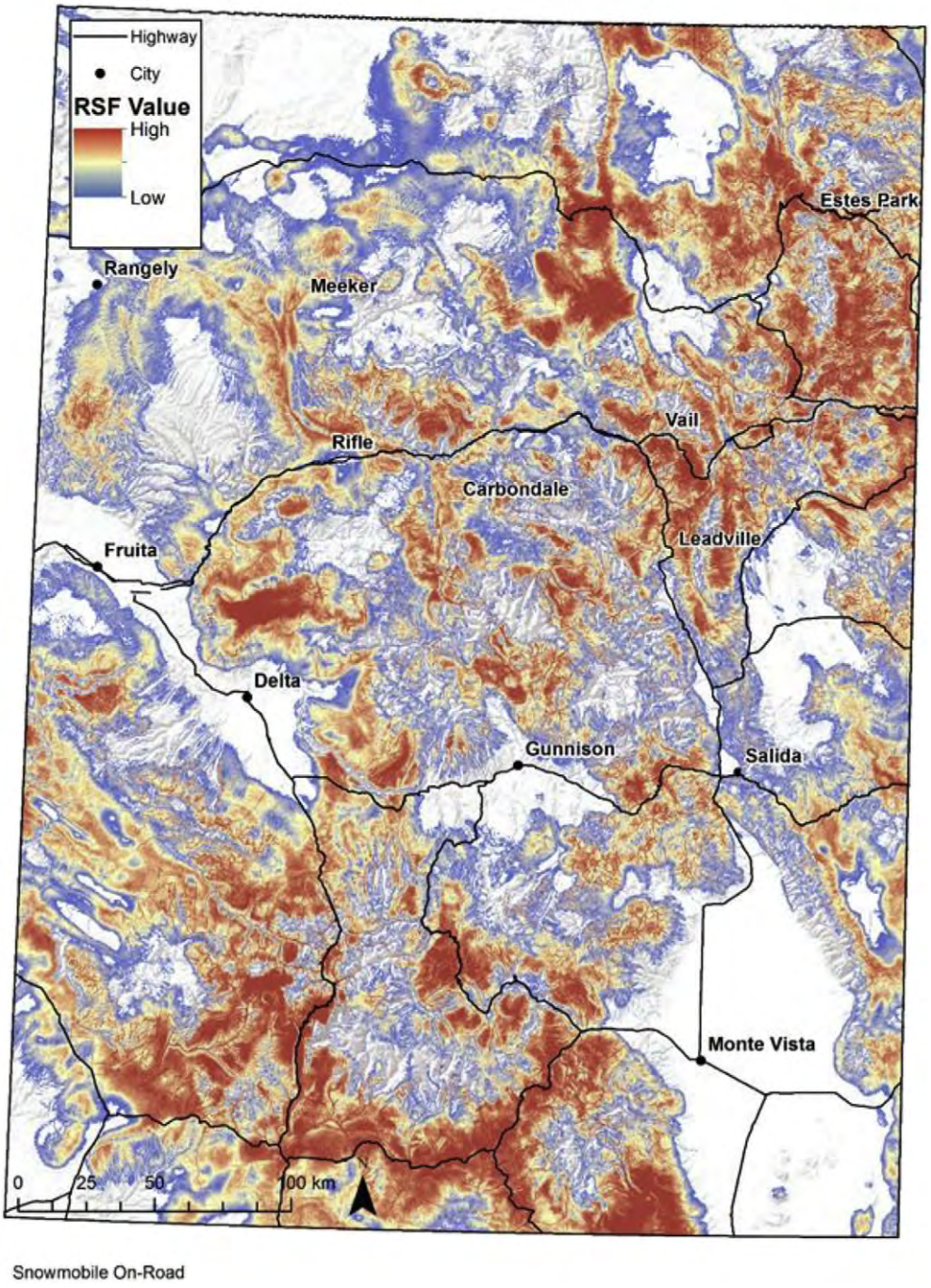

Figure C.1. Predicted probabilities of selection from the resource selection function model for on-trail snowmobile recreation across western Colorado. Warm colors indicate higher probability of selection, cool colors indicate an area is less likely to be selected.

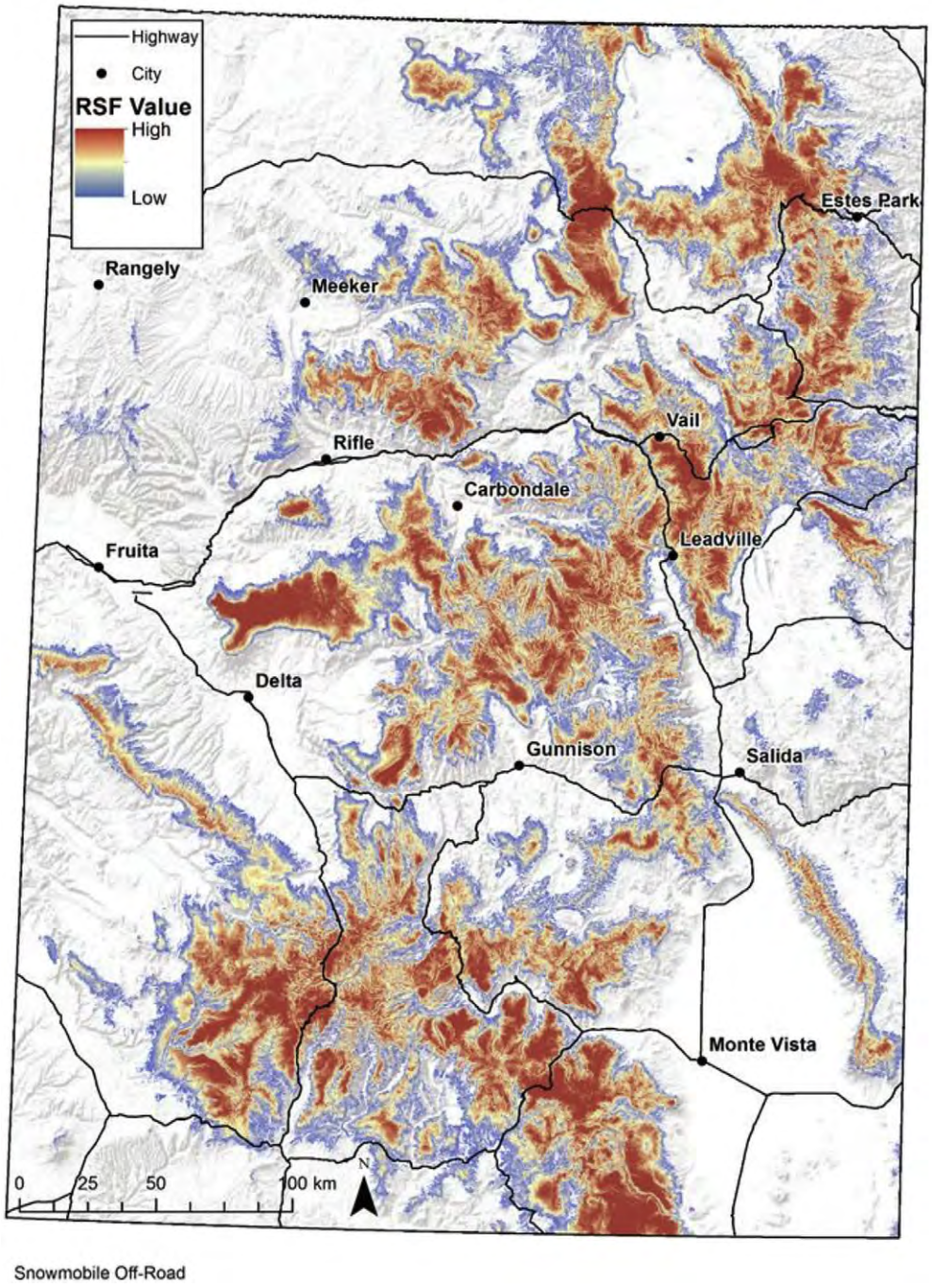

Figure C.2. Predicted probabilities of selection from the resource selection function model for off-trail snowmobile recreation across western Colorado. Warm colors indicate higher probability of selection, cool colors indicate an area is less likely to be selected.

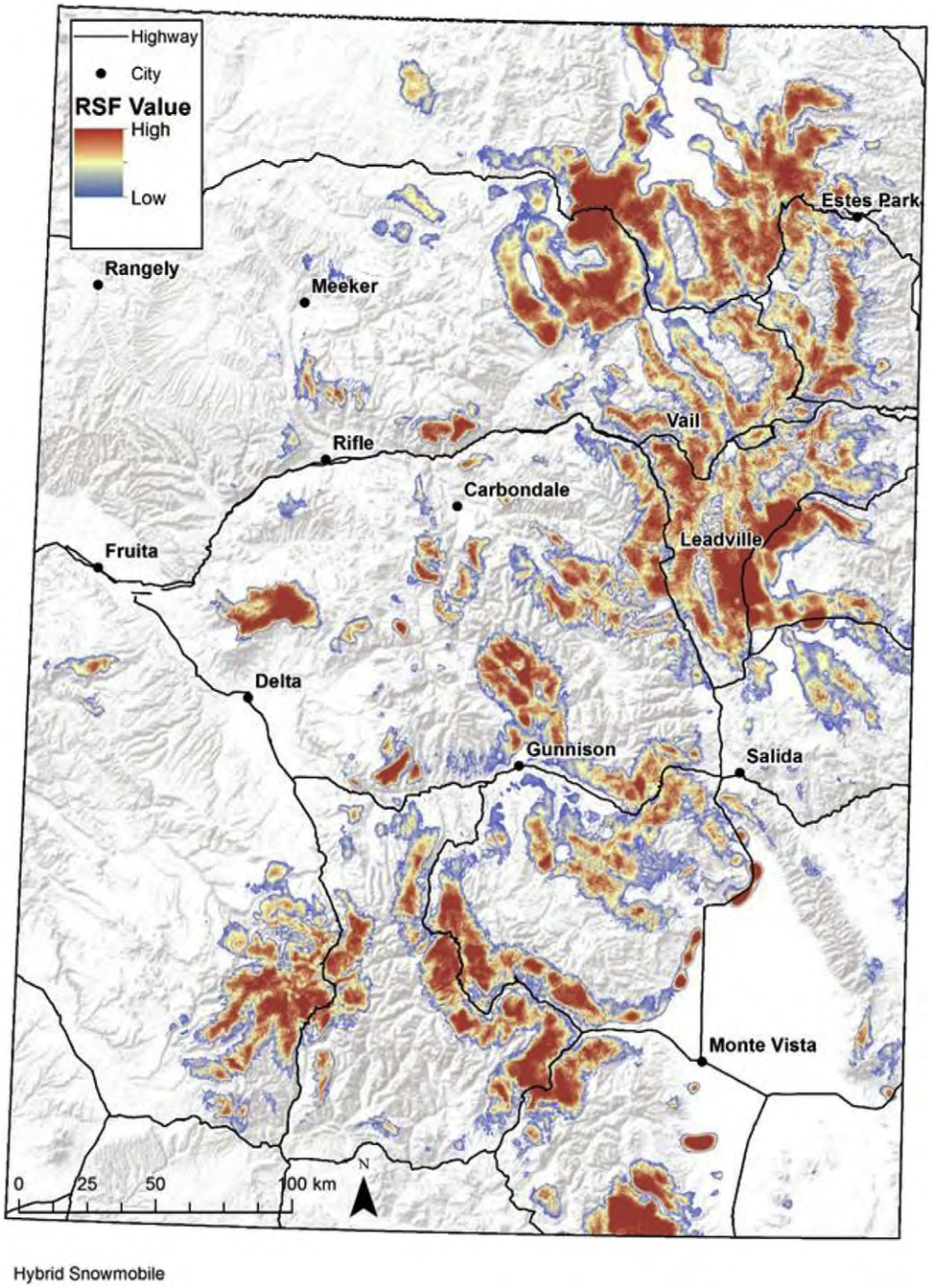

Figure C.3. Predicted probabilities of selection from the resource selection function model for hybrid snowmobile recreation across western Colorado. Warm colors indicate higher probability of selection, cool colors indicate an area is less likely to be selected.

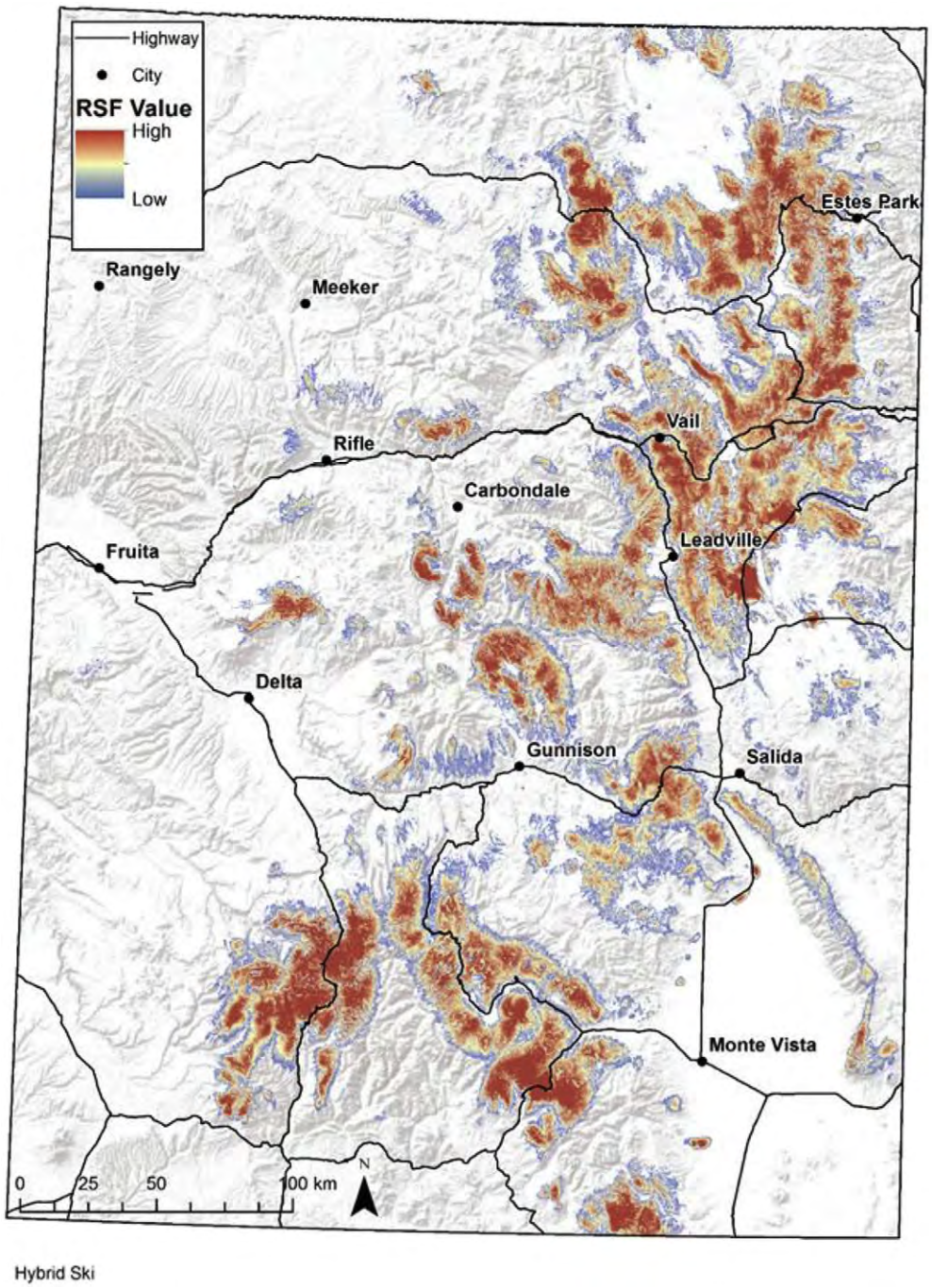

Figure C.4. Predicted probabilities of selection from the resource selection function model for hybrid ski recreation across western Colorado. Warm colors indicate higher probability of selection, cool colors indicate an area is less likely to be selected.

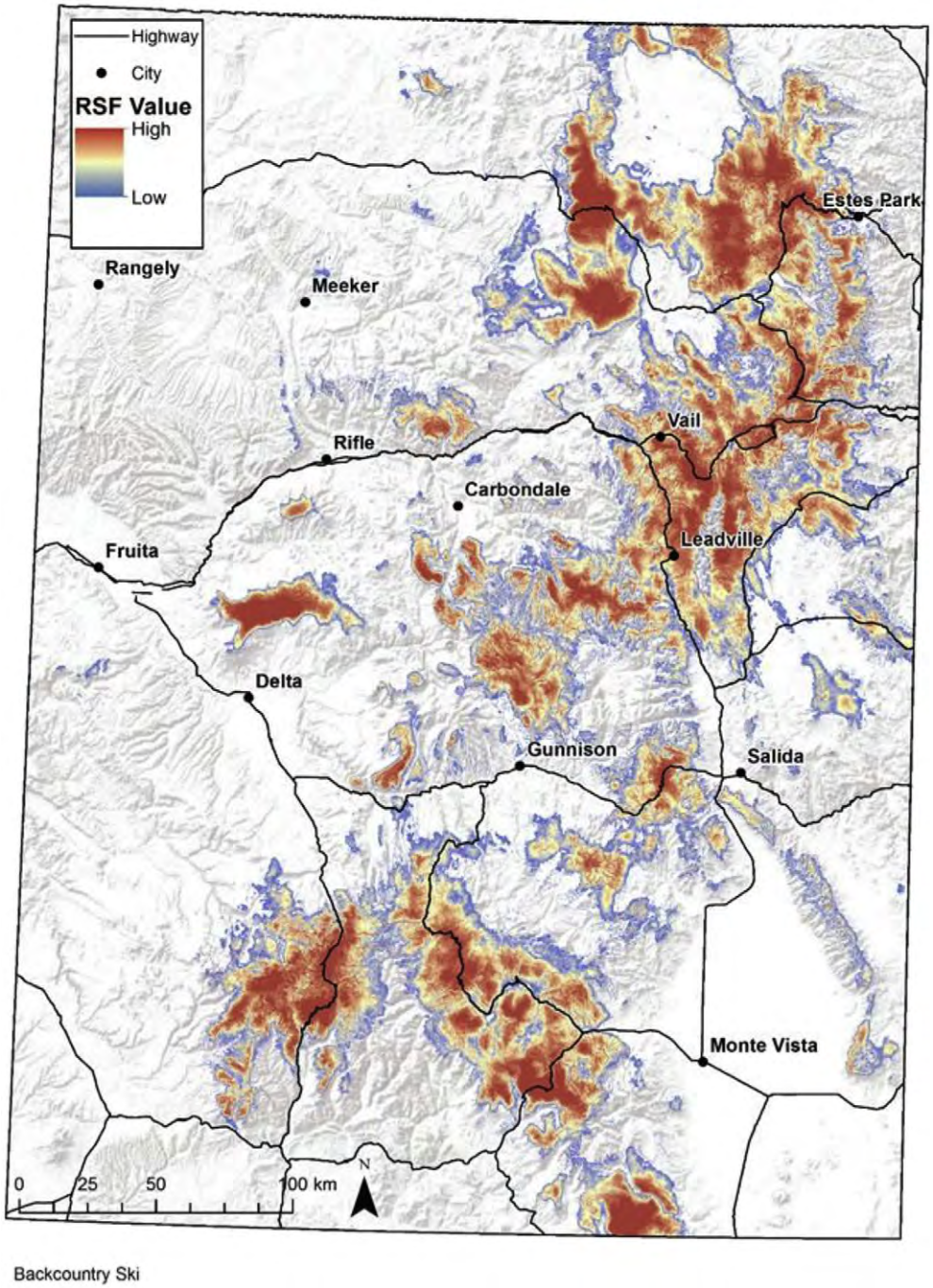

Figure C.5. Predicted probabilities of selection from the resource selection function model for backcountry ski recreation across western Colorado. Warm colors indicate higher probability of selection, cool colors indicate an area is less likely to be selected.

Appendix D. Model selection results showing the top 10 models from step selection functions (SSF) for each recreation type studied in western Colorado, USA from 2010 to 2013.

Table D.1
Model selection table for on-trail snowmobile SSF models showing selection of movement paths by winter recreationists driving snowmobiles on trails. Only the top 10 models are shown. K is the number of model parameters, LL is model log likelihood. The scale at which the covariate was measured (in meters) is given in subscript numbers; covariates included as quadratics are indicated with a superscript '2'. Further information on environmental covariates is given in Table 1 of the manuscript.

Model Covariates	K	AIC	Δ AIC	AIC Wt	LL
$Elevation_{125} + ForestEdge_{125} + Canopy_{125} + Canopy^2_{125} + North_{125} + RdDensity_{125} + RdDensity^2_{125} + Slope_{500} + Roughness_{125} + TPI_{125}$	10	340,845.00	0.00	0.59	−170,412.50
$Elevation_{125} + Elevation^2_{125} + ForestEdge_{125} + Canopy_{125} + Canopy^2_{125} + North_{125} + RdDensity_{125} + RdDensity^2_{125} + Slope_{500} + Roughness_{125} + TPI_{125}$	11	340,847.00	1.99	0.22	−170,412.50
$Elevation_{125} + Canopy_{125} + Canopy^2_{125} + North_{125} + RdDensity_{125} + RdDensity^2_{125} + Slope_{500} + Roughness_{125} + TPI_{125}$	9	340,849.20	4.17	0.07	−170,415.60
$Elevation_{125} + ForestEdge_{500} + Canopy_{125} + Canopy^2_{125} + North_{125} + RdDensity_{125} + RdDensity^2_{125} + Slope_{500} + Roughness_{125} + TPI_{125}$	10	340,849.90	4.80	0.05	−170,414.90
$Elevation_{125} + Elevation^2_{125} + Canopy_{125} + Canopy^2_{125} + North_{125} + RdDensity_{125} + RdDensity^2_{125} + Slope_{500} + Roughness_{125} + TPI_{125}$	10	340,851.20	6.17	0.03	−170,415.60
$Elevation_{125} + Elevation^2_{125} + ForestEdge_{500} + Canopy_{125} + Canopy^2_{125} + North_{125} + RdDensity_{125} + RdDensity^2_{125} + Slope_{500} + 0Roughness_{125} + TPI_{125}$	11	340,851.80	6.80	0.02	−170,414.90
$Elevation_{125} + ForestEdge_{125} + Canopy_{125} + Canopy^2_{125} + North_{125} + RdDensity_{125} + RdDensity^2_{125} + Roughness_{125} + TPI_{125}$	9	340,853.80	8.78	0.01	−170,417.90
$Elevation_{125} + ForestEdge_{125} + Canopy_{125} + Canopy^2_{125} + RdDensity_{125} + RdDensity^2_{125} + Slope_{500} + Roughness_{125} + TPI_{125}$	9	340,853.90	8.88	0.01	−170,418.00
$Elevation_{125} + Elevation^2_{125} + ForestEdge_{125} + Canopy_{125} + Canopy^2_{125} + North_{125} + RdDensity_{125} + RdDensity^2_{125} + Roughness_{125} + TPI_{125}$	10	340,855.60	10.60	0.00	−170,417.80
$Elevation_{125} + Elevation^2_{125} + ForestEdge_{125} + Canopy_{125} + Canopy^2_{125} + RdDensity_{125} + RdDensity^2_{125} + Slope_{500} + Roughness_{125} + TPI_{125}$	10	340,855.90	10.90	0.00	−170,418.00

Table D.2
Model selection table for off-trail snowmobile SSF models showing selection of movement paths by winter recreationists driving snowmobiles on off-trail play areas. Only the top 10 models are shown. K is the number of model parameters, LL is model log likelihood. The scale at which the covariate was measured (in meters) is given in subscript numbers; covariates included as quadratics are indicated with a superscript '2'. Further information on environmental covariates is given in Table 1 of the manuscript.

Model Covariates	K	AIC	Δ AIC	AIC Wt	LL
$Highway_{500} + Elevation_{125} + ForestEdge_{125} + Canopy_{125} + Canopy^2_{125} + North_{125} + RdDensity_{125} + Slope_{500} + Roughness_{125} + TPI_{125}$	10	102,826.30	0.00	0.42	−51403.15
$Highway_{125} + Elevation_{125} + ForestEdge_{125} + Canopy_{125} + Canopy^2_{125} + North_{125} + RdDensity_{125} + Slope_{500} + Roughness_{125} + TPI_{125}$	10	102,826.90	0.64	0.31	−51403.46
$Highway_{500} + Elevation_{500} + ForestEdge_{125} + Canopy_{125} + Canopy^2_{125} + North_{125} + RdDensity_{125} + Slope_{500} + Roughness_{125} + TPI +$	10	102,828.50	2.24	0.14	−51404.26
$Highway_{125} + Elevation_{500} + ForestEdge_{125} + Canopy_{125} + Canopy^2_{125} + North_{125} + RdDensity_{125} + Slope_{500} + Roughness_{125} + TPI +$	10	102,829.10	2.86	0.10	−51404.57
$Highway_{500} + ForestEdge_{125} + Canopy_{125} + Canopy^2_{125} + North_{125} + RdDensity_{125} + Slope_{500} + Roughness_{125} + TPI +$	9	102,834.00	7.70	0.01	−51408.00
$Highway_{125} + ForestEdge_{125} + Canopy_{125} + Canopy^2_{125} + North_{125} + RdDensity_{125} + Slope_{500} + Roughness_{125} + TPI +$	9	102,834.40	8.15	0.01	−51408.22
$Elevation_{125} + ForestEdge_{125} + Canopy_{125} + Canopy^2_{125} + North_{125} + RdDensity_{125} + Slope_{500} + Roughness_{125} + TPI +$	9	102,834.50	8.25	0.01	−51408.27
$Highway_{500} + Elevation_{125} + ForestEdge_{125} + Canopy_{125} + Canopy^2_{125} + RdDensity_{125} + Slope_{500} + Roughness_{125} + TPI$	9	102,836.20	9.94	0.00	−51409.12
$Elevation_{500} + ForestEdge_{125} + Canopy_{125} + Canopy^2_{125} + North_{125} + RdDensity_{125} + Slope_{500} + Roughness_{125} + TPI +$	9	102,836.30	9.98	0.00	−51409.14
$Highway_{125} + Elevation_{125} + ForestEdge_{125} + Canopy_{125} + Canopy^2_{125} + RdDensity_{125} + Slope_{500} + Roughness_{125} + TPI +$	9	102,836.90	10.60	0.00	−51409.43

Table D.3
Model selection table for hybrid snowmobile SSF models showing selection of movement paths by winter recreationists driving snowmobiles while engaging in hybrid-assisted skiing. Only the top 10 models are shown. K is the number of model parameters, LL is model log likelihood. The scale at which the covariate was measured (in meters) is given in subscript numbers; covariates included as quadratics are indicated with a superscript '2'. Further information on environmental covariates is given in Table 1 of the manuscript.

Model Covariates	K	AIC	Δ AIC	AIC Wt	LL
$Highway_{125} + ForestEdge_{500} + Canopy_{125} + Canopy_{125}^2 + North_{500} + Precip + RdDensity_{125} + RdDensity_{125}^2 + Slope_{500} + Roughness_{125} + Roughness_{125}^2 + Temp + TPI_{500} + TPI_{500}^2$	14	333,152.20	0.00	1.00	−166,562.10
$Highway_{500} + ForestEdge_{500} + Canopy_{125} + Canopy_{125}^2 + North_{500} + Precip + RdDensity_{125} + RdDensity_{125}^2 + Slope_{500} + Roughness_{125} + Roughness_{125}^2 + Temp + TPI_{500} + TPI_{500}^2$	14	333,169.40	17.18	0.00	−166,570.70
$Highway_{125} + ForestEdge_{500} + Canopy_{125} + Canopy_{125}^2 + North_{500} + RdDensity_{125} + RdDensity_{125}^2 + Slope_{500} + Roughness_{125} + Roughness_{125}^2 + Temp + TPI_{500} + TPI_{500}^2$	13	333,204.50	52.22	0.00	−166,589.20
$Highway_{125} + Elevation_{500} + ForestEdge_{500} + Canopy_{125} + Canopy_{125}^2 + North_{500} + Precip + RdDensity_{125} + RdDensity_{125}^2 + Slope_{500} + Roughness_{125} + Roughness_{125}^2 + TPI_{500} + TPI_{500}^2$	14	333,214.40	62.15	0.00	−166,593.20
$Highway_{125} + Elevation_{500} + Elevation_{500}^2 + ForestEdge_{500} + Canopy_{125} + Canopy_{125}^2 + North_{500} + Precip + RdDensity_{125} + RdDensity_{125}^2 + Slope_{500} + Roughness_{125} + Roughness_{125}^2 + TPI_{500} + TPI_{500}^2$	15	333,216.00	63.76	0.00	−166,593.00
$Highway_{125} + ForestEdge_{500} + Canopy_{125} + Canopy_{125}^2 + North_{500} + Precip + RdDensity_{125} + RdDensity_{125}^2 + Slope_{500} + Roughness_{125} + Roughness_{125}^2 + TPI_{500} + TPI_{500}^2$	13	333,216.20	63.94	0.00	−166,595.10
$ForestEdge_{500} + Canopy_{125} + Canopy_{125}^2 + North_{500} + Precip + RdDensity_{125} + RdDensity_{125}^2 + Slope_{500} + Roughness_{125} + Roughness_{125}^2 + Temp + TPI_{500} + TPI_{500}^2$	13	333,216.30	64.05	0.00	−166,595.10
$Highway_{500} + ForestEdge_{500} + Canopy_{125} + Canopy_{125}^2 + North_{500} + RdDensity_{125} + RdDensity_{125}^2 + Slope_{500} + Roughness_{125} + Roughness_{125}^2 + Temp + TPI_{500} + TPI_{500}^2$	13	333,223.30	71.03	0.00	−166,598.60
$Highway_{500} + Elevation_{500} + ForestEdge_{500} + Canopy_{125} + Canopy_{125}^2 + North_{500} + Precip + RdDensity_{125} + RdDensity_{125}^2 + Slope_{500} + Roughness_{125} + Roughness_{125}^2 + TPI_{500} + TPI_{500}^2$	14	333,228.40	76.13	0.00	−166,600.20
$Highway_{500} + ForestEdge_{500} + Canopy_{125} + Canopy_{125}^2 + North_{500} + Precip + RdDensity_{125} + RdDensity_{125}^2 + Slope_{500} + Roughness_{125} + Roughness_{125}^2 + TPI_{500} + TPI_{500}^2$	13	333,230.00	77.74	0.00	−166,602.00

Table D.4
Model selection table for hybrid ski SSF models showing selection of movement paths by winter recreationists skiing downhill while engaging in hybrid-assisted skiing. Only the top 10 models are shown. K is the number of model parameters, LL is model log likelihood. The scale at which the covariate was measured (in meters) is given in subscript numbers; covariates included as quadratics are indicated with a superscript '2'. Further information on environmental covariates is given in Table 1 of the manuscript.

Model Covariates	K	AIC	Δ AIC	AIC Wt	LL
$ForestEdge_{125} + Canopy_{125} + Canopy_{125}^2 + North_{500} + Precip + RdDensity_{500} + Slope_{500} + Roughness_{125} + Roughness_{125}^2 + Temp + TPI_{500} + TPI_{500}^2$	12	37,666.77	0.00	0.67	−18821.38
$ForestEdge_{125} + Canopy_{125} + Canopy_{125}^2 + North_{500} + Precip + Slope_{500} + Roughness_{125} + Roughness_{125}^2 + Temp + TPI_{500} + TPI_{500}^2$	11	37,669.51	2.73	0.17	−18823.75
$ForestEdge_{125} + Canopy_{125} + Canopy_{125}^2 + North_{500} + Precip + RdDensity_{125} + Slope_{500} + Roughness_{125} + Roughness_{125}^2 + Temp + TPI_{500} + TPI_{500}^2$	12	37,670.83	4.06	0.09	−18823.41
$ForestEdge_{500} + Canopy_{125} + Canopy_{125}^2 + North_{500} + Precip + RdDensity_{500} + Slope_{500} + Roughness_{125} + Roughness_{125}^2 + Temp + TPI_{500} + TPI_{500}^2$	12	37,673.18	6.41	0.03	−18824.59
$ForestEdge_{500} + Canopy_{125} + Canopy_{125}^2 + North_{500} + Precip + Slope_{500} + Roughness_{125} + Roughness_{125}^2 + Temp + TPI_{500} + TPI_{500}^2$	11	37,673.20	6.43	0.03	−18825.60
$ForestEdge_{500} + Canopy_{125} + Canopy_{125}^2 + North_{500} + Precip + RdDensity_{125} + Slope_{500} + Roughness_{125} + Roughness_{125}^2 + Temp + TPI_{500} + TPI_{500}^2$	12	37,674.45	7.68	0.01	−18825.22
$Canopy_{125} + Canopy_{120}^2 + North_{500} + Precip + RdDensity_{500} + Slope_{500} + Roughness_{125} + Roughness_{125}^2 + Temp + TPI_{500} + TPI_{500}^2$	11	37,684.50	17.72	0.00	−18831.25
$ForestEdge_{125} + Canopy_{125} + Canopy_{125}^2 + Precip + RdDensity_{500} + Slope_{500} + Roughness_{125} + Roughness_{125}^2 + Temp + TPI_{500} + TPI_{500}^2$	11	37,685.77	18.99	0.00	−18831.88
$Canopy_{125} + Canopy_{125}^2 + North_{500} + Precip + Slope_{500} + Roughness_{125} + Roughness_{125}^2 + Temp + TPI_{500} + TPI_{500}^2$	10	37,686.15	19.38	0.00	−18833.07
$Canopy_{125} + Canopy_{125}^2 + North_{500} + Precip + RdDensity_{125} + Slope_{500} + Roughness_{125} + Roughness_{125}^2 + Temp + TPI_{500} + TPI_{500}^2$	11	37,687.52	20.75	0.00	−18832.76

Table D.5
Model selection table for backcountry ski SSF models showing selection of movement paths by winter recreationists engaged in backcountry skiing. Only the top 10 models are shown. K is the number of model parameters, LL is model log likelihood. The scale at which the covariate was measured (in meters) is given in subscript numbers; covariates included as quadratics are indicated with a superscript '2'. Further information on environmental covariates is given in Table 1 of the manuscript.

Model Covariates	K	AIC	Δ AIC	AIC Wt	LL
$Highway_{500} + Highway^2_{500} + Elevation_{500} + Elevation^2_{500} + ForestEdge_{500} + Canopy_{500} + Canopy^2_{500} + Evergreen_{125} + Evergreen^2_{125} + Precip + RdDensity_{125} + Roughness_{125} + TPI_{500} + TPI^2_{500}$	14	195,195.80	0.00	0.55	−97583.89
$Highway_{500} + Highway^2_{500} + Elevation_{500} + Elevation^2_{500} + ForestEdge_{500} + Canopy_{500} + Canopy^2_{500} + Evergreen_{125} + Evergreen^2_{125} + RdDensity_{125} + Roughness_{125} + TPI_{500} + TPI^2_{500}$	13	195,196.80	1.00	0.33	−97585.39
$Highway_{500} + Highway^2_{500} + Elevation_{500} + Elevation^2_{500} + Canopy_{500} + Canopy^2_{500} + Evergreen_{125} + Evergreen^2_{125} + Precip + RdDensity_{125} + Roughness_{125} + TPI_{500} + TPI^2_{500}$	13	195,200.30	4.54	0.06	−97587.16
$Highway_{500} + Highway^2_{500}2 + Elevation_{500} + Elevation^2_{500} + Canopy_{500} + Canopy^2_{500} + Evergreen_{125} + Evergreen^2_{125} + RdDensity_{125} + Roughness_{125} + TPI_{500} + TPI^2_{500}$	12	195,201.70	5.96	0.03	−97588.87
$Highway_{500} + Highway^2_{500} + Elevation_{500} + Elevation^2_{500} + ForestEdge_{125} + Canopy_{500} + Canopy^2_{500} + Evergreen_{125} + Evergreen^2_{125} + Precip + RdDensity_{125} + Roughness_{125} + TPI_{500} + TPI^2_{500}$	14	195,202.30	6.50	0.02	−97587.14
$Highway_{500} + Highway^2_{500} + Elevation_{500} + Elevation^2_{500} + ForestEdge_{125} + Canopy_{500} + Canopy^2_{500} + Evergreen_{125} + Evergreen^2_{125} + RdDensity_{125} + Roughness_{125} + TPI_{500} + TPI^2_{500}$	13	195,203.70	7.91	0.01	−97588.85
$Highway_{500} + Elevation_{500} + Elevation^2_{500} + ForestEdge_{500} + Canopy\ _{500} + Canopy\ ^2_{500} + Evergreen_{125} + Evergreen^2_{125} + Precip + RdDensity_{125} + Roughness_{125} + TPI_{500} + TPI^2_{500}$	13	195,207.50	11.67	0.00	−97590.73
$Highway_{500} + Elevation_{500} + Elevation^2_{500} + ForestEdge_{500} + Canopy_{500} + Canopy^2_{500} + Evergreen_{125} + Evergreen^2_{125} + RdDensity_{125} + Roughness_{125} + TPI_{500} + TPI^2_{500}$	12	195,210.80	15.00	0.00	−97593.40
$Highway_{500} + Elevation_{00} + Elevation^2_{500} + Canopy_{500} + Canopy^2_{500} + Evergreen_{125} + Evergreen^2_{125} + Precip + RdDensity_{125} + Roughness_{125} + TPI_{500} + TPI^2_{500}$	12	195,212.50	16.75	0.00	−97594.27
$Highway_{500} + Elevation_{500} + Elevation^2_{500} + ForestEdge_{125} + Canopy_{500} + Canopy^2_{500} + Evergreen_{125} + Evergreen^2_{125} + Precip + RdDensity_{125} + Roughness_{125} + TPI_{500} + TPI^2_{500}$	13	195,214.50	18.69	0.00	−97594.24

Appendix E. Pairwise similarities between the continuous predicted maps generated by the top-performing resource selection function models for each recreation type studied in western Colorado, USA 2010–2013, as measured by Pearson correlation. Pairs of recreation types with higher Pearson correlations are predicted to have greater similarity of terrain selection, and thus potentially greater interpersonal conflict.

Table 6
Pearson correlations between predicted surfaces for each of the recreation activities. Recreation activities shown are on-trail snowmobiles (Snmb on-tr), off-trail snowmobiles (Snmb off-tr), snowmobile segments of hybrid-assisted skiing (Hybrid snmb), ski segments of hybrid-assisted skiing (Hybrid ski), and back-country ski or snowboard (BC Ski).

	Snmb on-tr	Snmb off-tr	Hybrid snmb	Hybrid ski	BC Ski
Snmb on-rd	1.00	0.07	0.04	0.07	0.14
Snmb off-rd		1.00	0.03	0.05	0.12
Hybrid snmb			1.00	0.18	0.20
Hybrid ski				1.00	0.25
Ski/board					1.00

References

Akaike, H. (1974). A new look at the statistical model identification. *IEEE Transactions on Automatic Control, 19*(6), 716–723.

Albritton, R., & Stein, T. V. (2011). Integrating social and natural resource information to improve planning for motorized recreation. *Applied Geography, 31*(1), 85–97. http://dx.doi.org/10.1016/j.apgeog.2010.02.005.

Arlettaz, R., Nussle, S., Baltic, M., Vogel, P., Palme, R., Jenni-Eiermann, S., et al. (2015). Disturbance of wildlife by outdoor winter recreation: Allostatic stress response and altered activity–energy budgets. *Ecological Applications, 25*(5), 1197–1212.

Barton, K. (2015). *MuMIn: Multi-model inference*. R Package Version 1.15.1.

Bates, D., Maechler, M., Bolker, B., & Walker, S. (2014). *lme4: Linear mixed-effects models using Eigen and S4*. R Package Version 1.1-13.

Beeco, J. A., & Brown, G. (2013). Integrating space, spatial tools, and spatial analysis into the human dimensions of parks and outdoor recreation. *Applied Geography, 38*(1), 76–85. http://dx.doi.org/10.1016/j.apgeog.2012.11.013.

Beeco, J. A., & Hallo, J. C. (2014). GPS tracking of visitor use: Factors influencing visitor spatial behavior on a complex trail system. *Journal of Park and Recreation Administration, 32*(2), 43–61.

Beeco, J. A., Hallo, J. C., & Brownlee, M. T. J. (2014). GPS visitor tracking and recreation suitability Mapping: Tools for understanding and managing visitor use. *Landscape and Urban Planning, 127*, 136–145. http://dx.doi.org/10.1016/j.landurbplan.2014.04.002.

Bowker, J. M., Askew, A. E., Cordell, H. K., Betz, C. J., Zarnoch, S. J., & Seymour, L. (2012). US outdoor recreation participation projections to 2060. In *Outdoor recreation participation in the United States - projections to 2060: A technical document supporting the forest Service 2010 RPA assessment* (pp. 105–124). Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station.

Boyce, M. S., Vernier, P. R., Nielsen, S. E., & Schmiegelow, F. K. A. (2002). Evaluating resource selection functions. *Ecological Modelling, 157*, 281–300.

Brabyn, L., & Sutton, S. (2013). A population based assessment of the geographical accessibility of outdoor recreation opportunities in New Zealand. *Applied Geography, 41*, 124–131. http://dx.doi.org/10.1016/j.apgeog.2013.03.013.

Braunisch, V., Patthey, P., & Arlettaz, R. (2011). Spatially explicit modelling of conflict zones between wildlife and outdoor snow-sports: Prioritizing areas for winter refuges. *Ecological Applications, 21*(3), 955–967. http://dx.doi.org/10.1890/09-2167.1.

Brown, G., & Raymond, C. M. (2014). Methods for identifying land use conflict potential using participatory mapping. *Landscape and Urban Planning, 122*, 196–208. http://dx.doi.org/10.1016/j.landurbplan.2013.11.007.

Cessford, G. (2003). Perception and reality of conflict: Walkers and mountain bikes on the Queen Charlotte track in New Zealand. *Journal for Nature Conservation, 11*(4), 310–316. http://dx.doi.org/10.1078/1617-1381-00062.

Cole, D. N., & Daniel, T. C. (2003). The science of visitor management in parks and protected areas: From verbal reports to simulation models. *Journal for Nature Conservation, 11*(4), 269–277.

D'Antonio, A., Monz, C., Lawson, S., Newman, P., Pettebone, D., & Courtemanch, A. (2010). GPS-based measurements of backcountry visitors in parks and protected areas: Examples of methods and applications from three case studies. *Journal of Park and Recreation Administration, 28*(3), 42–60.

Fortin, D., Beyer, H. L., Boyce, M. S., Smith, D. W., Duchesne, T., & Mao, J. S. (2005). Wolves influence elk movements: Behavior shapes a trophic cascade in Yellowstone National Park. *Ecology, 86*(5), 1320–1330. http://dx.doi.org/10.1890/04-0953.

Freeman, E. A., & Moisen, G. G. (2008). A comparison of the performance of threshold criteria for binary classification in terms of predicted prevalence and kappa. *Ecological Modelling, 217*, 48–58. http://dx.doi.org/10.1016/j.ecolmodel.2008.05.015.

Gillies, C. S., Hebblewhite, M., Nielsen, S. E., Krawchuk, M. A., Aldridge, C. L., Frair, J. L., et al. (2006). Application of random effects to the study of resource selection by animals. *Journal of Animal Ecology, 75*(4), 887–898. http://dx.doi.org/10.1111/j.1365-2656.2006.01106.x.

Gramann, J. H. (1982). Toward a behavioral theory of crowding in outdoor recreation: An evaluation and synthesis of research. *Leisure Sciences, 5*(2), 109–126.

Hallo, J. C., Beeco, J. A., Goetcheus, C., McGee, J., McGehee, N. G., & Norman, W. C. (2012). GPS as a method for assessing spatial and temporal use distributions of nature-based tourists. *Journal of Travel Research, 51*(5), 591–606. http://dx.doi.org/10.1177/0047287511431325.

Hallo, J. C., Manning, R. E., Valliere, W., & Budruck, M. (2004). A case study

comparison of visitor self-reported and GPS recorded travel routes. In *Proceedings of the 2004 Northeastern recreation research symposium* (pp. 172–177).
Harris, G., Nielson, R. M., Rinaldi, T., & Lohuis, T. (2014). Effects of winter recreation on northern ungulates with focus on moose (Alces alces) and snowmobiles. *European Journal of Wildlife Research, 60*(1), 45–58. http://dx.doi.org/10.1007/s10344-013-0749-0.
Havlick, D. (2002). *No place distant: Roads and motorized recreation on America's public lands*. Washington, D.C.: Island Press.
Homer, C. G., Dewitz, J. A., Yang, L., Jin, S., Danielson, P., Xian, G., et al. (2015). Completion of the 2011 National Land Cover Database for the conterminous United States-Representing a decade of land cover change information. *Photogrammetric Engineering and Remote Sensing, 81*(5), 345–354.
Hosmer, D. W., Jr., Lemeshow, S., & Sturdivant, R. X. (2013). *Applied logistic regression* (3rd ed.). Hoboken, New Jersey: John Wiley & Sons.
Jackson, S. A., Haider, W., & Elliot, T. (2003). Resolving inter-group conflict in winter recreation: Chilkoot trail national historic site, British Columbia. *Journal for Nature Conservation, 11*(4), 317–323. http://dx.doi.org/10.1078/1617-1381-00063.
Jacob, G. R., & Schreyer, R. (1980). Conflict in outdoor recreation: A theoretical perspective. *Journal of Leisure Research, 12*(4), 368–380.
Jenness, J. (2013). *DEM Surface Tools for ArcGIS (surface_area.exe)*. Retrieved from: http://www.jennessent.com/arcgis/surface_area.htm.
Jenness, J., Brost, B., & Beier, P. (2013). *Land facet corridor Designer: Extension for ArcGIS*. Retrieved from: http://www.jennessent.com/arcgis/land_facets.htm.
Keating, K. A., & Cherry, S. (2004). Use and interpretation of logistic regression in habitat-selection studies. *Journal of Wildlife Management, 64*(4), 744–789.
Kliskey, A. D. (2000). Recreation terrain suitability mapping: A spatially explicit methodology for determining recreation potential for resource use assessment. *Landscape and Urban Planning, 52*(1), 33–43. http://dx.doi.org/10.1016/S0169-2046(00)00111-0.
Krebs, J., Lofroth, E., & Parfitt, I. (2007). Multiscale habitat use by wolverines in British Columbia, Canada. *Journal of Wildlife Management, 71*(7), 2180–2192. http://dx.doi.org/10.2193/2007-099.
Lai, P. C., Li, C. L., Chan, K. W., & Kwong, K. H. (2007). An assessment of GPS and GIS in recreational tracking. *Journal of Park and Recreation Administration, 25*(1), 128–139.
Larson, C. L., Reed, S. E., Merenlender, A. M., & Crooks, K. R. (2016). Effects of recreation on animals revealed as widespread through a global systematic review. *PLoS One*, 1–21. http://dx.doi.org/10.1371/journal.pone.0167259.
Leung, Y., & Marion, J. L. (1999). Spatial strategies for managing visitor impacts in national parks. *Journal of Park and Recreation Administration, 17*(4), 20–38.
Manly, B. F. J., McDonald, L. L., Thomas, D. L., McDonald, T. L., & Erickson, W. P. (2002). *Resource selection by animals: Statistical design and analysis for field studies* (2nd ed.). New York: Kluwer Academic Publishers.
Manning, R. E., & Valliere, W. A. (2001). Coping in outdoor recreation: Causes and consequences of crowding and conflict among community residents. *Journal of Leisure Research, 33*(4), 410–426.
Miller, A. D. (2016). *Recreation conflict and management options in the Vail Pass winter recreation area, Colorado, USA*. Colorado State University.
Miller, A. D., Vaske, J. J., Squires, J. R., Olson, L. E., & Roberts, E. K. (2016). Does zoning winter recreationists reduce recreation conflict? *Environmental Management*, 1–18. http://dx.doi.org/10.1007/s00267-016-0777-0.
National Weather Service, National Oceanic and Atmospheric Administration. (2017). Colorado snowpack. Retrieved from: https://www.weather.gov/bou/co_snowpack.
Patthey, P., Wirthner, S., Signorell, N., & Arlettaz, R. (2008). Impact of outdoor winter sports on the abundance of a key indicator species of alpine ecosystems. *Journal of Applied Ecology, 45*, 1704–1711. http://dx.doi.org/10.1111/j.1365-2664.2008.01547.x.
R Core Team. (2015). R: A language and environment for statistical computing. Retrieved July 1, 2015, from: https://www.r-project.org/.
Reimers, E., Eftestøl, S., & Colman, J. E. (2003). Behavior responses of wild reindeer to direct provocation by a snowmobile or skier. *Journal of Wildlife Management, 67*(4), 747–754.
Richard, J. H., & Côté, S. D. (2016). Space use analyses suggest avoidance of a ski area by mountain goats. *The Journal of Wildlife Management, 80*(3), 387–395. http://dx.doi.org/10.1002/jwmg.1028.
Rupf, R., Wyttenbach, M., Köchli, D., Hediger, M., Lauber, S., Ochsner, P., et al. (2011). Assessing the spatio-temporal pattern of winter sports activities to minimize disturbance in capercaillie habitats. *Eco.mont, 3*(2), 23–32. http://dx.doi.org/10.1553/eco.mont-3-2s23.
Sato, C. F., Wood, J. T., & Lindenmayer, D. B. (2013). The effects of winter recreation on alpine and subalpine fauna: A systematic review and meta-analysis. *PLoS One, 8*(5), e64282. http://dx.doi.org/10.1371/journal.pone.0064282.
Seip, D. R., Johnson, C. J., & Watts, G. S. (2007). Displacement of mountain caribou from winter habitat by snowmobiles. *Journal of Wildlife Management, 71*(5), 1539–1544. http://dx.doi.org/10.2193/2006-387.
Shively, D. D., Pape, B. M. C., Mower, R. N., Zhou, Y., Russo, R., & Sive, B. C. (2008). Blowing smoke in Yellowstone: Air quality impacts of oversnow motorized recreation in the park. *Environmental Management, 41*(2), 183–199. http://dx.doi.org/10.1007/s00267-007-9036-8.
Snyder, S. A., Whitmore, J. H., Schneider, I. E., & Becker, D. R. (2008). Ecological criteria, participant preferences and location models: A GIS approach toward ATV trail planning. *Applied Geography, 28*(4), 248–258. http://dx.doi.org/10.1016/j.apgeog.2008.07.001.
Thapa, B., & Graefe, A. (2004). Recreation conflict and tolerance among skiers and snowboarders. *Journal of Park and Recreation Administration, 22*(1), 37–52. http://dx.doi.org/10.1080/01490409950202311.
Theobald, D. M. (2004). Placing exurban land-use change in a human modification framework. *Frontiers in Ecology and the Environment, 2*(3), 139–144.
Therneau, T. (2015). A package for survival analysis in S. Retrieved from: http://CRAN.R-project.org/package=survival.
Thurfjell, H., Ciuti, S., & Boyce, M. S. (2014). Applications of step-selection functions in ecology and conservation. *Movement Ecology, 2*(4), 12. http://dx.doi.org/10.1186/2051-3933-2-4.
Tomczyk, A. M. (2011). A GIS assessment and modelling of environmental sensitivity of recreational trails: The case of Gorce National Park, Poland. *Applied Geography, 31*(1), 339–351. http://dx.doi.org/10.1016/j.apgeog.2010.07.006.
U.S.D.A. Forest Service. (2015). White River national forest official webpage on Vail Pass winter recreation area. Retrieved July 30, 2015, from: http://www.fs.usda.gov/recarea/whiteriver/recreation/recarea/?recid=41445&actid=92.
Vaske, J. J., Carothers, P., Donnelly, M. P., & Baird, B. (2000). Recreation conflict among skiers and snowboarders. *Leisure Sciences, 22*(4), 297–313. http://dx.doi.org/10.1080/01490409950202311.
Vaske, J. J., Donnelly, M. P., Wittmann, K., & Laidlaw, S. (1995). Interpersonal versus social-values conflict. *Leisure Sciences, 17*(3), 205–222. http://dx.doi.org/10.1080/01490409509513257.
Vaske, J. J., Needham, M. D., & Cline, R. C., Jr. (2007). Clarifying interpersonal and social values conflict among recreationists. *Journal of Leisure Research, 39*(1), 182–195.
Westcott, F., & Andrew, M. E. (2015). Spatial and environmental patterns of off-road vehicle recreation in a semi-arid woodland. *Applied Geography, 62*, 97–106. http://dx.doi.org/10.1016/j.apgeog.2015.04.011.
Zielinski, W. J., Slauson, K. M., & Bowles, A. E. (2008). Effects of off highway vehicle use on the American Marten. *Journal of Wildlife Management, 72*(7), 1558–1571. http://dx.doi.org/10.2193/2007-397.

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.

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FOREST SERVICE
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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.

Study Guide and Supplemental Information

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)*.

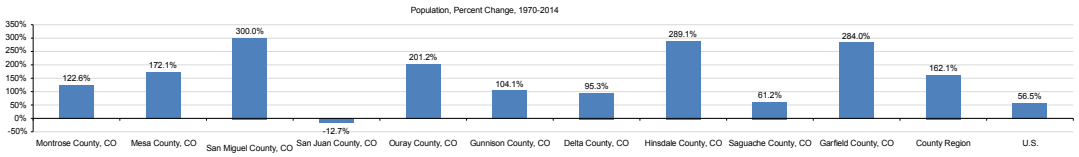
Data Sources

Various; see following pages for specifics.

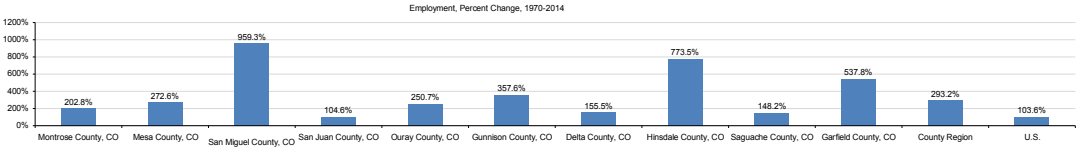
How have population, employment, and personal income changed?

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

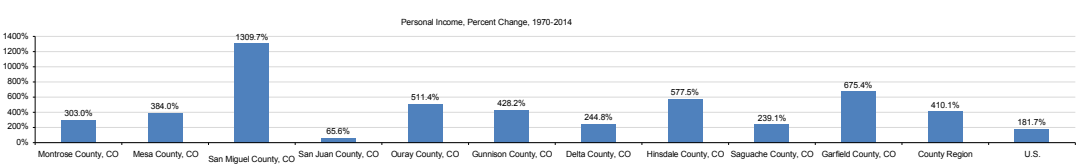
- Between 1970 and 2014, San Miguel County, CO had the largest percent change in population (300%), and San Juan County, CO had the smallest (-12.7%).



- 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.

Study Guide and Supplemental Information

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)*.

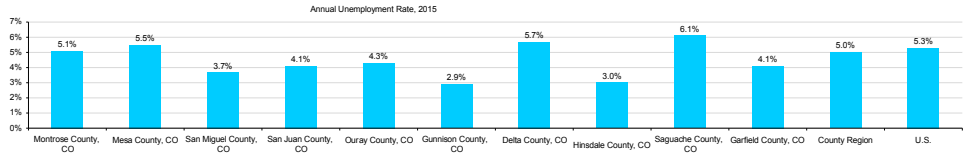
Data Sources

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?

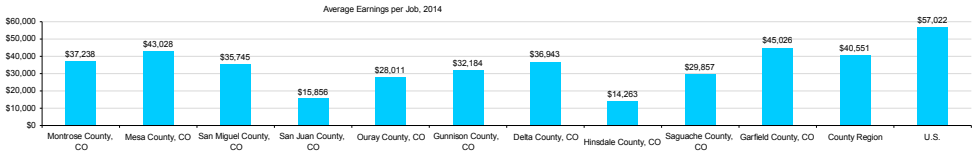
This page describes differences in three measures of individual prosperity (unemployment, average earnings per job, and per capita income).

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



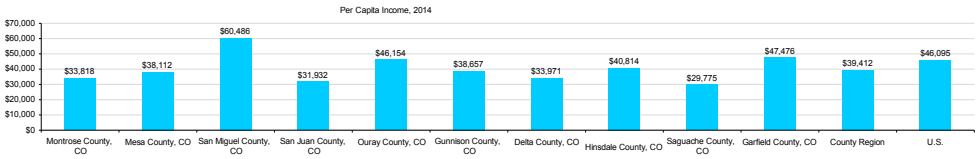
- In 2014, the U.S. had the highest average earnings per job ($57,022), and Hinsdale County, CO had the lowest ($14,263).

2015 $s



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

2015 $s



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)*.

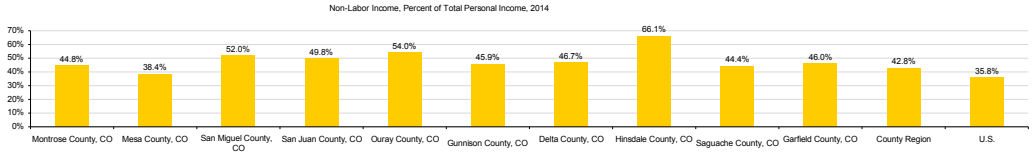
Data Sources

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.

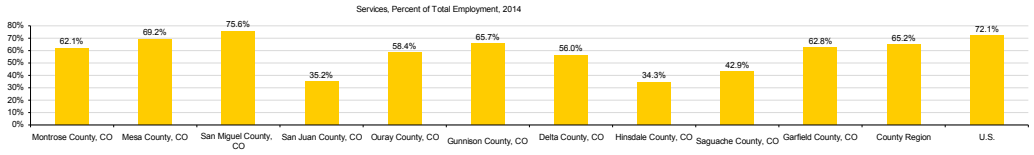
How do non-labor income and employment in services and government vary across geographies?

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

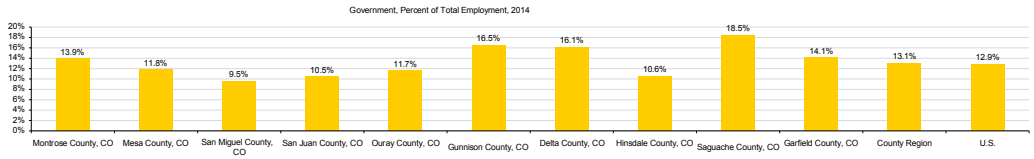
- In 2014, Hinsdale County, CO had the largest percent of total personal income from non-labor income sources (66.1%), and the U.S. had the smallest (35.8%).



- 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)*.

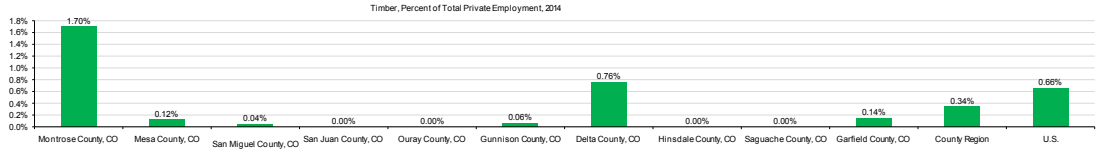
Data Sources

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

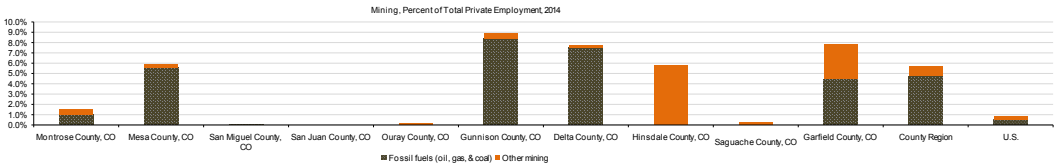
How does employment in commodity sectors vary across geographies?

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."

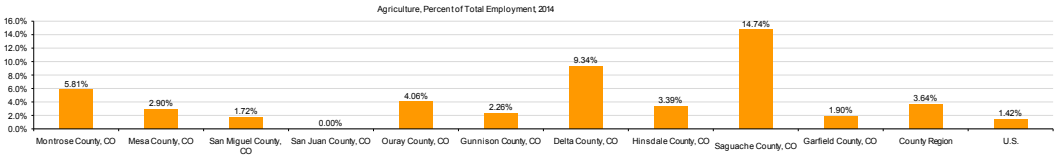
- In 2014, Montrose County, CO had the largest percent of total jobs in timber (1.7%), and San Juan County, CO had the smallest (0%).



- 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

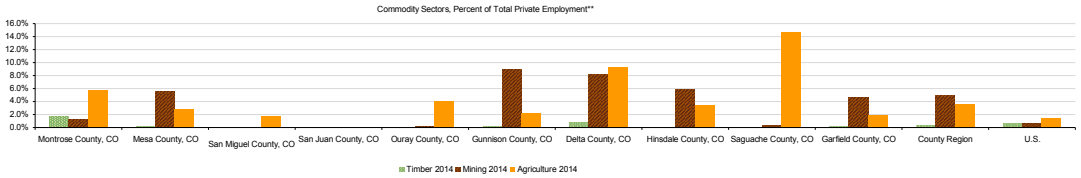
U.S. Department of Commerce. 2015. Bureau of Economic Analysis, Regional Economic Accounts, Washington, D.C.; U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.

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.

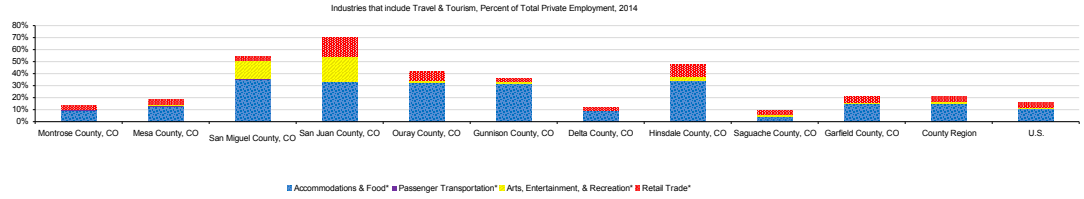
- Delta County, CO had the largest percent of total jobs in commodity sectors (18.3%), and San Juan County, CO had the smallest (0%).
- Mining was the largest component of commodity sector employment (4.9% of total jobs) in the County Region, and timber was the smallest component (0.3% of total jobs).



** 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.

Study Guide and Supplemental Information

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

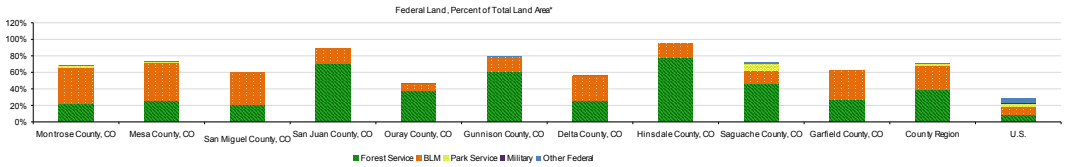
U.S. Department of Commerce. 2015. Bureau of Economic Analysis, Regional Economic Accounts, Washington, D.C.; U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.

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.

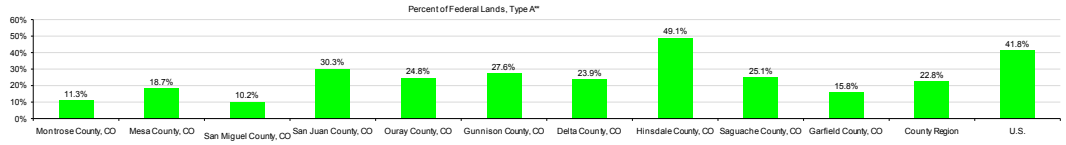
- Hinsdale County, CO had the largest percent of total land area in federal ownership (95.3%), and the U.S. had the smallest (28.2%).
- Forest Service lands were the largest component of federal land ownership (38.8%) in County Region, and Military lands were the smallest (0%).

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

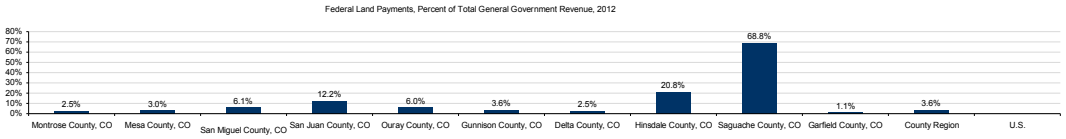


- Hinsdale County, CO had the largest percent of federal lands in Type A (49.1%), and San Miguel County, CO had the smallest (10.2%).

** 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.

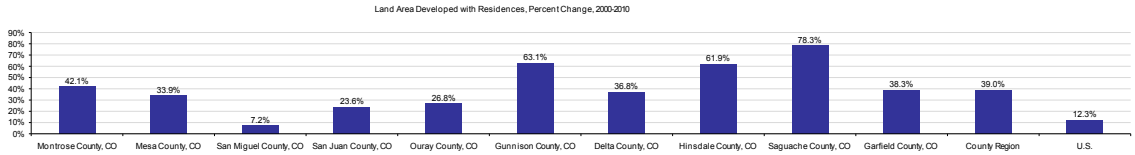
Data Sources

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)?

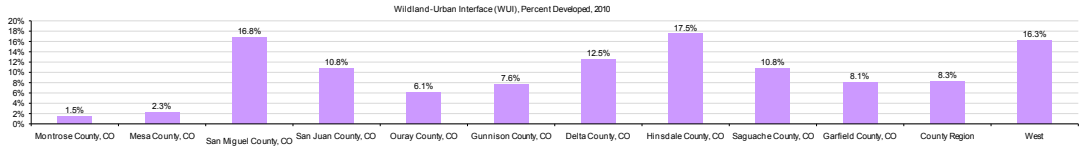
This page describes differences in the change in residential development on private lands, and the proportion of the wildland-urban interface (WUI) that is developed with homes.

- 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

- **Local Area Unemployment Statistics**
  Bureau of Labor Statistics, U.S. Department of Labor
  http://www.bls.gov/lau
  Tel. 202-691-6392

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

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.

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.

NATIONAL SYSTEM OF PUBLIC LANDS
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

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.

FOREST SERVICE
US
DEPARTMENT OF AGRICULTURE

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)

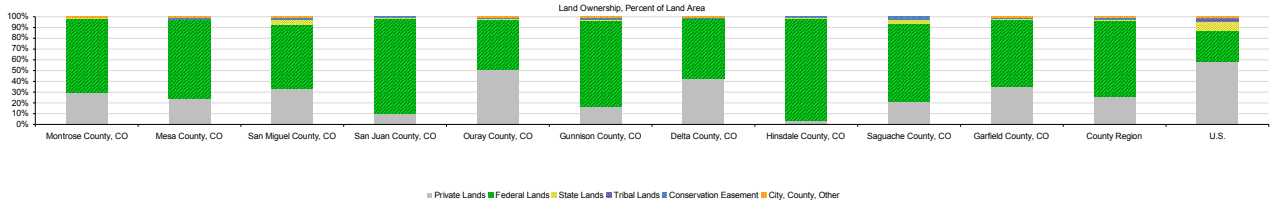
	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Total Area	1,435,422	2,138,287	824,791	248,513	347,015	2,086,164	735,108	718,815	2,028,983	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

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).

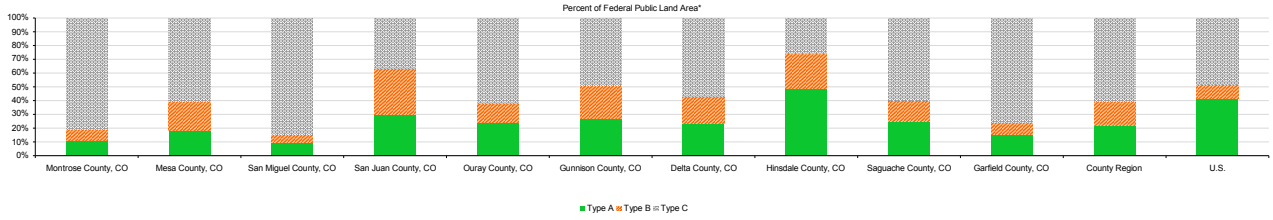
NPS = National Park Service; FS = Forest Service; BLM = Bureau of Land Management; FWS = Fish and Wildlife

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

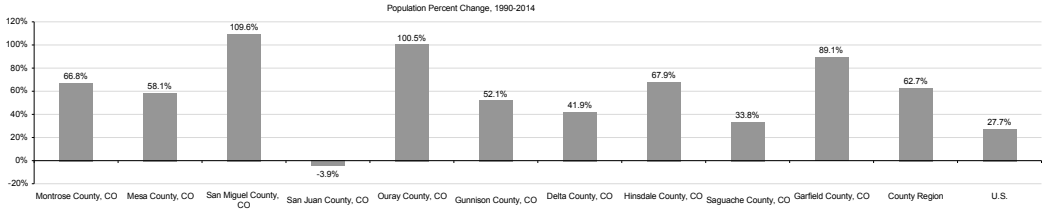
What are population trends?

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.

Study Guide and Supplemental Information

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

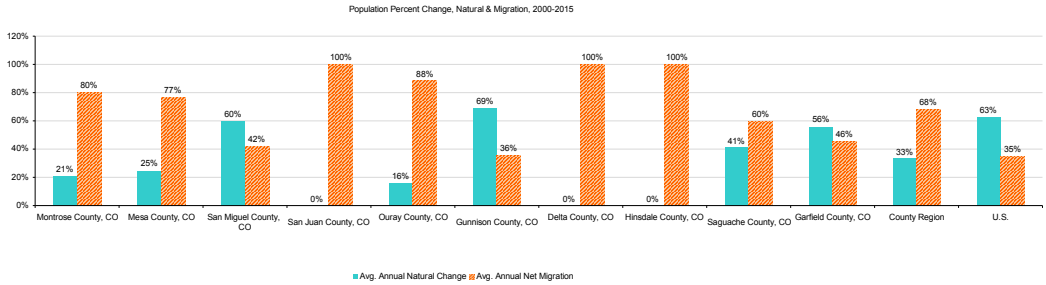
	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Population Change, 2000-2015	7,346	31,025	1,263	142	915	2,061	2,063	-16	273	13,836	58,908	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

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.

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?

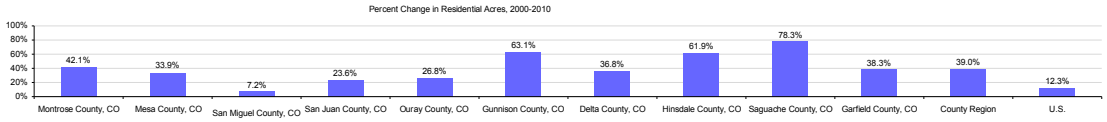
This page describes differences in the conversion of open space to residential development and residential acres per person, and the percent of homes that are second homes.

Residential Development 2000-2010

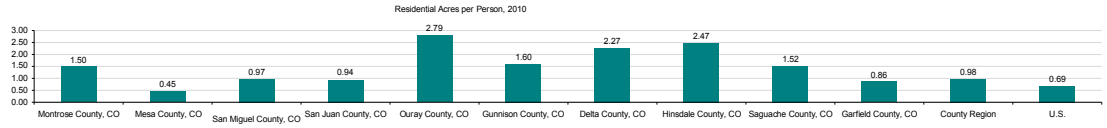
	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Residential Acres 2000	43,344	48,695	6,678	542	9,812	15,054	51,245	1,285	5,218	35,084	216,957	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.

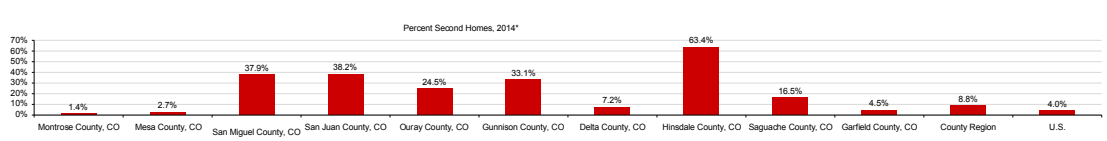
- From 2000 to 2010, Saguache County, CO had the largest percent change in residential development (78.3%), and San Miguel County, CO had the smallest (7.2%).



- 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.

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.

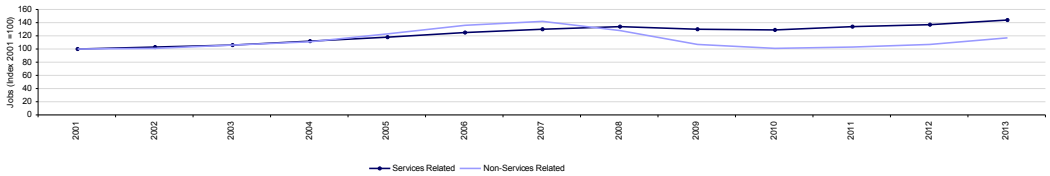
How important are service sectors?

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

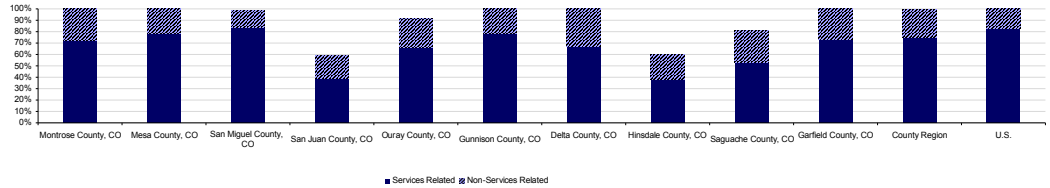
Services Related Employment, 2014

	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



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



- 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%).

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.

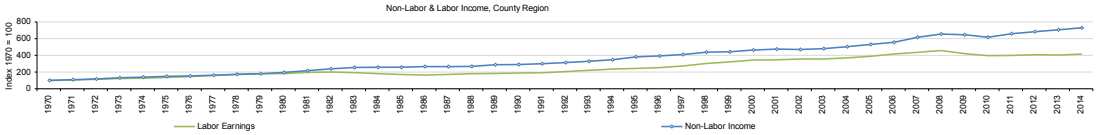
How important is non-labor income?

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.

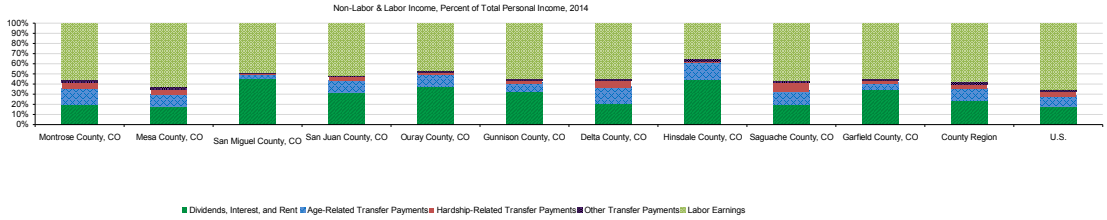
Components of Non-Labor Income, 2014 (Thousands of 2015 $s)

	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												
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.



- 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%).



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

Study Guide and Supplemental Information

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

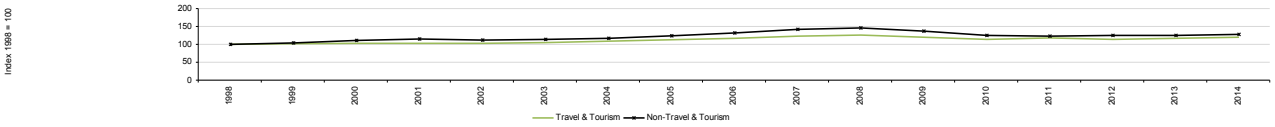
	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Total Private Employment	11,560	50,695	4,688	197	1,041	6,171	6,738	139	790	18,937	100,956	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

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%

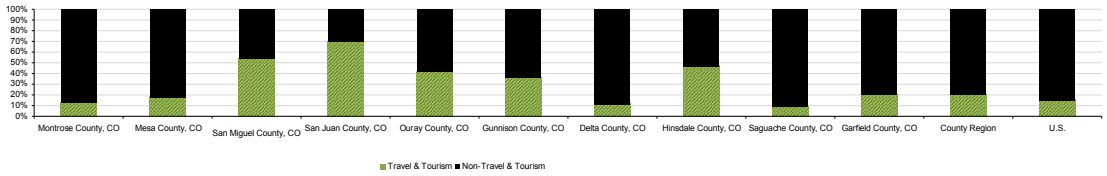
- From 1998 to 2014, industries associated with travel and tourism in the region grew by 20 percent. Over the same period, non-travel and tourism industries grew by 28 percent.

Jobs in Industries that include Travel & Tourism and Non-Travel & Tourism, County Region



- 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%).

Jobs in Industries that include Travel & Tourism and Non-Travel & Tourism, Percent of Total Private Employment, 2014



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

Study Guide and Supplemental Information

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

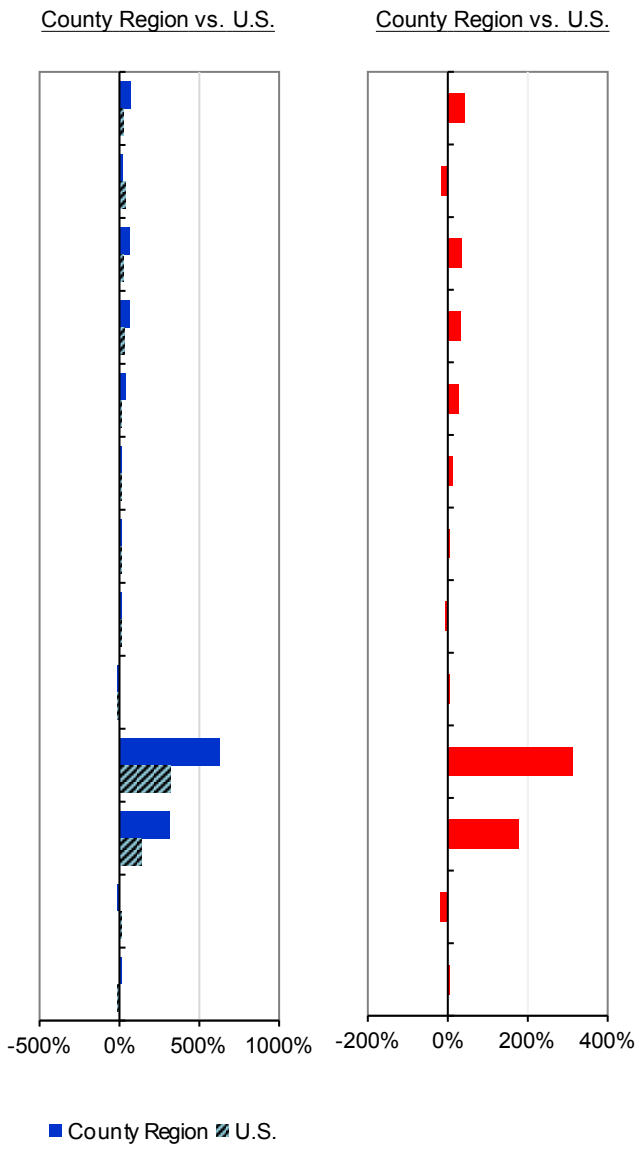
U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.

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..

Potential Indicators of Amenity Growth	County Region	U.S.	Difference in Percent 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%



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.

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.

NATIONAL SYSTEM OF PUBLIC LANDS
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

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.

FOREST SERVICE
US
DEPARTMENT OF AGRICULTURE

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)

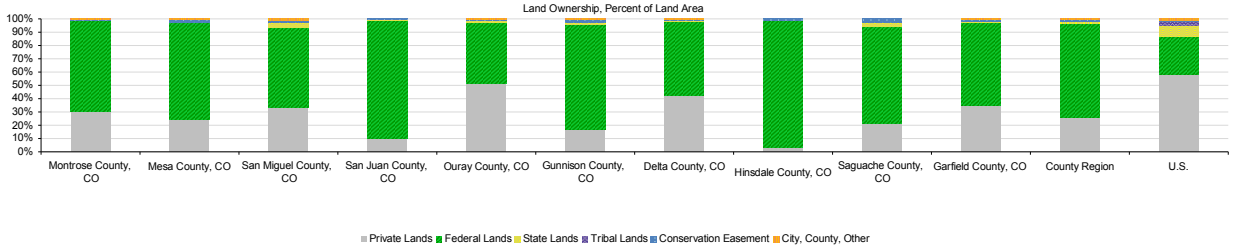
	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Total Area	1,435,422	2,138,287	824,791	248,513	347,015	2,086,164	735,108	718,815	2,028,983	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

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.

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

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

Study Guide and Supplemental Information

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).

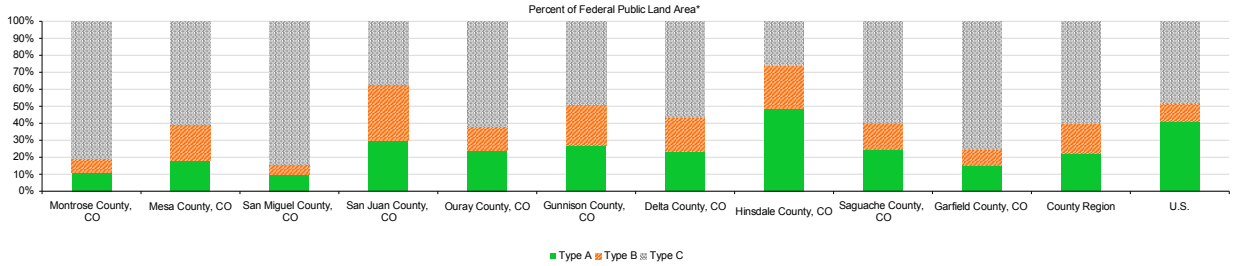
NPS = National Park Service; FS = Forest Service; BLM = Bureau of Land Management; FWS = Fish and Wildlife

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.

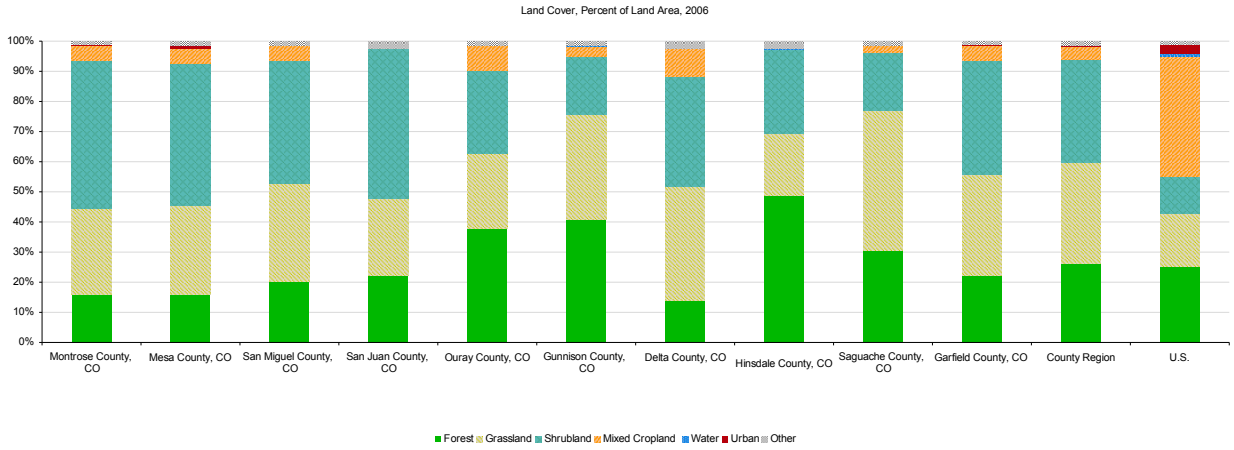
Land Cover (Acres), 2006

	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

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.

Study Guide and Supplemental Information

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

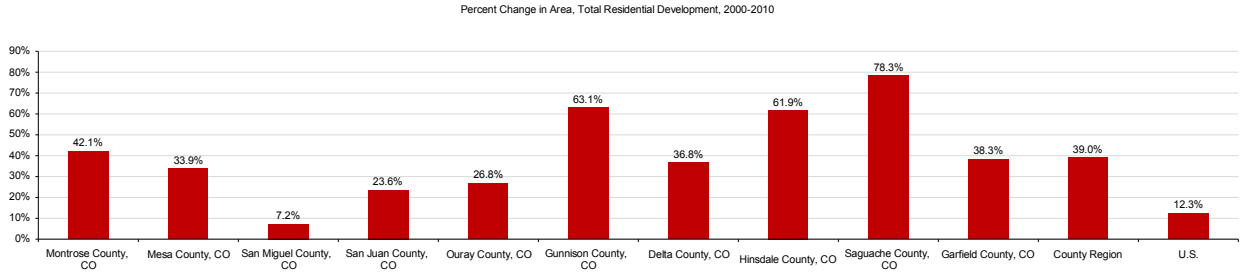
	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Total Private Land	443,170	537,788	284,091	26,868	179,826	367,654	316,429	28,800	450,453	673,242	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*

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%.

- 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?

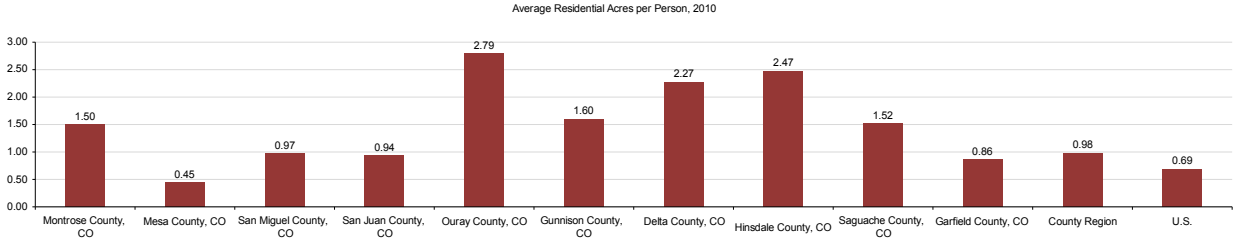
This page describes the per capita area (in acres) used for housing and the rate at which this area is growing on a per capita basis.

Population Density, 2000-2010

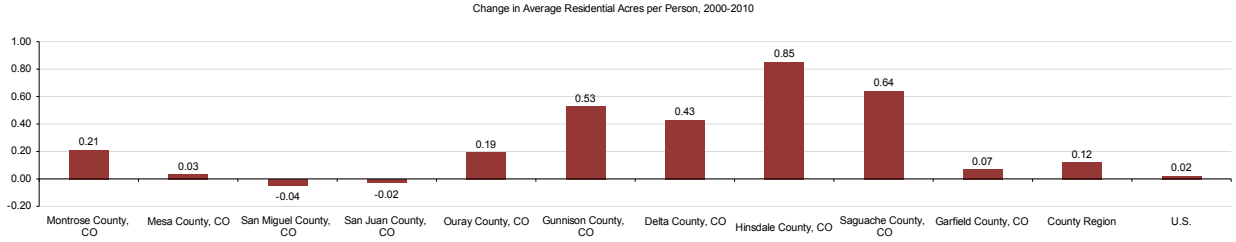
	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Residential Acres/Person, 2000	1.29	0.41	1.01	0.96	2.60	1.07	1.84	1.62	0.88	0.79	0.85	0.67
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).



- 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).



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.

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.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.

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.

NATIONAL SYSTEM OF PUBLIC LANDS
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

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.

FOREST SERVICE
US
DEPARTMENT OF AGRICULTURE

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

Travel & Tourism Employment

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	~28	~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	~28	~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

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.

Study Guide and Supplemental Information

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.

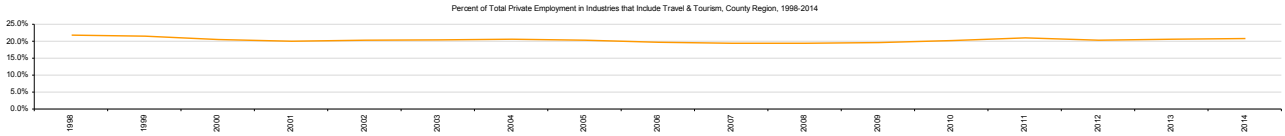
Data Sources

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

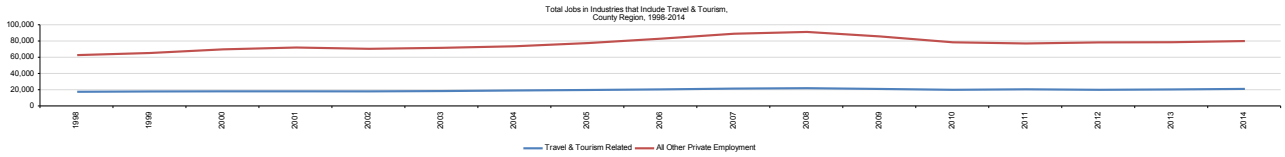
How have industries that include travel and tourism changed?

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.

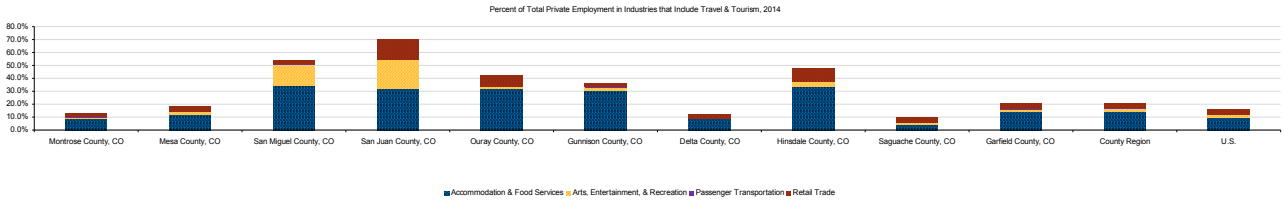
- In 1998, travel & tourism represented 22% of total employment. By 2014, travel & tourism represented 21% of total employment.



- 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.



- 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%).



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.

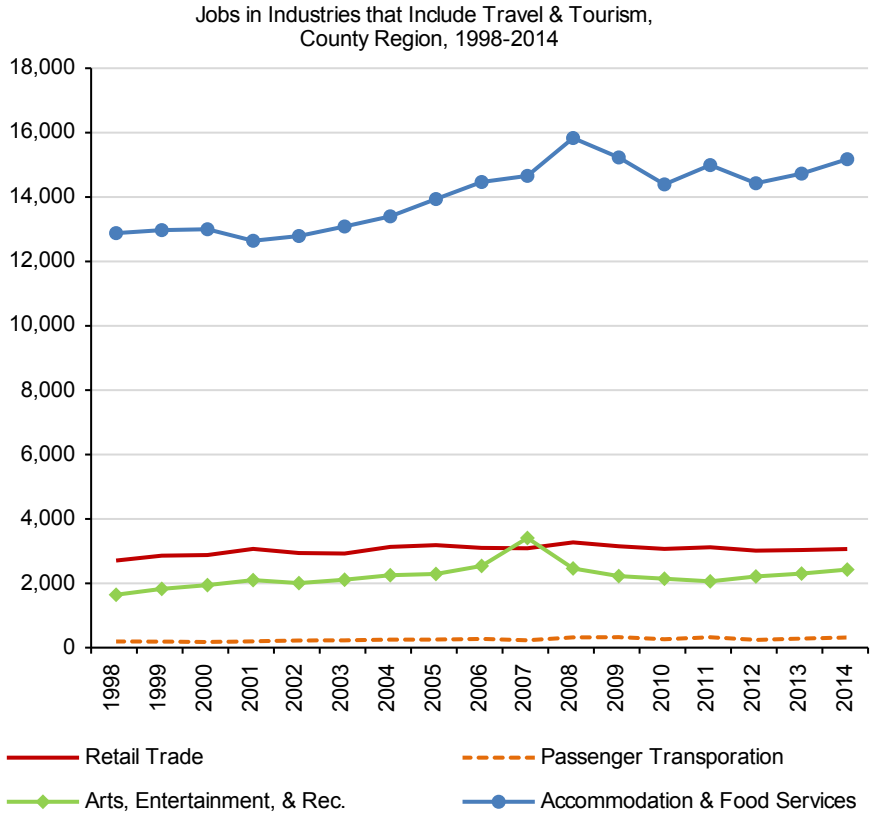
Travel & Tourism Employment

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.

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.

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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.

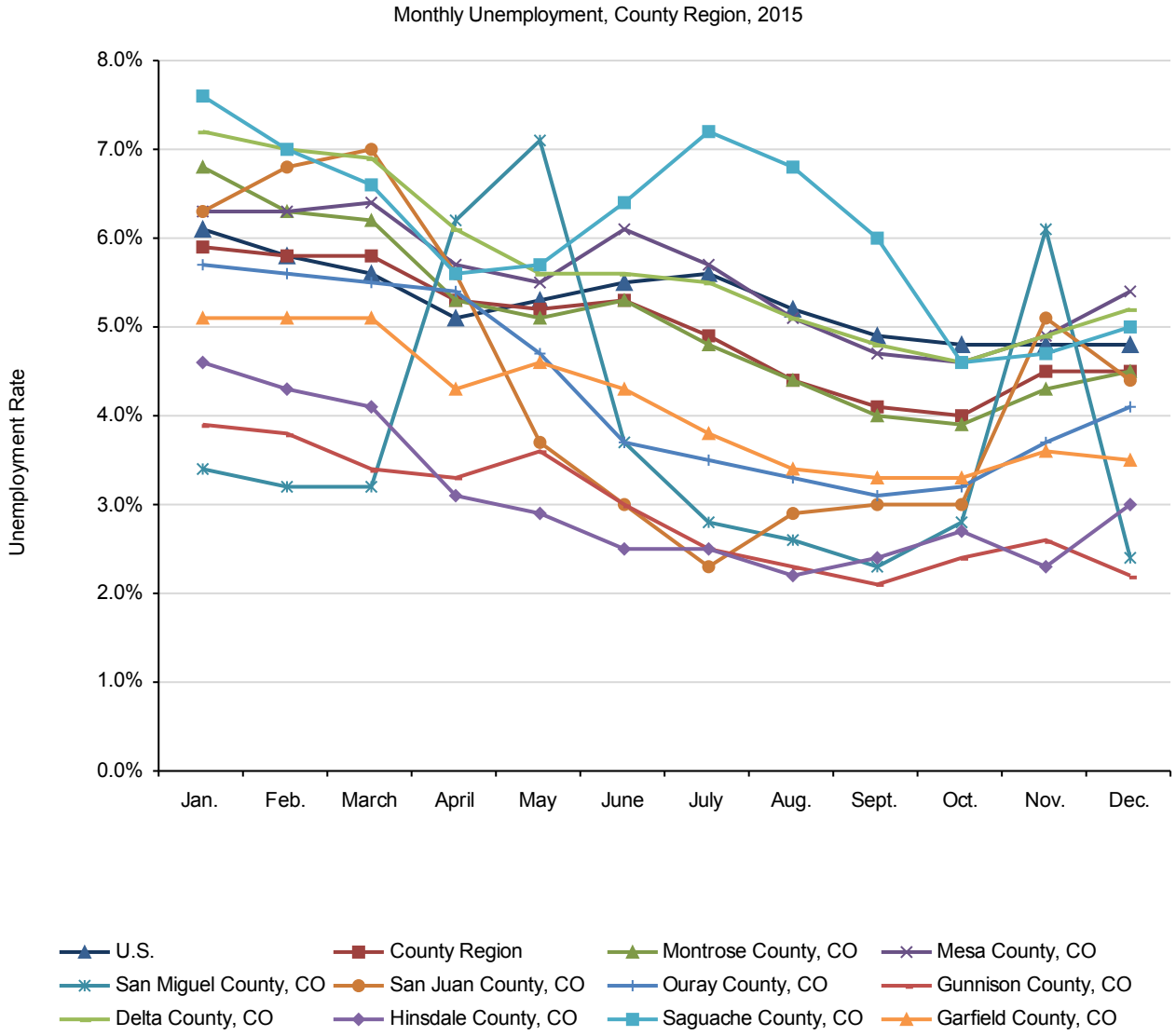
Data Sources

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

Travel & Tourism Employment

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)*.

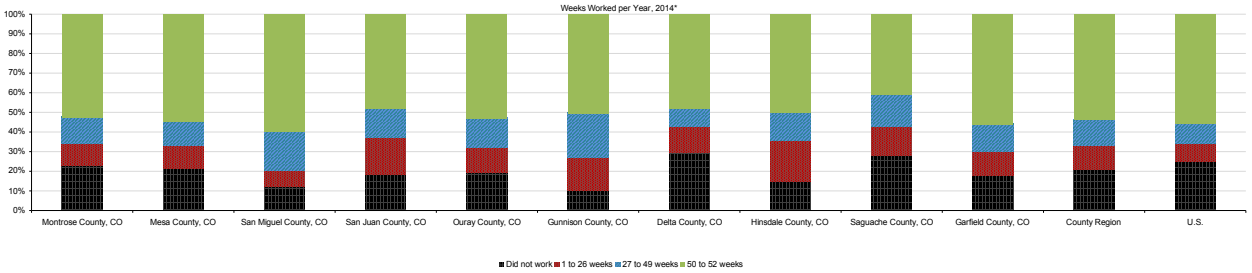
Data Sources

U.S. Department of Labor. 2016. Bureau of Labor Statistics, Local Area Unemployment Statistics, Washington, D.C.

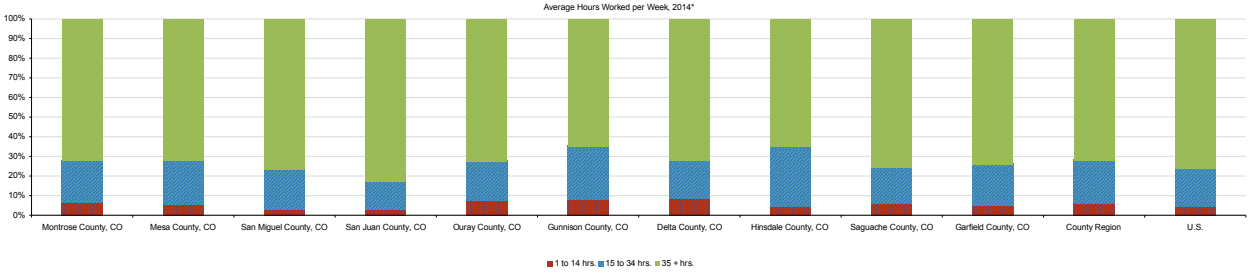
To what extent is overall employment seasonal or part time?

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

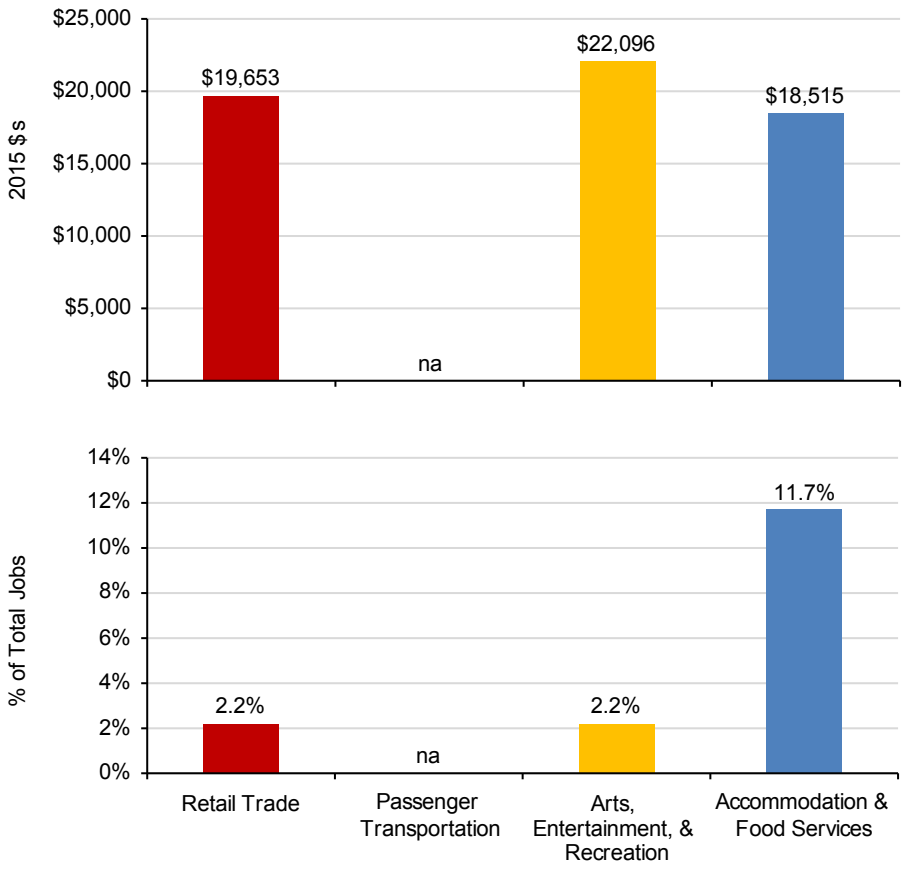
U.S. Department of Labor. 2016. Bureau of Labor Statistics, Quarterly Census of Employment and Wages, Washington, D.C.

Travel & Tourism Wages

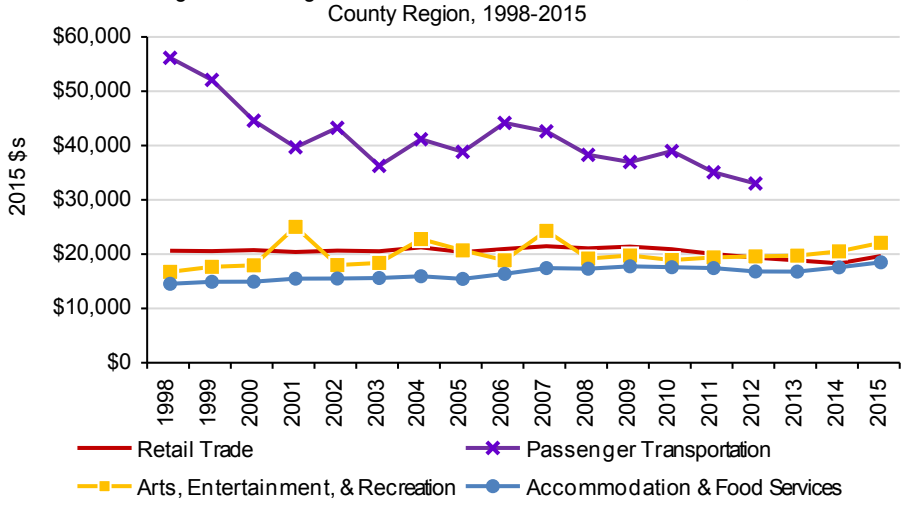
How do jobs and wages in industries that include travel and tourism compare?

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.

Study Guide and Supplemental Information

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

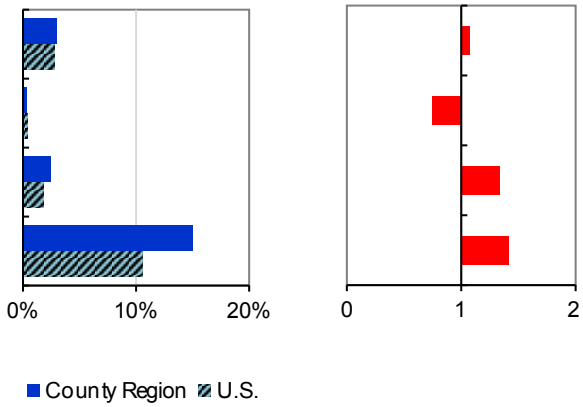
U.S. Department of Labor. 2016. Bureau of Labor Statistics, Quarterly Census of Employment and Wages, Washington, D.C.

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

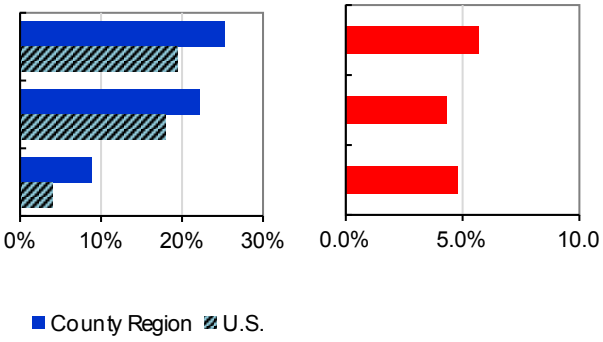
	Employment Share		Location Quotient	Employment Share	Location Quotient
Industries Including Travel and Tourism	County Region	U.S.		County Region vs. U.S.	County Region vs. U.S.
Retail Trade	3.0%	2.8%	1.1		
Passenger Transportation	0.3%	0.4%	0.8		
Arts, Entertainment, & Recreation	2.4%	1.8%	1.3		
Accommodation & 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.	County Region vs. U.S.	Difference in Percent, County Region vs. U.S.
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.

Study Guide and Supplemental Information

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

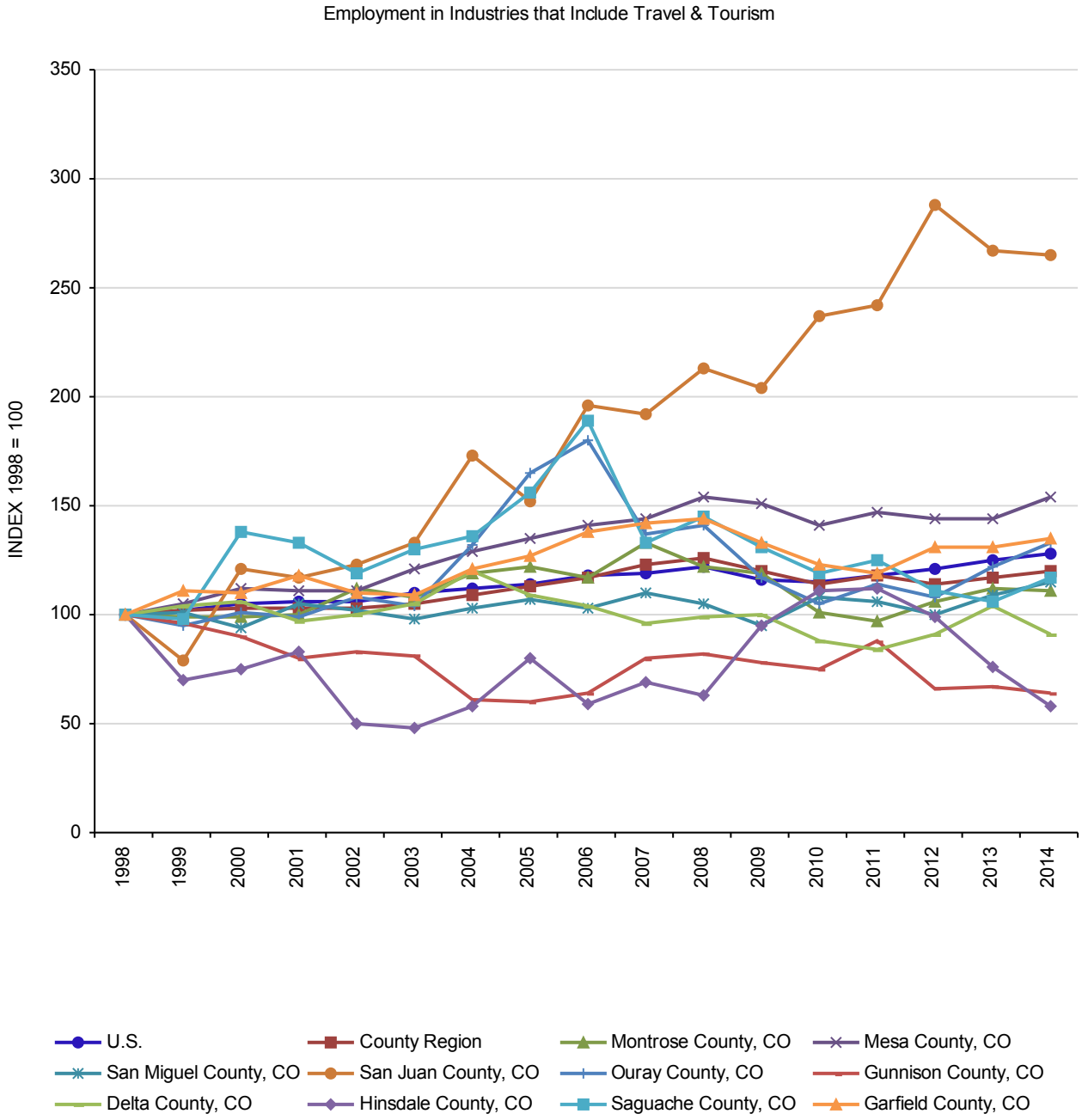
For a review of literature on economic diversity, see Sterling 1998. "On the Economics and Analysis of Diversity." Electronic Working Papers Series, University of Sussex, available at: sussex.ac.uk/Units/spru/publications/imprint/sewps/sewp28/sewp28.pdf *(17)*.
A useful book on the evolving competitive 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.

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.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.

NATIONAL SYSTEM OF PUBLIC LANDS
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

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.

FOREST SERVICE
US
DEPARTMENT OF AGRICULTURE

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.

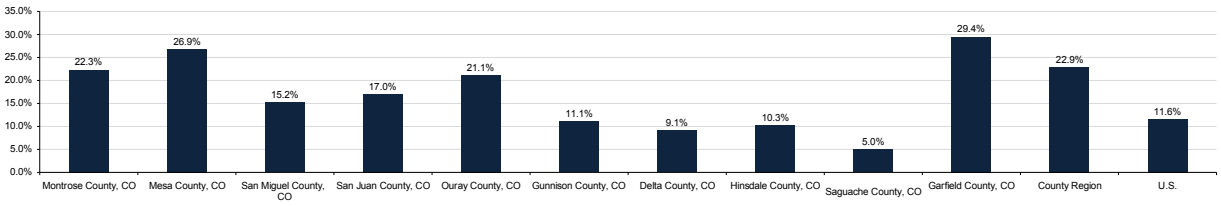
Note: with the exception of some 2000 Decennial Census data used on pages 1-3, all other data used in this report are from the American Community Survey (ACS) of the Census Bureau. Red, orange, and black text indicate different data quality thresholds – please read the Methods section in the Study Guide 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.

Percent Change in Population, 2000-2014*



- 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%).

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*

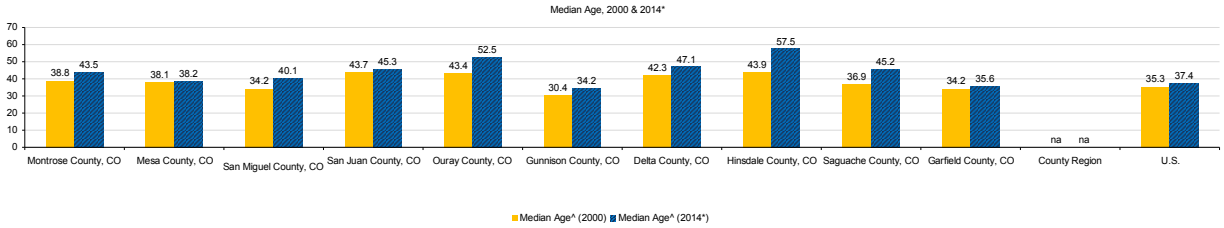
	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Total Population	40,885	147,509	7,597	653	4,532	15,503	30,378	871	6,211	56,684	310,823	314,107,084
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*

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

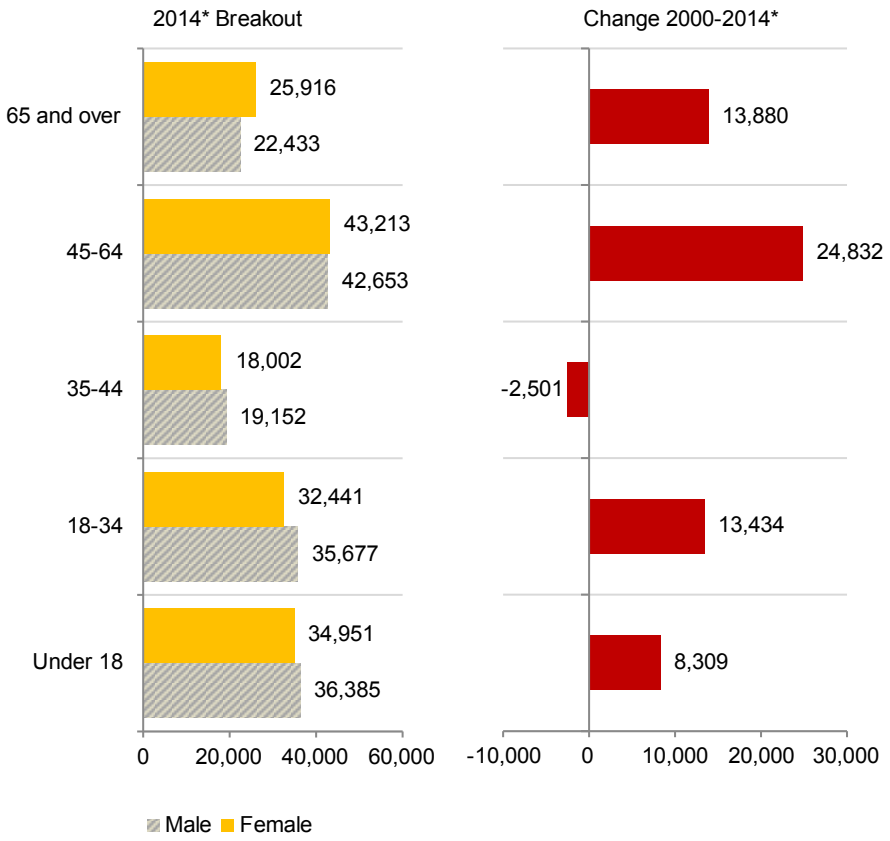
Percent of Total

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.

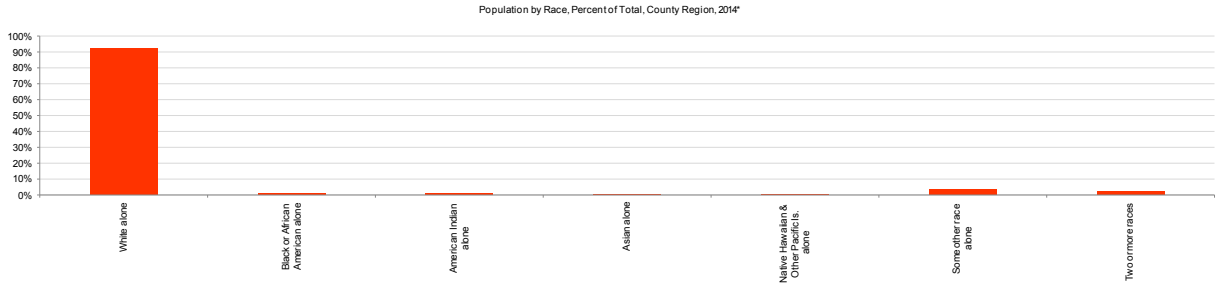
Race: Race is a self-identification data item in which Census respondents choose the race or races with which they most closely identify. The Office of Management and Budget revised the standards in 1997 for how the Federal government collects and presents data on race and ethnicity.

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												
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%).



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.

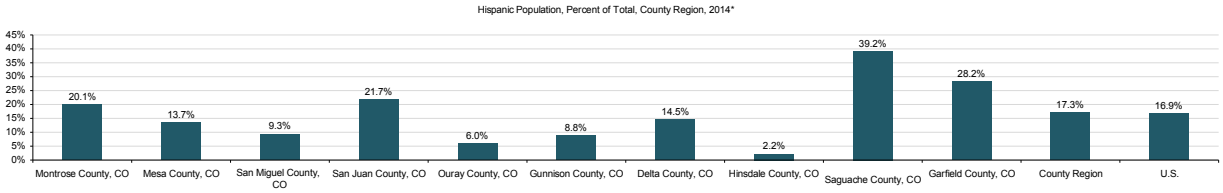
Hispanic or Latino Origin: People who identify with the terms "Hispanic" or "Latino" are those who classify themselves in one of the specific Hispanic or Latino categories listed on the Census questionnaire "Mexican," "Puerto Rican," or "Cuban" as well as those who indicate that they are "other Spanish, 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												
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.

Study Guide and Supplemental Information

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.

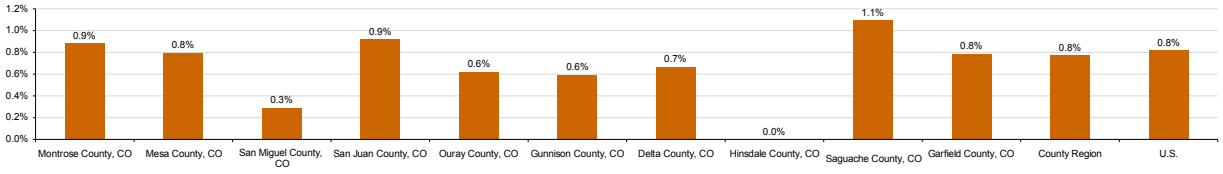
Non-Specified Tribes: This category shows self-identification among people of American Indian or Alaska Native decent that does not fall within a major tribal affiliation.

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%).



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 (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.

Study Guide and Supplemental Information

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												
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												
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.

Study Guide and Supplemental Information

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

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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*

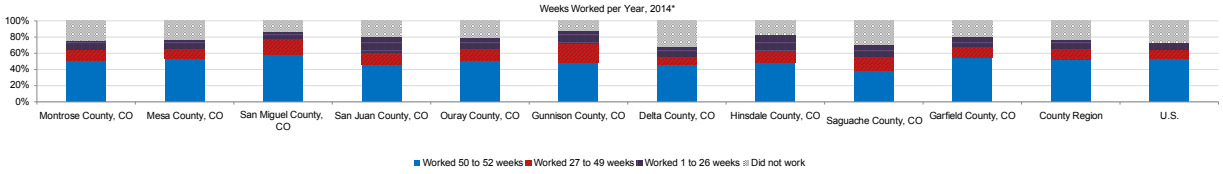
	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Population 16 to 64	24,604	93,659	5,564	¨500	2,856	11,453	17,936	496	3,976	37,830	198,874	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

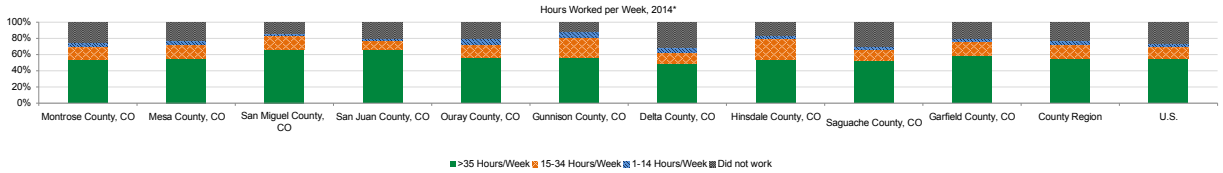
WEEKS WORKED PER YEAR:												
Worked 50 to 52 weeks	52.2%	54.6%	59.5%	47.6%	52.8%	50.2%	47.8%	50.0%	40.5%	55.8%	53.5%	55.1%
Worked 27 to 49 weeks	13.1%	12.1%	19.7%	¨15.0%	14.6%	22.5%	9.2%	14.1%	16.3%	13.5%	13.2%	10.3%
Worked 1 to 26 weeks	11.1%	11.4%	8.3%	**¨18.8%**	¨13.0%	16.7%	13.0%	**¨20.8%**	¨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.

Study Guide and Supplemental Information

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*

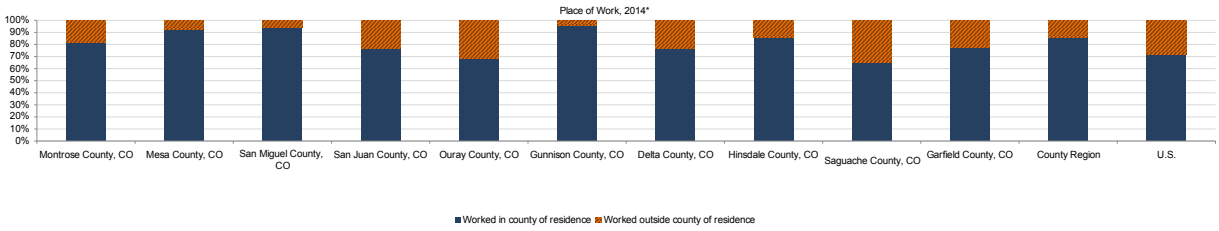
	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Workers 16 years and over	17,155	66,035	4,370	366	2,084	8,725	11,505	401	2,563	28,483	141,687	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**	±198	±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

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.

Study Guide and Supplemental Information

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

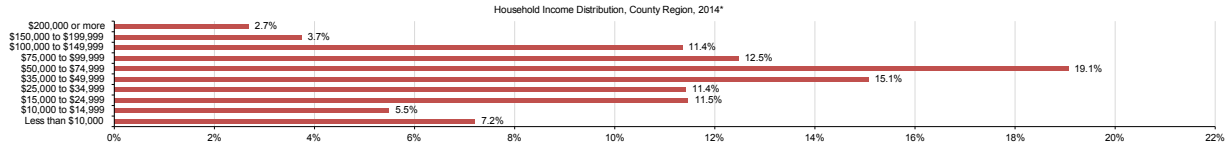
Percent of Total

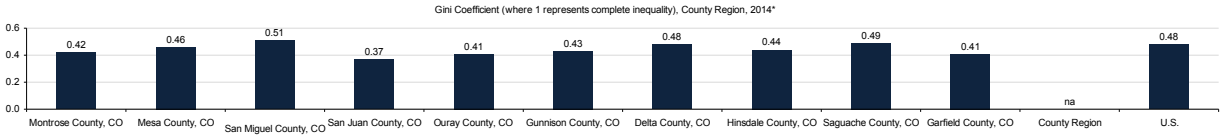
Less than $10,000	6.3%	7.9%	±4.4%	**±6.2%**	±5.7%	±7.8%	8.8%	**±3.1%**	±12.7%	±4.7%	7.2%	7.2%
$10,000 to $14,999	6.7%	5.5%	±4.7%	**±4.4%**	±5.0%	±4.5%	±8.1%	**±4.8%**	±7.7%	±3.0%	5.5%	5.3%
$15,000 to $24,999	14.2%	10.7%	±7.8%	±16.6%	±7.1%	±10.2%	13.3%	±15.3%	±17.6%	10.6%	11.5%	10.7%
$25,000 to $34,999	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).





Data Sources: U.S. Department of Commerce. 2015. Census Bureau, American Community Survey Office, Washington, D.C.

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=0AXe2E1Mm09WIZGhzazhxaDRfMjUzZ25nMjdkZzY&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*

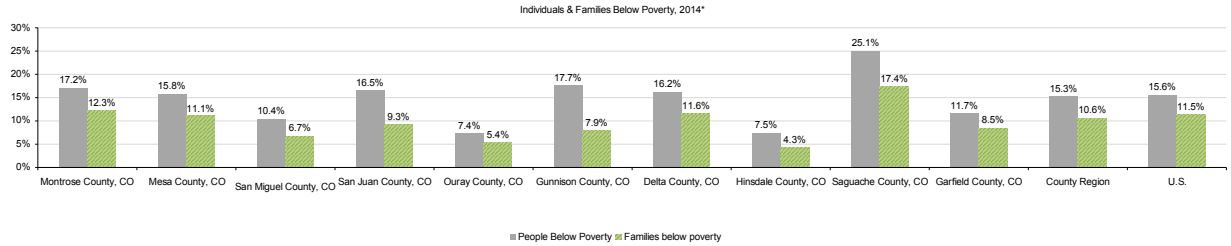
	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
People	40,300	144,055	7,568	653	4,521	14,551	29,171	871	6,172	55,605	303,467	306,226,394
Families	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.

Study Guide and Supplemental Information

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	ˇ787	ˇˇ108	ˇ334	2,570	4,738	ˇ65	ˇ1,547	6,503	46,293	47,755,606
White alone	5,996	19,961	ˇ772	ˇˇ108	ˇ289	2,486	4,406	ˇ61	ˇ1,169	5,346	40,594	28,912,690
Black or African American alone	ˇˇ41	ˇ297	ˇˇ0	ˇˇ0	ˇˇ0	ˇˇ0	ˇˇ11	ˇˇ0	ˇˇ3	ˇˇ142	ˇ494	10,351,976
American Indian alone	ˇˇ88	ˇ274	ˇˇ0	ˇˇ0	ˇˇ12	ˇˇ0	ˇˇ47	ˇˇ0	ˇˇ9	ˇˇ68	ˇ498	714,053
Asian alone	ˇˇ30	ˇ140	ˇˇ15	ˇˇ0	ˇˇ0	ˇˇ10	ˇˇ75	ˇˇ0	ˇˇ29	ˇˇ8	ˇ307	1,957,794
Native Hawaiian & Oth.Pacific Is. alone	ˇˇ0	ˇˇ69	ˇˇ0	ˇˇ0	ˇˇ0	ˇˇ0	ˇˇ0	ˇˇ0	ˇˇ0	ˇˇ0	ˇˇ69	107,874
Some other race	ˇˇ363	ˇ1,150	ˇˇ0	ˇˇ0	ˇˇ0	ˇˇ0	ˇˇ119	ˇˇ0	ˇ266	ˇˇ777	ˇ2,675	3,914,622
Two or more races	ˇ397	ˇ835	ˇˇ0	ˇˇ0	ˇˇ33	ˇˇ74	ˇˇ80	ˇˇ4	ˇˇ71	ˇˇ162	ˇ1,656	1,796,597
All Ethnicities in Poverty												
Hispanic or Latino (of any race)	ˇ2,196	5,087	ˇˇ92	ˇˇ30	ˇˇ41	ˇ519	ˇ1,097	ˇˇ0	ˇ837	ˇ3,033	12,932	12,880,559
Not Hispanic or Latino (of any race)	4,347	16,341	ˇ680	ˇˇ78	ˇ281	1,971	3,475	ˇ61	ˇ657	ˇ3,296	31,187	20,834,824
Percent of Total**												
White alone	86.7%	87.8%	ˇ98.1%	ˇˇ100.0%	ˇ86.5%	96.7%	93.0%	ˇ93.8%	ˇ75.6%	82.2%	87.7%	60.5%
Black or African American alone	ˇˇ0.6%	ˇ1.3%	ˇˇ0.0%	ˇˇ0.0%	ˇˇ0.0%	ˇˇ0.0%	ˇˇ0.2%	ˇˇ0.0%	ˇˇ0.2%	ˇˇ2.2%	ˇ1.1%	21.7%
American Indian alone	ˇˇ1.3%	ˇ1.2%	ˇˇ0.0%	ˇˇ0.0%	ˇˇ3.6%	ˇˇ0.0%	ˇˇ1.0%	ˇˇ0.0%	ˇˇ0.6%	ˇˇ1.0%	ˇ1.1%	1.5%
Asian alone	ˇˇ0.4%	ˇ0.6%	ˇˇ1.9%	ˇˇ0.0%	ˇˇ0.0%	ˇˇ0.4%	ˇˇ1.6%	ˇˇ0.0%	ˇˇ1.9%	ˇˇ0.1%	ˇ0.7%	4.1%
Native Hawaiian & Oth.Pacific Is. alone	ˇˇ0.0%	ˇˇ0.3%	ˇˇ0.0%	ˇˇ0.0%	ˇˇ0.0%	ˇˇ0.0%	ˇˇ0.0%	ˇˇ0.0%	ˇˇ0.0%	ˇˇ0.0%	ˇˇ0.1%	0.2%
Some other race	ˇˇ5.2%	ˇ5.1%	ˇˇ0.0%	ˇˇ0.0%	ˇˇ0.0%	ˇˇ0.0%	ˇˇ2.5%	ˇˇ0.0%	ˇ17.2%	ˇˇ11.9%	ˇ5.8%	8.2%
Two or more races	ˇ5.7%	ˇ3.7%	ˇˇ0.0%	ˇˇ0.0%	ˇˇ9.9%	ˇˇ2.9%	ˇˇ1.7%	ˇˇ6.2%	ˇˇ4.6%	ˇˇ2.5%	ˇ3.6%	3.8%
Hispanic or Latino (of any race)	31.8%	22.4%	ˇˇ11.7%	ˇˇ27.8%	ˇˇ12.3%	20.2%	23.2%	ˇˇ0.0%	ˇ54.1%	ˇ46.6%	27.9%	27.0%
Not Hispanic or Latino (of any race)	62.9%	71.9%	ˇ86.4%	ˇˇ72.2%	ˇ84.1%	76.7%	73.3%	ˇ93.8%	ˇ42.5%	ˇ50.7%	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%	ˇ10.6%	ˇˇ17.8%	ˇ6.6%	17.7%	15.8%	ˇ7.1%	ˇ22.1%	10.8%	14.5%	12.8%
Black or African American alone	ˇˇ19.8%	ˇ34.2%	ˇˇ0.0%	na	na	ˇˇ0.0%	ˇˇ25.0%	na	ˇˇ37.5%	ˇˇ44.9%	ˇ33.3%	27.3%
American Indian alone	ˇˇ24.2%	ˇ23.7%	ˇˇ0.0%	ˇˇ0.0%	ˇˇ42.9%	ˇˇ0.0%	ˇˇ24.2%	na	ˇˇ13.2%	ˇˇ15.3%	ˇ21.0%	28.8%
Asian alone	ˇˇ14.3%	ˇ16.5%	ˇˇ16.5%	ˇˇ0.0%	ˇˇ0.0%	ˇˇ10.5%	ˇˇ47.5%	na	ˇˇ93.5%	ˇˇ2.1%	ˇ16.9%	12.7%
Native Hawaiian & Oceanic alone	ˇˇ0.0%	ˇˇ65.7%	na	na	na	na	na	na	na	na	ˇˇ40.1%	20.7%
Some other race alone	ˇˇ25.0%	ˇ27.3%	ˇˇ0.0%	ˇˇ0.0%	na	ˇˇ0.0%	ˇˇ25.2%	na	ˇ50.2%	ˇˇ21.5%	ˇ25.7%	27.1%
Two or more races alone	ˇ41.1%	ˇ21.8%	ˇˇ0.0%	ˇˇ0.0%	ˇˇ42.3%	ˇˇ28.0%	ˇˇ22.1%	ˇˇ23.5%	ˇˇ29.0%	ˇˇ10.8%	ˇ22.5%	20.3%
Hispanic or Latino alone	ˇ27.4%	25.9%	ˇˇ13.0%	ˇˇ21.1%	ˇˇ15.2%	42.8%	ˇ26.6%	ˇˇ0.0%	ˇ34.7%	ˇ19.5%	24.8%	24.8%
Non-Hispanic/Latino alone	14.0%	13.7%	ˇ10.3%	ˇˇ16.2%	ˇ6.7%	15.2%	14.2%	ˇ7.3%	ˇ18.6%	ˇ8.5%	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.

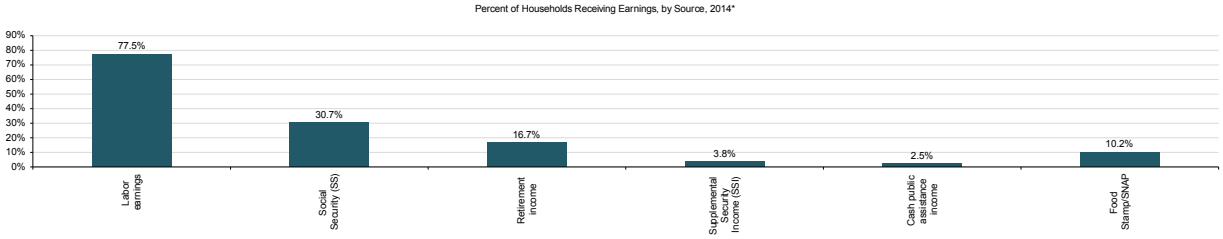
Number of Households Receiving Earnings, by Source, 2014*

	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	ˇ75	715	1,152	5,418	ˇ181	880	4,086	38,013	34,082,501
Retirement income	3,322	10,476	253	ˇ54	525	746	2,527	ˇ108	431	2,196	20,638	20,738,512
Supplemental Security Income (SSI)	ˇ673	2,460	**ˇˇ37**	**ˇˇ5**	ˇ93	ˇ89	ˇ604	**ˇˇ3**	ˇ195	ˇ501	4,660	6,160,788
Cash public assistance income	ˇ661	1,518	ˇ15	**ˇˇ31**	**ˇˇ17**	ˇ172	ˇ375	**ˇˇ9**	ˇ81	ˇ228	3,107	3,274,407
Food Stamp/SNAP	2,186	6,555	ˇ133	**ˇˇ26**	ˇ122	ˇ389	1,411	**ˇˇ9**	ˇ404	1,392	12,627	15,089,358
Percent of Total^												
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%	ˇ22.2%	36.3%	18.2%	43.3%	ˇ43.3%	33.9%	20.1%	30.7%	29.3%
Retirement income	19.8%	17.8%	ˇ7.6%	ˇ16.0%	26.7%	11.8%	20.2%	ˇ25.8%	16.6%	10.8%	16.7%	17.8%
Supplemental Security Income (SSI)	ˇ4.0%	4.2%	**ˇˇ1.1%**	**ˇˇ1.5%**	ˇ4.7%	ˇ1.4%	ˇ4.8%	**ˇˇ0.7%**	ˇ7.5%	ˇ2.5%	3.8%	5.3%
Cash public assistance income	ˇ3.9%	2.6%	**ˇˇ0.5%**	**ˇˇ9.2%**	**ˇˇ0.9%**	ˇ2.7%	ˇ3.0%	**ˇˇ2.2%**	ˇ3.1%	ˇ1.1%	2.5%	2.8%
Food Stamp/SNAP	13.0%	11.1%	ˇ4.0%	**ˇˇ7.7%**	ˇ6.2%	ˇ6.1%	11.3%	**ˇˇ2.2%**	ˇ15.6%	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%).



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	ˇ$42,310	$65,360	$57,147	$61,969	ˇ$60,175	$46,615	$68,806	$63,256	$76,303
Mean Social Security income	$17,302	$17,301	$18,021	ˇ$13,915	$21,457	$14,328	$16,268	ˇ$17,056	$13,730	$15,988	$16,921	$17,636
Mean retirement income	$25,436	$24,650	ˇ$30,013	ˇ$19,265	ˇ$31,329	$33,749	$20,525	**ˇˇ$52,528**	ˇ$16,720	$28,879	$25,252	$24,095
Mean Supplemental Security Income	ˇ$8,436	$9,596	**ˇˇ$8,003**	**ˇˇ$8,620**	ˇ$10,456	ˇ$8,011	ˇ$8,856	**ˇˇ$11,667**	ˇ$10,377	ˇ$12,635	$9,666	$9,400
Mean cash public assistance income	ˇ$3,833	ˇ$3,609	**ˇˇ$1,633**	**ˇˇ$781**	**ˇˇ$1,494**	$2,748	ˇ$3,136	**ˇˇ$2,167**	**ˇˇ$4,017**	ˇ$3,899	ˇ$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?

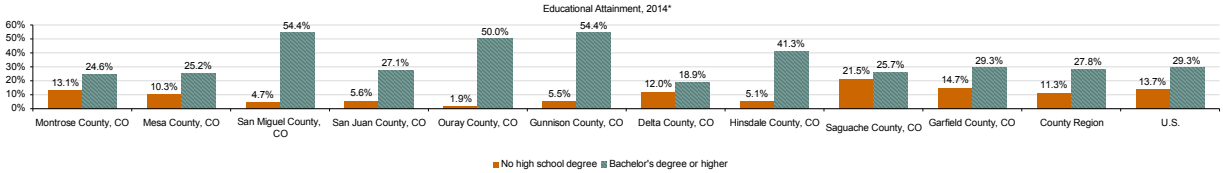
This page describes educational attainment and school enrollment.

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	ˇ269	**ˇˇ29**	**ˇ68**	ˇ535	2,615	**ˇ38**	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	ˇ251	ˇ54	ˇ195	ˇ614	1,702	ˇ34	ˇ214	2,844	17,243	16,580,076
Bachelor's degree or higher	7,061	24,901	3,082	ˇ140	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	ˇ110	1,084	3,986	2,793	ˇ196	718	7,468	39,362	38,184,668
Graduate or professional	2,880	8,376	781	**ˇˇ30**	ˇ737	1,324	1,342	ˇ114	ˇ400	3,399	19,383	23,021,479
Percent of Total												
No high school degree	13.1%	10.3%	ˇ4.7%	**ˇˇ5.6%**	ˇ1.9%	ˇ5.5%	12.0%	**ˇˇ5.1%**	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%	ˇ4.4%	ˇ10.4%	ˇ5.4%	ˇ6.3%	7.8%	ˇ4.5%	ˇ4.9%	7.7%	8.2%	7.9%
Bachelor's degree or higher	24.6%	25.2%	54.4%	ˇ27.1%	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%	ˇ26.1%	16.5%	20.1%	18.7%	18.3%
Graduate or professional	10.0%	8.5%	13.8%	**ˇˇ5.8%**	ˇ20.2%	13.6%	6.1%	ˇ15.2%	ˇ9.2%	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	ˇ51	760	4,880	6,117	ˇ85	1,393	14,960	75,513	82,735,509
Enrolled in nursery school, preschool	ˇ625	2,381	ˇ166	**ˇˇ3**	**ˇˇ53**	ˇ247	ˇ497	**ˇˇ28**	ˇ118	1,087	5,205	4,996,054
Enrolled in kindergarten	ˇ637	ˇ1,778	ˇ82	**ˇˇ0**	**ˇˇ33**	ˇ286	ˇ243	**ˇˇ8**	ˇ90	ˇ716	3,873	4,214,718
Enrolled in grade 1 to grade 4	2,067	7,512	366	**ˇˇ11**	ˇ148	710	1,416	ˇ10	ˇ292	3,207	15,739	16,313,067
Enrolled in grade 5 to grade 8	2,177	7,415	ˇ324	**ˇˇ18**	ˇ155	ˇ485	1,613	**ˇˇ9**	290	3,673	16,159	16,529,309
Enrolled in grade 9 to grade 12	2,331	7,575	223	**ˇˇ11**	ˇ273	599	1,653	**ˇ20**	358	3,450	16,493	17,053,876
Enrolled in college, undergraduate years	ˇ806	9,414	ˇ79	**ˇ8**	ˇ76	2,364	ˇ537	**ˇˇ10**	ˇ168	2,335	15,797	19,482,655
Graduate or professional school	ˇ226	ˇ1,033	**ˇ50**	**ˇ0**	**ˇ22**	ˇ189	ˇ158	**ˇ0**	ˇ77	ˇ492	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												
Enrolled in school:	22.4%	26.1%	17.4%	ˇ8.1%	17.0%	32.3%	20.7%	ˇ10.2%	23.3%	27.5%	25.2%	27.4%
Enrolled in nursery school, preschool	ˇ1.6%	1.7%	ˇ2.2%	**ˇˇ0.5%**	**ˇˇ1.2%**	ˇ1.6%	ˇ1.7%	**ˇˇ3.4%**	ˇ2.0%	ˇ2.0%	1.7%	1.7%
Enrolled in kindergarten	1.6%	1.3%	ˇ1.1%	**ˇˇ0.0%**	**ˇˇ0.7%**	ˇ1.9%	ˇ0.8%	**ˇˇ1.0%**	ˇ1.5%	ˇ1.3%	1.3%	1.4%
Enrolled in grade 1 to grade 4	5.2%	5.3%	4.9%	**ˇˇ1.8%**	ˇ3.3%	4.7%	4.8%	ˇ1.2%	ˇ4.9%	5.9%	5.2%	5.4%
Enrolled in grade 5 to grade 8	5.5%	5.2%	ˇ4.4%	**ˇˇ2.9%**	ˇ3.5%	ˇ3.2%	5.5%	**ˇˇ1.1%**	4.9%	6.8%	5.4%	5.5%
Enrolled in grade 9 to grade 12	5.9%	5.3%	ˇ3.0%	**ˇˇ1.8%**	ˇ6.1%	ˇ4.0%	5.6%	**ˇˇ2.4%**	ˇ6.0%	6.3%	5.5%	5.6%
Enrolled in college, undergraduate years	2.0%	6.6%	ˇ1.1%	**ˇˇ1.3%**	ˇ1.7%	15.7%	ˇ1.8%	**ˇˇ1.2%**	ˇ2.8%	4.3%	5.3%	6.4%
Graduate or professional school	ˇ0.6%	ˇ0.7%	**ˇˇ0.7%**	**ˇˇ0.0%**	ˇ0.5%	ˇ1.3%	ˇ0.5%	**ˇˇ0.0%**	ˇ1.3%	ˇ0.9%	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.

Study Guide and Supplemental Information

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.

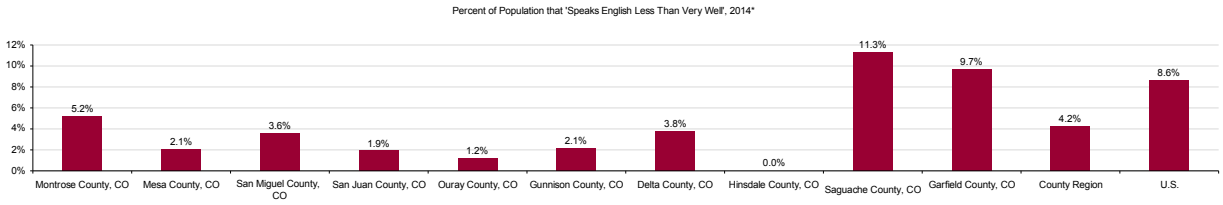
Language Spoken at Home: The language currently used by respondents five years and over at home, either "English only" or a non-English language which is used in addition to English or in place of English.

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												
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%).



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

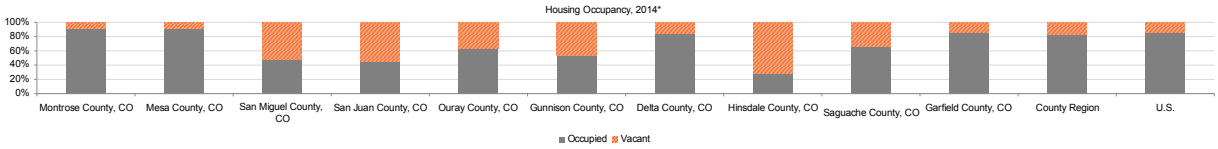
Percent of Total

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.

Study Guide and Supplemental Information

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.

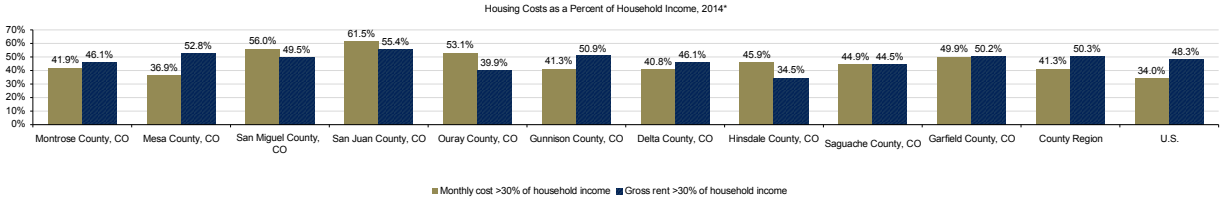
Housing Costs as a Percent of Household Income, 2014*

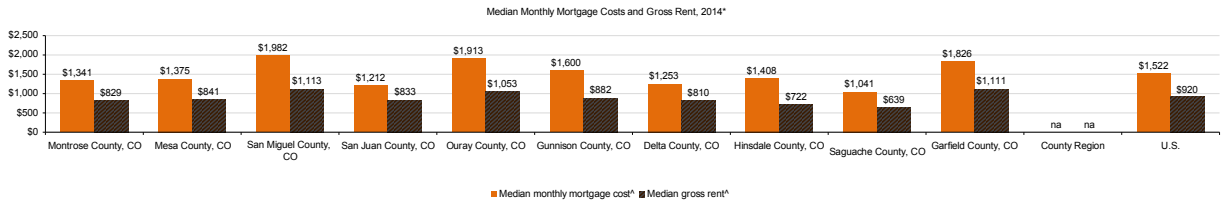
	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Owner-occupied housing w/ a mortgage	7,046	28,191	1,440	˜104	868	2,487	4,850	˜157	900	9,982	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)*.

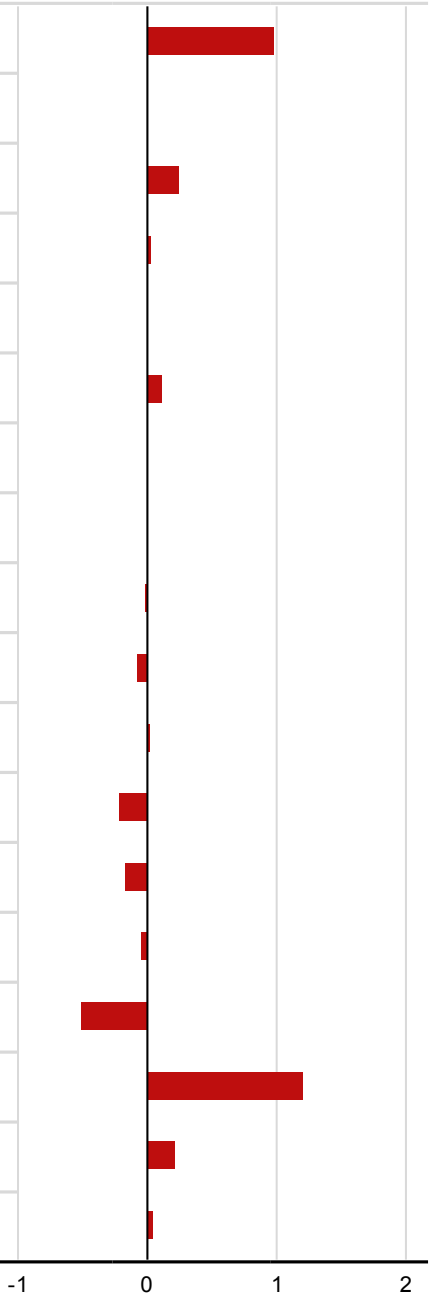
Data Sources

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%
	Median Age (2014*)	na	37.4
	Percent Population White Alone (2014*)	92.0%	73.8%
	Percent Population Hispanic or Latino (2014*)	17.3%	16.9%
	Percent Population American Indian or Alaska Native (2014*)	0.8%	0.8%
	Percent of Population 'Baby Boomers' (2014*)	26.5%	23.9%
Income	Median Household Income (2014*)	na	$53,482
	Per Capita Income (2014*)	na	$28,555
	Percent Individuals Below Poverty (2014*)	15.3%	15.6%
	Percent Families Below Poverty (2014*)	10.6%	11.5%
	Percent of Households with Retirement and Social Security Income (2014*)	47.4%	47.2%
	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%
	Percent Population 25 Years or Older with Bachelor's Degree or Higher (2014*)	27.8%	29.3%
	Percent Population That Speak English Less Than 'Very Well' (2014*)	4.2%	8.6%
	Percent of Houses that are Seasonal Homes (2014*)	8.8%	4.0%
	Owner-Occupied Homes where Greater than 30% of Household Income Spent on Mortgage (2014*)	41.3%	34.0%
	Renter-Occupied Homes where Greater than 30% of Household Income Spent on Gross Rent (2014*)	50.3%	48.3%



* 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.

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.

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.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.

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.

NATIONAL SYSTEM OF PUBLIC LANDS
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

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.

FOREST SERVICE
US
DEPARTMENT OF AGRICULTURE

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

Federal Land Payments

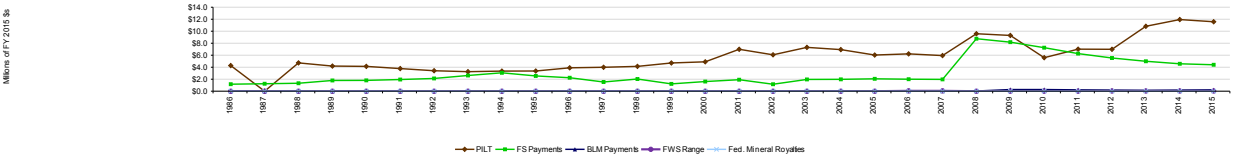
What are federal land payments?

This page describes all federal land payments distributed to state and local governments by the geography of origin.

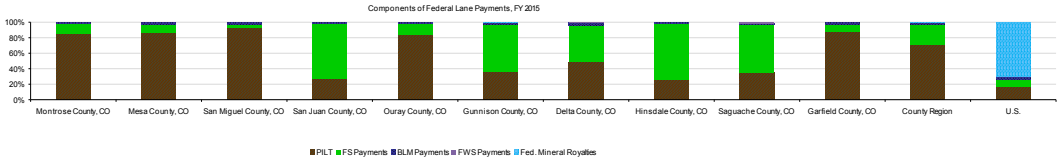
Components of Federal Land Payments to State and Local Governments by Geography of Origin, FY 2015 (FY 2015 $s)

	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												
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

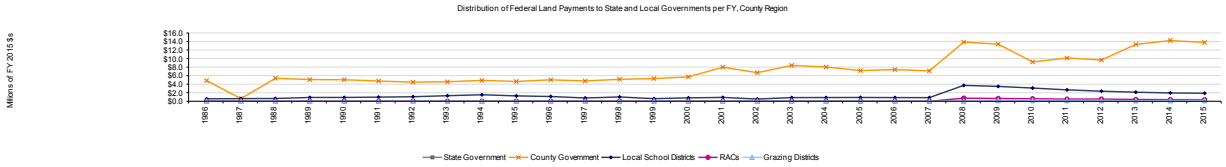
How are federal land payments distributed to state and local governments?

This page describes how federal land payments are distributed to state and local governments by geography of origin.

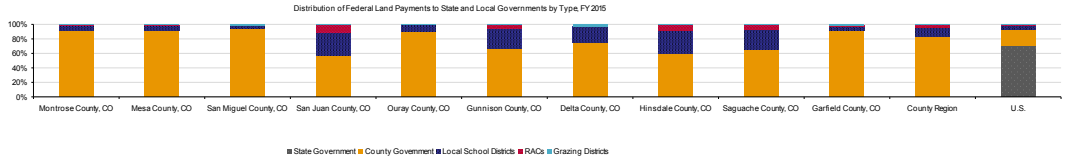
Distribution of Federal Land Payments to State and Local Governments by Geography of Origin, FY 2015 (FY 2015 $s)

	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%

- 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.



- 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.

Study Guide and Supplemental Information

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

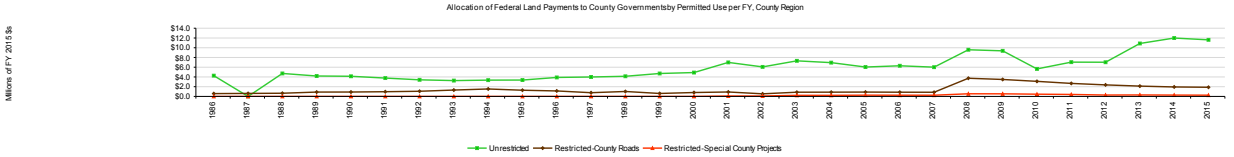
How are federal land payments distributed to county governments allocated to unrestricted and restricted uses?

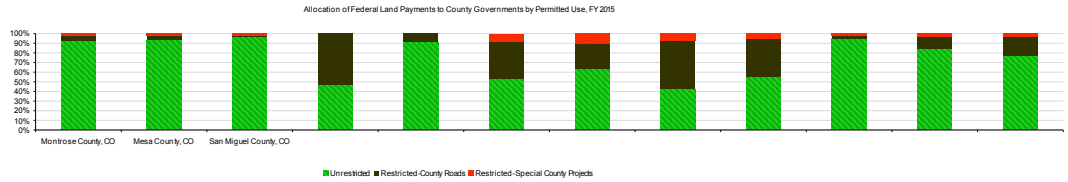
This page describes the amount of money distributed to county governments (federal land payments distributed to the state, school districts, grazing districts, and RACs are excluded) based on the permitted uses of federal land payments.

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

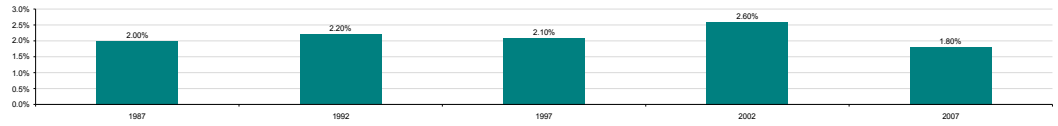
How important are federal land payments to state and local governments?

This page describes federal land payments as a proportion of total county and state government general revenue.

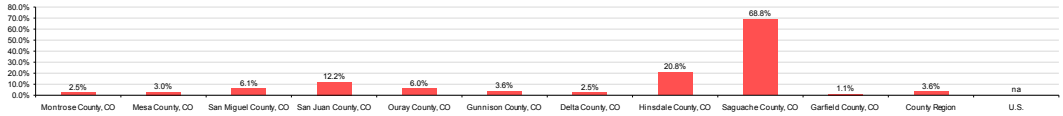
Federal Land Payments as a Share of Total General Government Revenue, Thousands of FY 2012 (FY 2015 $s)

	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



Federal Land Payments, Percent of Total General Government Revenue, FY 2012



- In FY 2012, federal land payments as a percent of total general government revenue in County Region was 3.6%.

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).

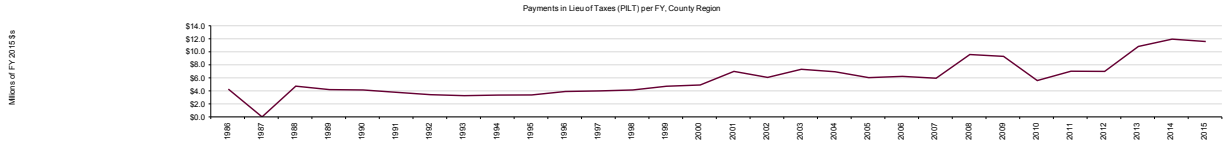
PILT Eligible Acres by Agency, FY 2015

	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

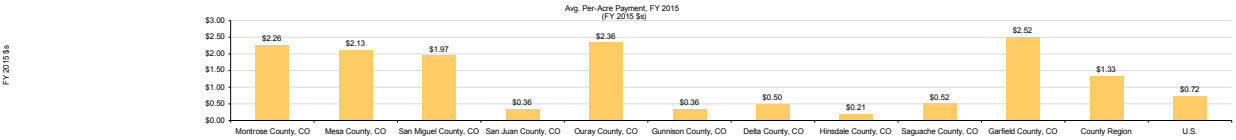
Percent of Total

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.

Study Guide and Supplemental Information

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.

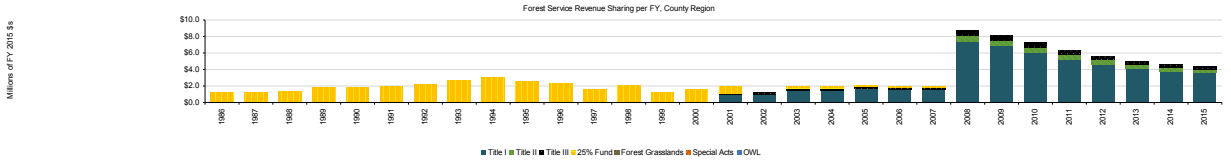
Forest Service Revenue Sharing Payments, FY 2015 (FY 2015 $s)

	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

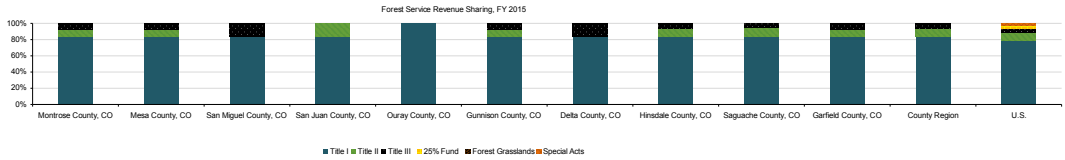
Percent of Total

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.



- 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%).



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

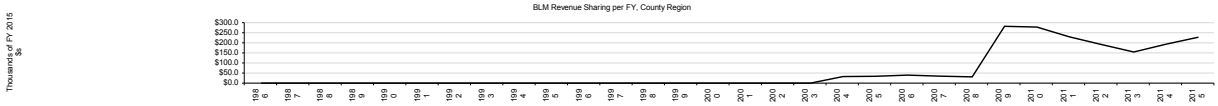
What is BLM Revenue Sharing?

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.

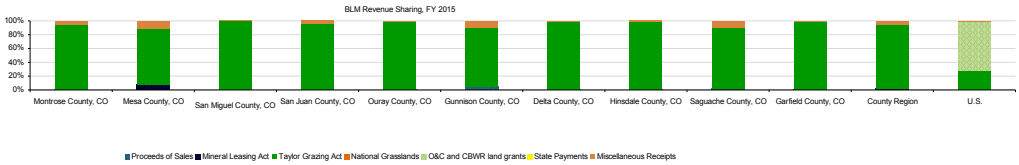
BLM Payments to States and Local Governments, FY 2015 (FY 2015 $s)

	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												
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.



- 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%).



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

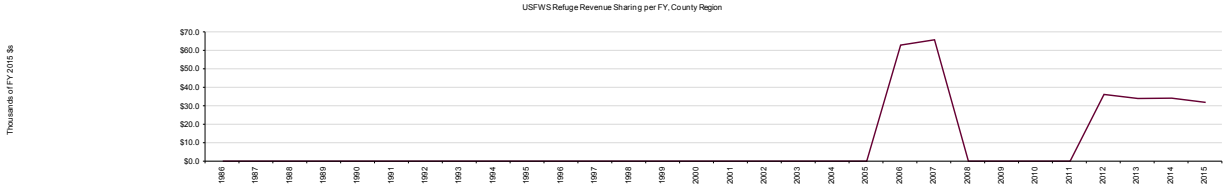
What is U.S. Fish and Wildlife Service Refuge Revenue Sharing?

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)

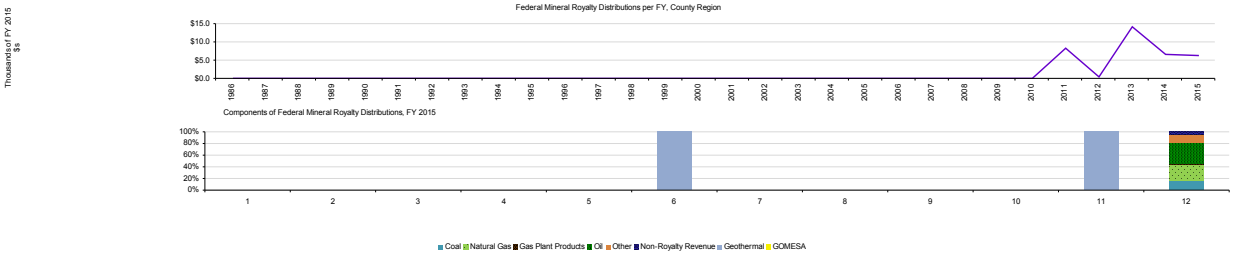
	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Total Federal Royalty	0	0	0	0	0	6,259	0	0	0	0	6,259	1,834,894,159
Royalties	0	0	0	0	0	0	0	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

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%).



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.

NATIONAL SYSTEM OF PUBLIC LANDS
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

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.

FOREST SERVICE
US
DEPARTMENT OF AGRICULTURE

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

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.

Study Guide and Supplemental Information

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

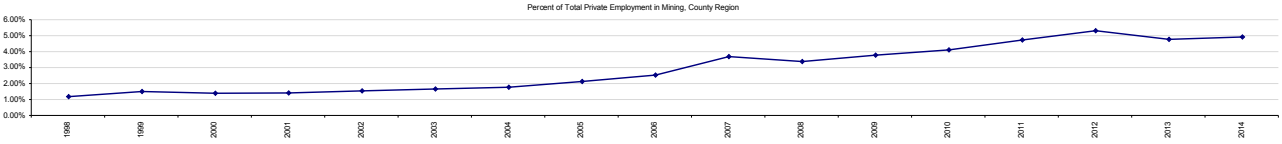
U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.

How has mining changed over time?

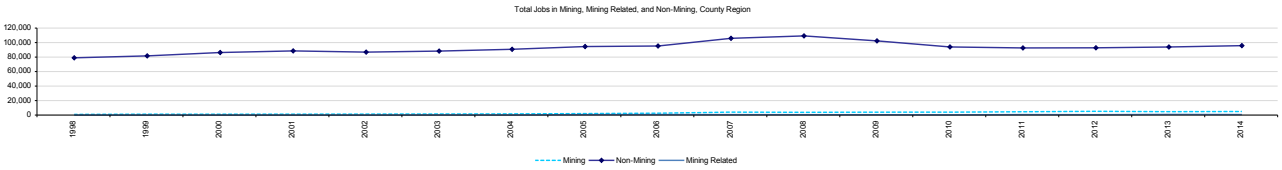
This page describes long-term trends in mining employment as a percent of all jobs and compares mining to non-mining employment over time for the region.

- 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

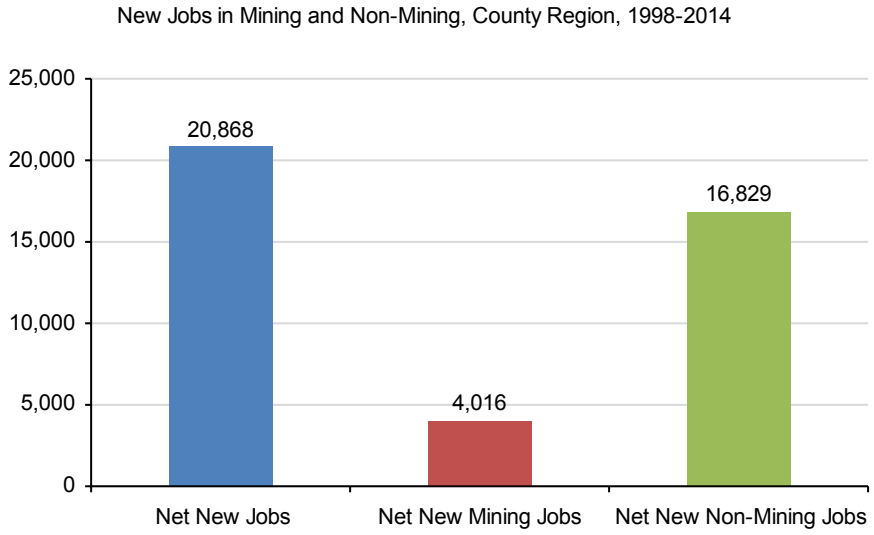
U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.

Mining Employment

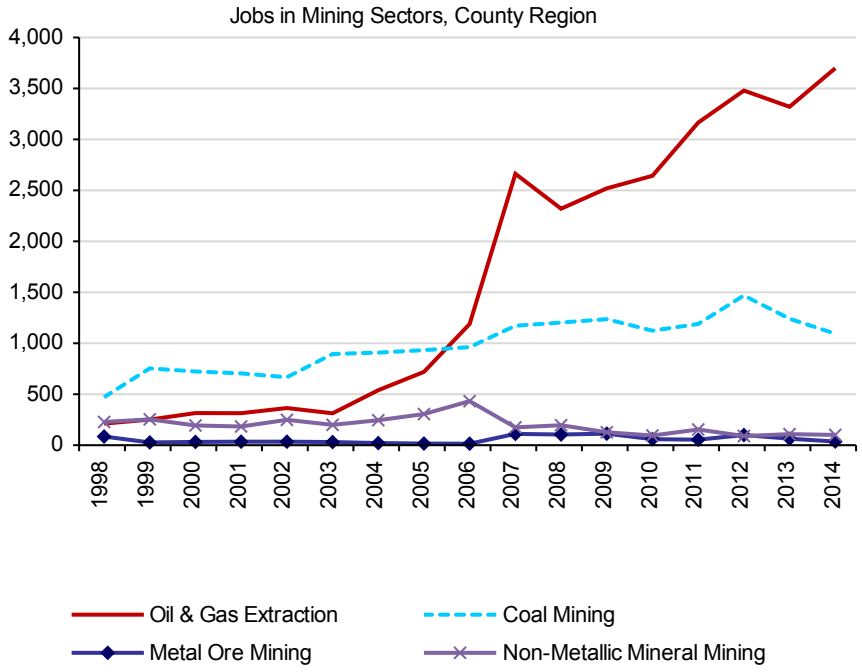
Which mining sectors are changing the fastest?

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.

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.

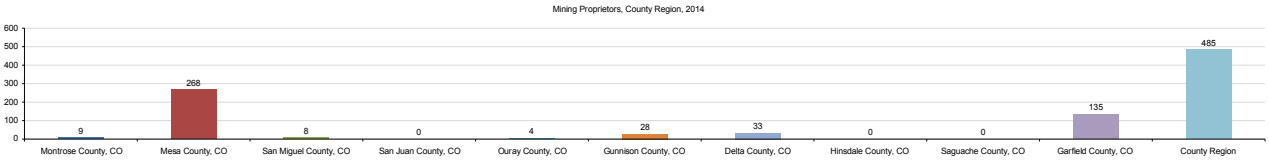
Proprietors in Mining, 2014

	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

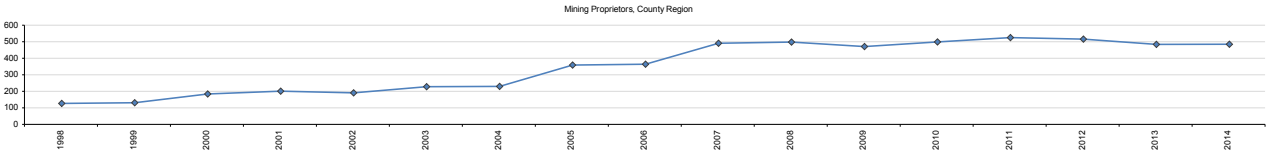
Percent of Total

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.

Study Guide and Supplemental Information

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	¯$32,585	$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)*.

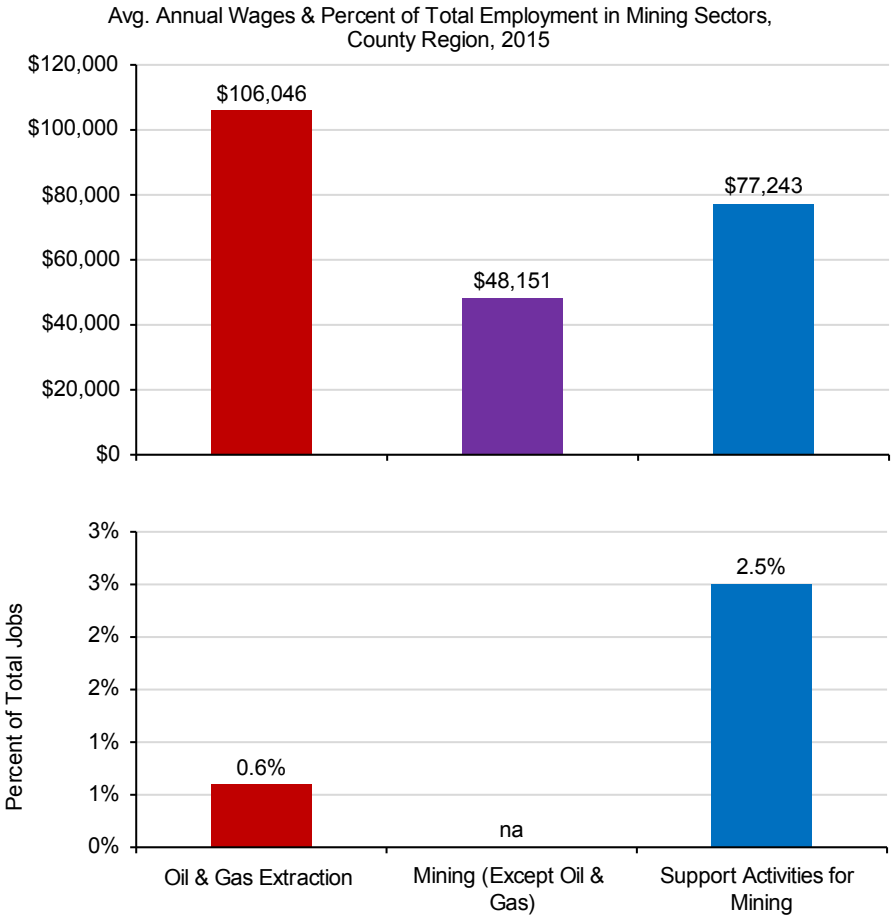
For more information on wages in non-mining industries run the EPS-HDT Socioeconomic Measures report.

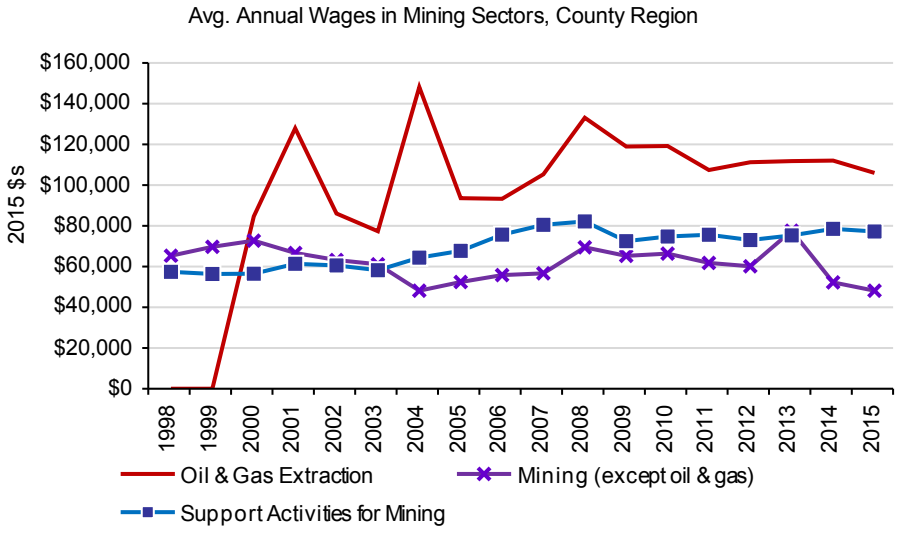
Data Sources

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.

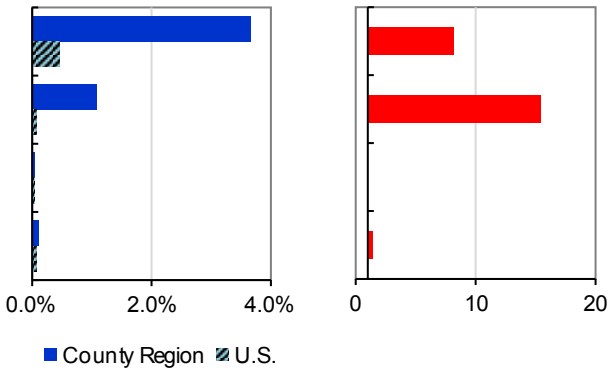
How does regional mining employment compare to the U.S.?

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	Employment Share	Location Quotient
Mining Sector	County Region	U.S.		County Region vs. U.S.	County Region vs. 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		



- 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.

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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)*.

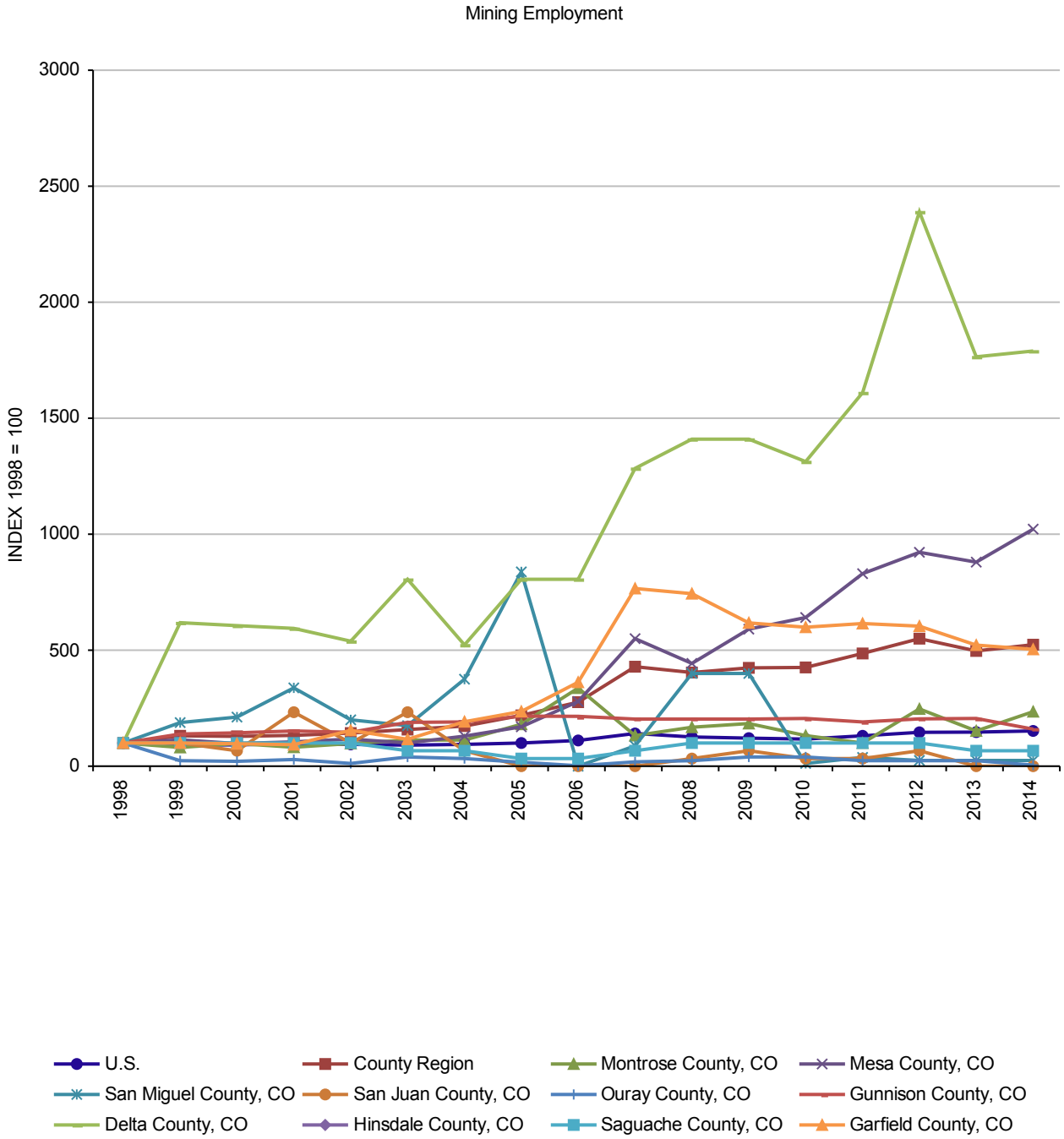
Documentation explaining methods developed by Headwaters Economics for estimating disclosure gaps is available at headwaterseconomics.org/eps *(4)*.

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?

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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.

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.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.

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.

NATIONAL SYSTEM OF PUBLIC LANDS
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

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.

FOREST SERVICE
US
DEPARTMENT OF AGRICULTURE

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

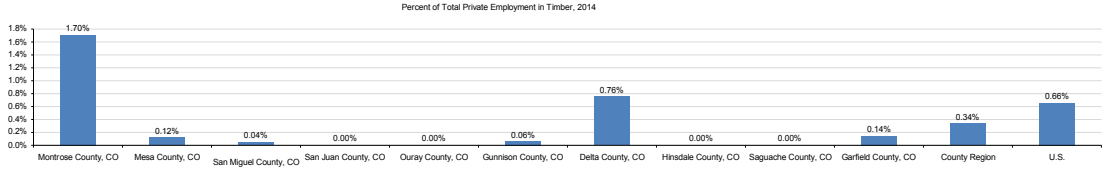
	Montrose County, CO	Mesa County, CO	San Miguel County, CO	San Juan County, CO	Ouray County, CO	Gunnison County, CO	Delta County, CO	Hinsdale County, CO	Saguache County, CO	Garfield County, CO	County Region	U.S.
Total Private Employment	11,560	50,695	4,688	197	1,041	6,171	6,738	139	790	18,937	100,956	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

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%).



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

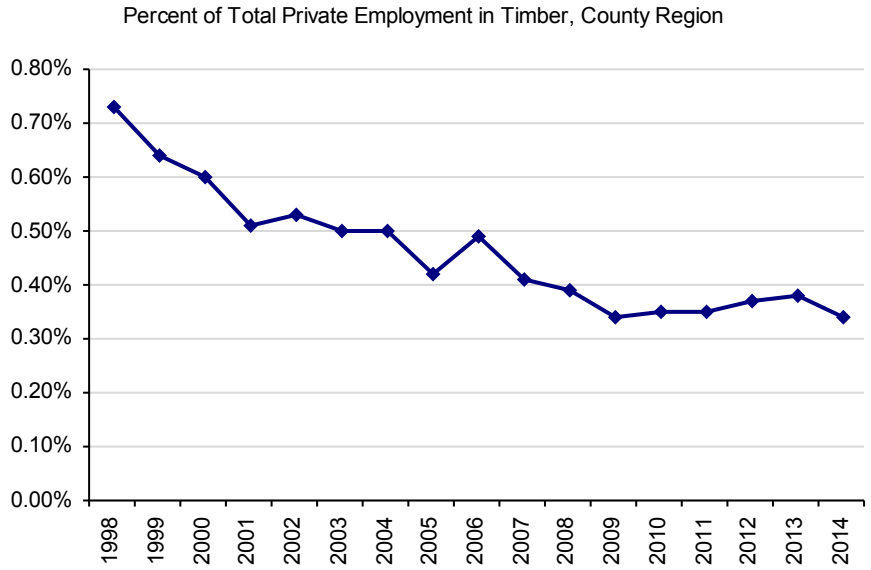
U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.

Timber Employment

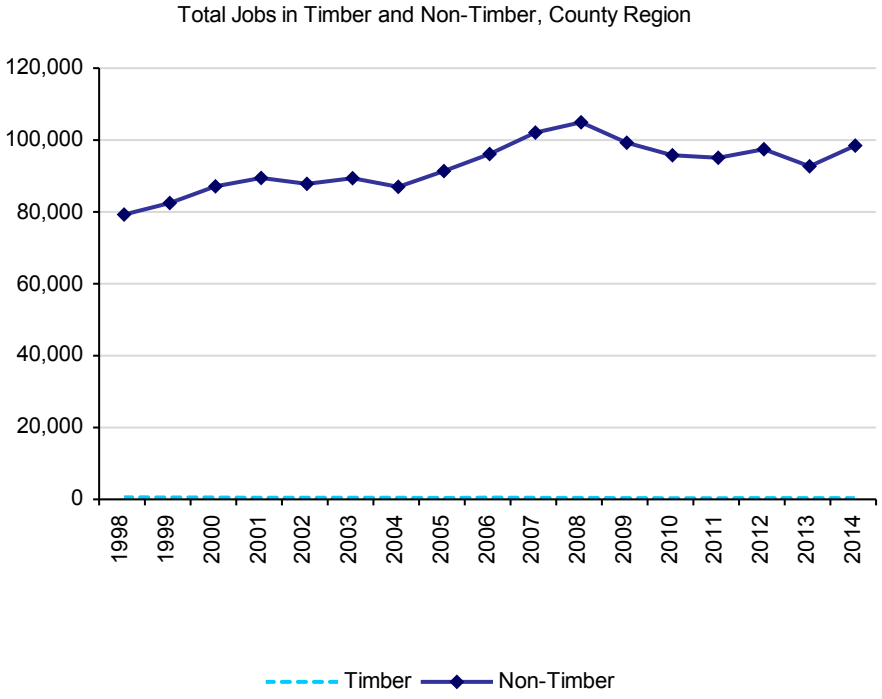
How has timber changed over time?

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.

Study Guide and Supplemental Information

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

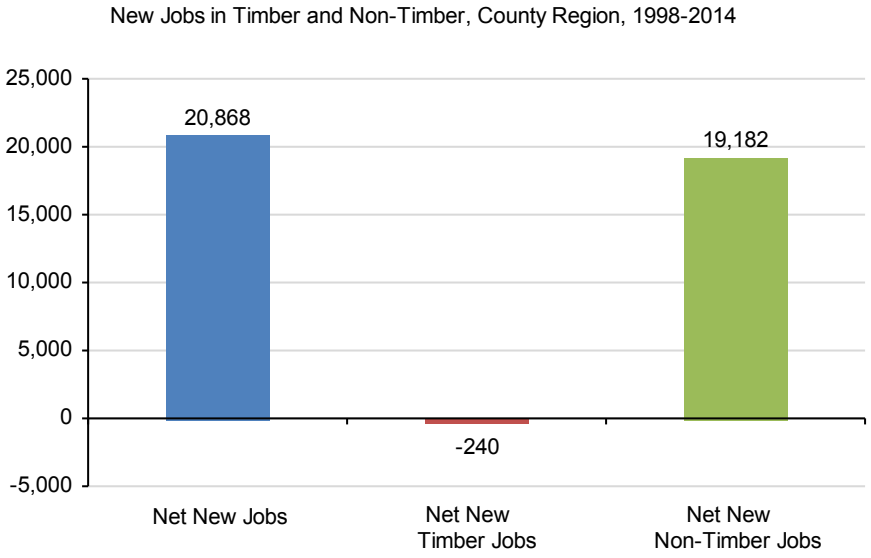
U.S. Department of Commerce. 2016. Census Bureau, County Business Patterns, Washington, D.C.

Timber Employment

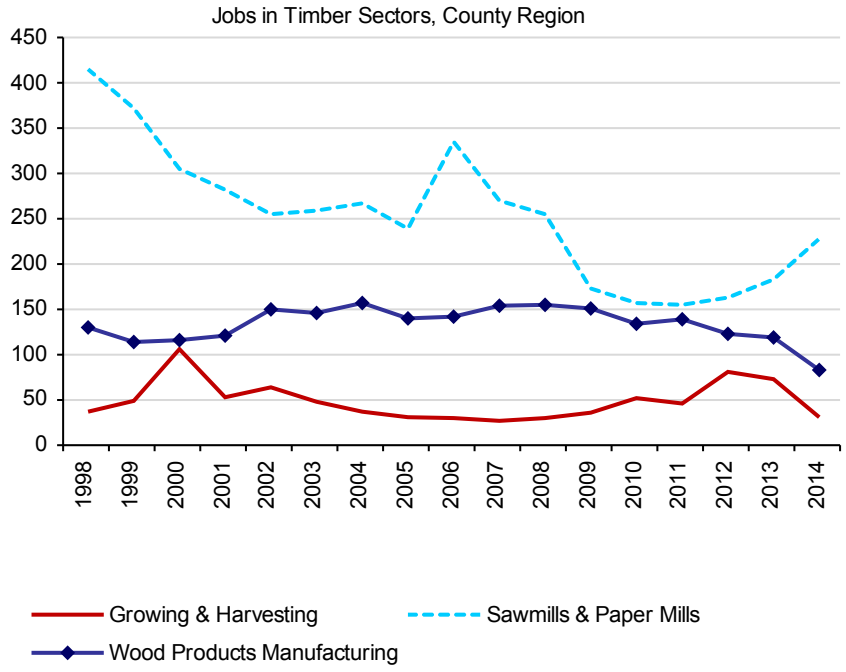
Which timber sectors are changing the fastest?

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.

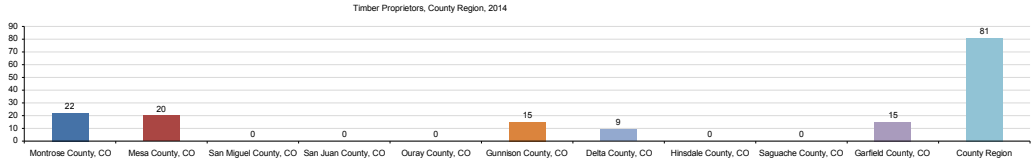
Proprietors in Timber, 2014

	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

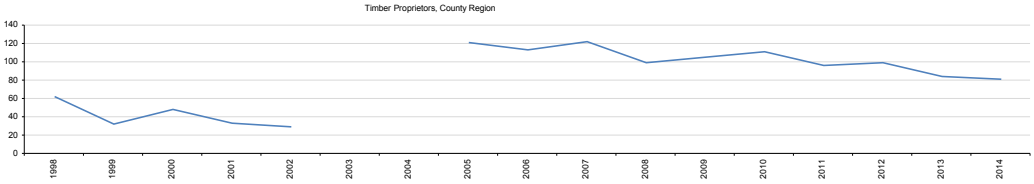
Percent of Total

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.

Study Guide and Supplemental Information

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)*.

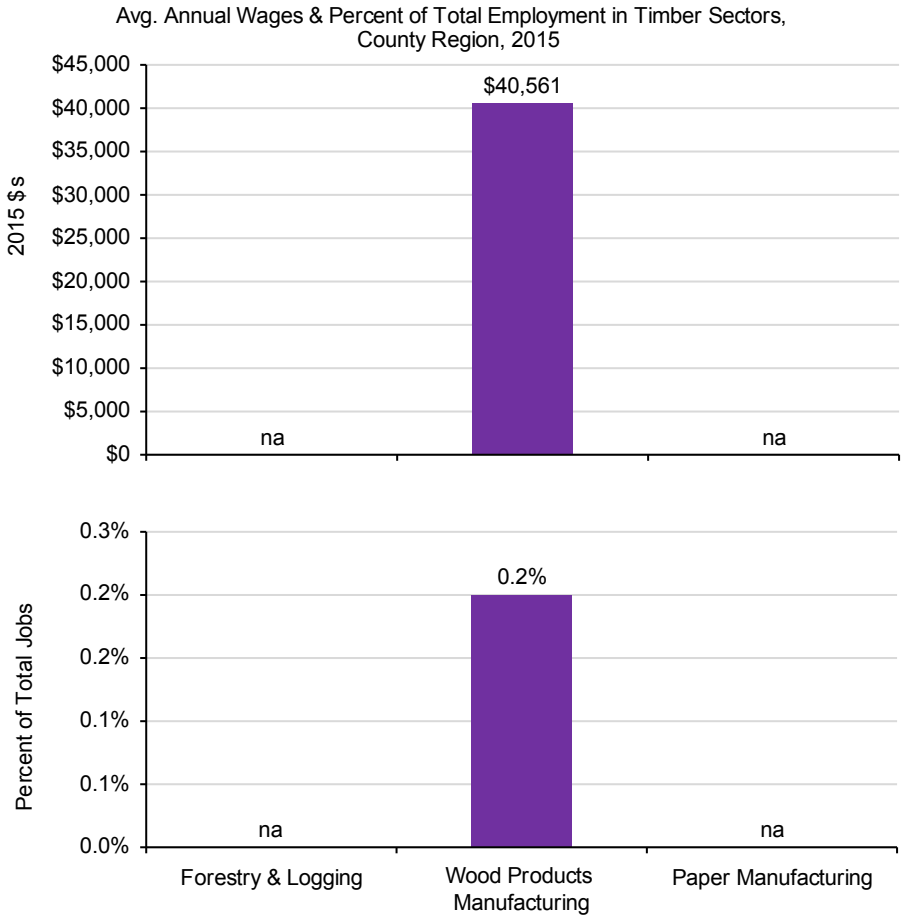
For more information on wages in non-timber industries run the EPS Socioeconomic Measures report.

Data Sources

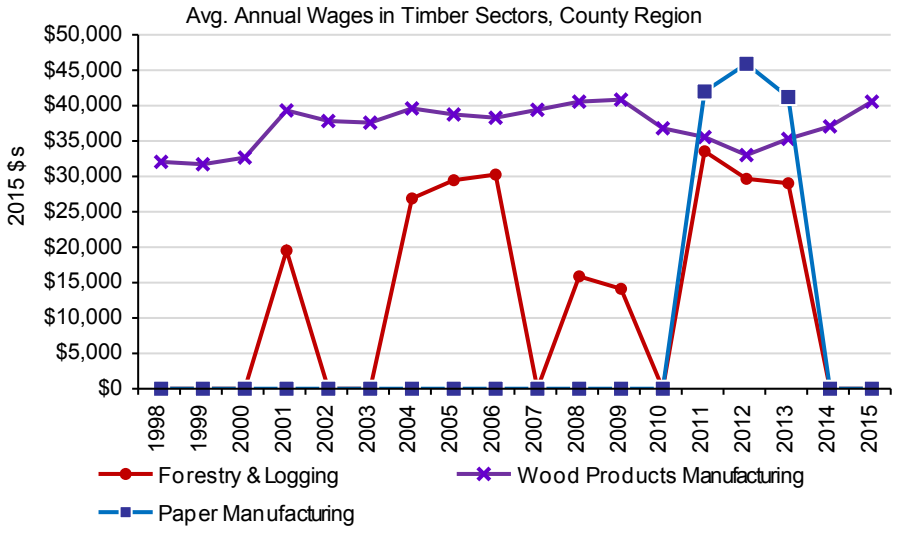
U.S. Department of Labor. 2016. Bureau of Labor Statistics, Quarterly Census of Employment and Wages, Washington, D.C.

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.

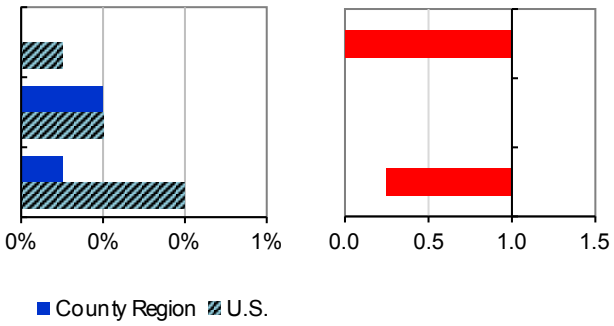
How does regional timber employment compare to the U.S.?

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	Employment Share	Location Quotient
Timber Sector	County Region	U.S.		County Region vs. U.S.	County Region vs. 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		



- 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)*.

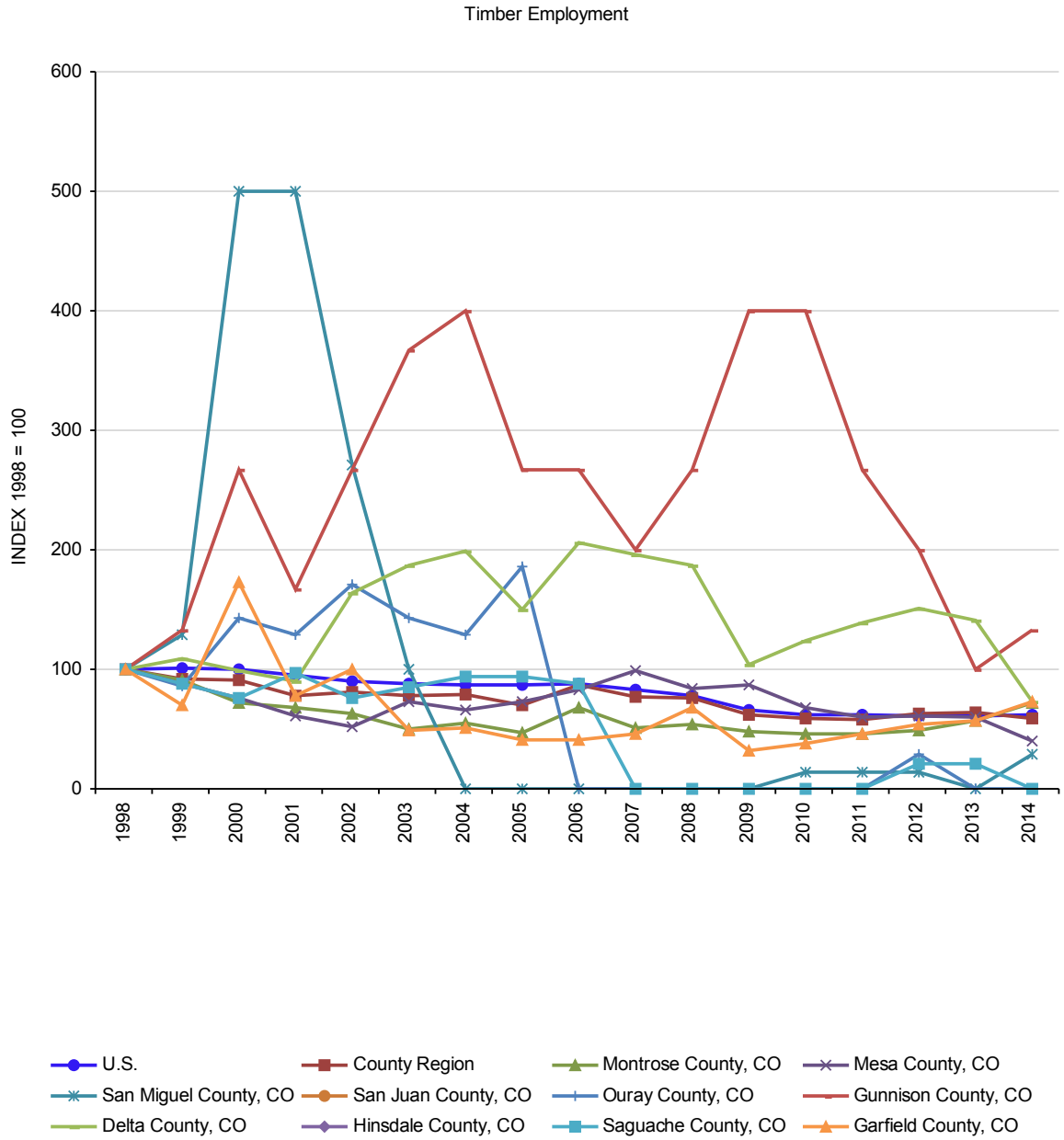
Documentation explaining methods developed by Headwaters Economics for estimating disclosure gaps is available at headwaterseconomics.org/eps *(4)*.

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.

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.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.

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.

NATIONAL SYSTEM OF PUBLIC LANDS
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

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.

FOREST SERVICE
US
DEPARTMENT OF AGRICULTURE

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

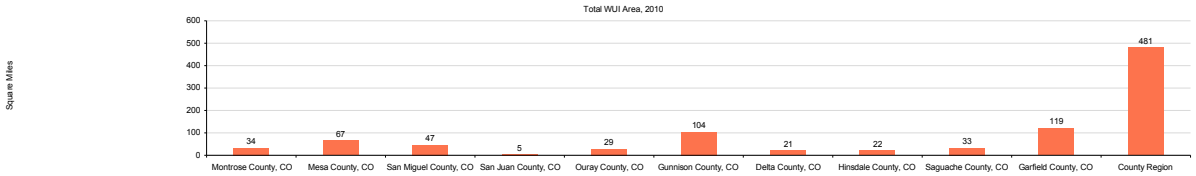
How much of the WUI has been developed, and how much has not yet been developed?

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.

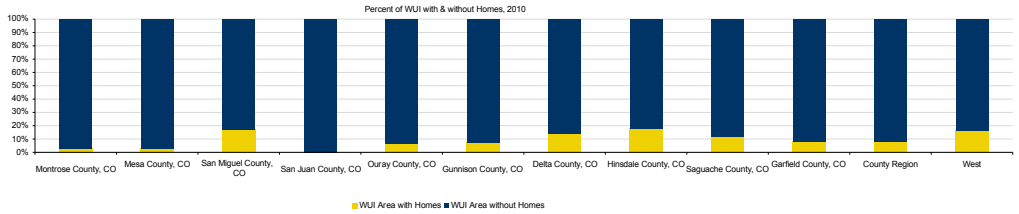
Wildland-Urban Interface (Square Miles), 2010

	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												
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.

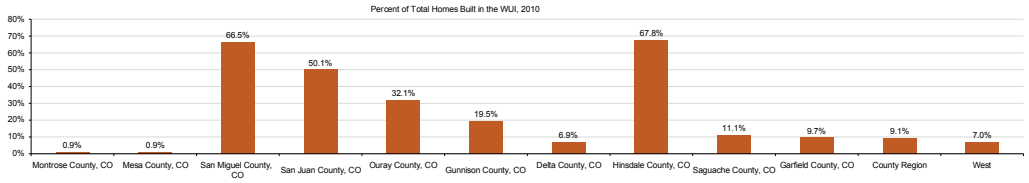
Total Homes and Wildland-Urban Interface Homes, 2010

	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

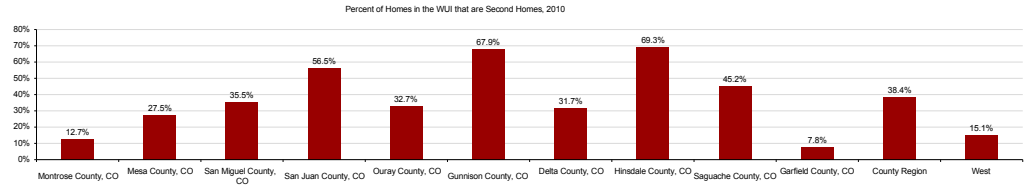
Percent of Total

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.

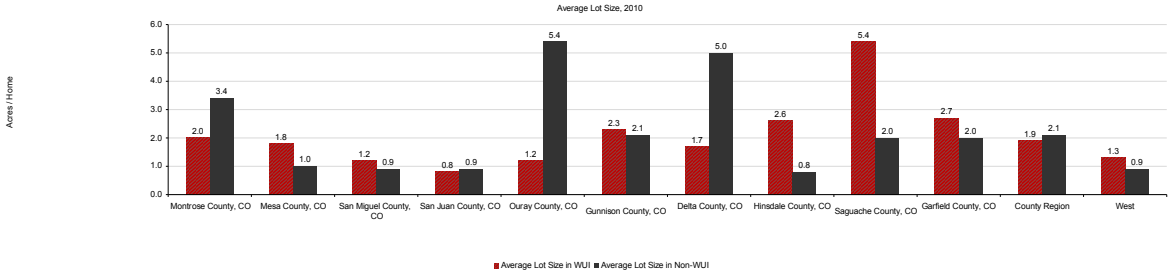
How much land is used inside and outside of the WUI?

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.

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.

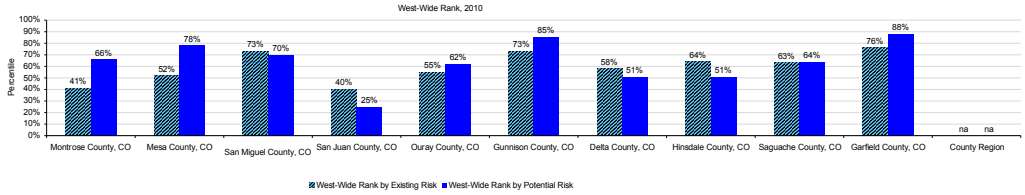
What is the wildfire risk to development?

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.

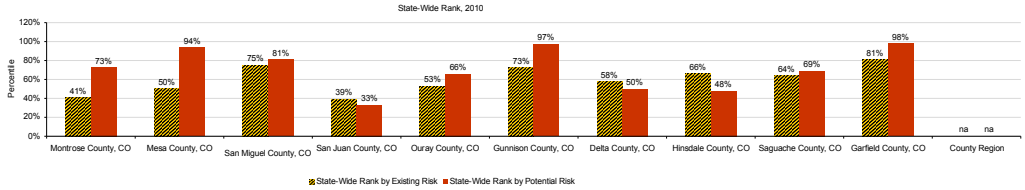
West-Wide and State-Wide County Rankings, 2010

	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.

Study Guide and Supplemental Information

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