Dan Dallas, Supervisor
Erin Minks, Forest Planner
Rio Grande National Forest
1803 W. Highway 160
Monte Vista, CO 81144

February 9, 2016

Dear Supervisor Dallas and Ms. Minks,

Thank you for the opportunity to comment on the draft assessment report chapters. In this letter we are submitting to you our comments on Chapter 15- Designations, although we provide information on wildlife movement that is also germane to chapters covering ecological integrity, landscape processes, and species. We divided our comments into two general sections: Specific Comments and Technical Recommendations.

Let us begin by complementing you and your staff on one of the most comprehensive analyses of the "potential need and opportunity for additional designated areas" that we have seen to date. This is a required element in the assessment report, and we are heartened that you gave it the thought and attention it deserves.

I. Specific Comments, Designations Chapter 15

A. Information Sources and Gaps. Page 2. The draft report identifies information gaps related to 1) how designated areas contribute to economic sustainability in the broader landscape affected by the Rio Grande National Forest, and 2) identifying the need for additional designated areas on the national forest. To help fill the gaps, we offer the following information sources (attached), and ask that they be considered and incorporated into the assessment report. We reference these specific studies among others in our specific comments below.

1. Joanna Lemly, 2012. "Assessment of Wetland Condition on the Rio Grande National Forest." Colorado Natural Heritage Program, Colorado State University. 97 pages. (Attached) This wetlands study was conducted by the Colorado Natural Heritage Program in coordination with the Forest Service, EPA, and Colorado Division of Parks and Wildlife. The researchers surveyed 137 wetlands, 77 of which were located within the Rio Grande National Forest, finding that:

- The condition of the national forest's wetlands was very good with little deviance from natural conditions.
- The wetland acreage makes up 2% of the Rio Grande National Forest acres. It is 42, 862 acres (with 4,687 being rivers and lakes).
- 65% of the wetland acres are in the subalpine, and 29% are in the alpine.
- They found 500 plant taxa in the wetlands. Ninety-four of the species are native while noxious weeds were present in only 4% of plots.
- They surveyed 17 fens which are considered to be the "old growth" of wetlands.

The study is relevant to this chapter because it highlights that there is a unique and rare resource – alpine and subalpine wetlands – on the national forest that is currently in very good condition and merits consideration as a designated area.

2. BBC Research and Consulting, 2012. "Economic Impacts of National Monument Designation, Rio Grande del Norte, New Mexico." August 22, 2102. 27 Pages. This economic study estimates the projected economic contribution of a Rio Grande del Norte National Monument designation in northern New Mexico. It projects that the establishment of a national monument would increase regional economic activity by $15 million and would add 279 jobs to the region. This report is relevant to the Rio Grande National Forest because it analyzes the economic impact of a proposed conservation designation in the Upper Rio Grande landscape, and projects that the designation of conservation lands enhances the economic sustainability of the region. The proposed (now designated) National Monument is located just to the southeast of the Rio Grande National Forest in the southern part of the San Luis Valley.

3. Eco-Resolutions, Inc., 2009. "Ecologically-Based Travel Management Recommendations for the Rio Grande National Forest, Colorado, Parts I and II." Executive Summary and Full Report. This report identifies 37 high priority ecological areas on the forest that merit heightened protections. These areas are where multiple important ecological values coincide, and do not represent other places that may have one very important ecological value. This paper is relevant to this assessment report chapter because it identifies 37 important ecological zones that should be considered for possible future designation.

4. Belote, T., Dietz M., and Aplet G., 2015. "Allocating Untreated "Controls" in the National Wilderness Preservation System as a Climate Adaptation Strategy: A Case Study from the Flathead National Forest, Montana." *in* Northwest Science, Vol. 89, No. 3. This study evaluates the value of wilderness areas to climate change adaptation, and finds that 1) adding more wilderness areas, especially in under-represented ecosystems, is one of the most important climate change adaptation strategies, 2) designating potential wilderness areas (identified pursuant to FSH 1909.12, chapter 70, section 71) as wilderness can significantly increase the forest-level and national-level representation of ecosystems in a high protected status, thereby making wilderness more effective as protected areas as the climate changes, and serving as a necessary comparative control for alternative climate adaptation treatments, and 3) reserving lands as untrammeled wilderness may be an important climate adaptation strategy to maintain connectivity for sensitive species. This study is relevant because it demonstrates that designating additional wilderness quality areas as recommended wilderness or some other type of highly protective designation

facilitates climate change adaptation and species connectivity, and serves as a control for lands with more ground disturbing uses.

5. Dietz, M., Belote, T., Aplet, G., Aycrigg, J, 2015. "The world's largest wilderness protection network after 50 years: An assessment of ecological system representation in the U.S. National Wilderness Preservation System." *in* Conservation Biology, 184, pages 431–438. Knowing that protected areas, such as wilderness, form the foundation of most strategies to conserve biological diversity, the authors examined how well the world's largest highly-protected conservation network—the U.S. National Wilderness Preservation System—currently represents ecological systems found on federal lands in the contiguous United States and how ecological system representation has accumulated over the 50-year tenure of the Wilderness Act. The authors concluded that 1) the National Wilderness Preservation System currently under-represents ecological system diversity; although the total area of NWPS has risen fairly steadily since 1964, the diversity of ecological systems accumulated in wilderness areas (436 ecological systems) reached an asymptote 30 years ago that is well below the total pool of ecological systems available (553) on federal lands, 3) only 113 ecological systems are represented at more than 20% of federal land area, and 4) as the designation of new wilderness areas becomes more difficult, it is important to increase the ecological representation of those areas to achieve greater protection of biological diversity. This study is relevant because it demonstrates the ecological value to biodiversity and climate change adaptation of designating additional lands (especially those in under-represented ecosystems) as recommended wilderness or some other designation type with strong protections.

B. Types, Purposes and Locations of Designated Areas on the Rio Grande National Forest

- **Page 3.** In general, please provide maps showing the designated areas, both at unit scale and forest scale, so we can understand the spatial extent of the unit in relationship to other designated areas and resources.

- **National Recreation Trails, Page 5.** The assessment report provides almost no information on the two National Recreation Trails within the forest. Please provide necessary detail including length, location (with a map), important resources along the trail such as high quality viewsheds, the management requirements for the trails, management challenges and opportunities, types of experiences and settings the trail affords (e.g, solitude, challenge, opportunities to observe and photograph nature), types of uses and their levels, and opportunities for interpretation and education associated with the trails.

- **Wild and Scenic Rivers, Pages 6-7.** It would be helpful to include a chart that lists the outstanding resource values identified for each of the rivers found eligible in the 1996 planning process.

- **Research Natural Areas, page 10.** This section needs to provide more information about the adequacy of the RNA network, and whether gaps exist that preclude the Forest Service from meeting the objectives for RNAs articulated in FSM 4063. Forest Service policy requires each forest to establish and periodically amend, primarily through additions, RNAs that achieve the eight objectives listed in FSM 4063. Two of these objectives are "maintain a wide spectrum of high quality representative areas that represent the major forms of variability found in forest, shrubland, grassland, alpine, and natural situations that have scientific interest and importance that, in combination, form a national network of ecological areas for research, education, and maintenance of biological diversity" and "[p]reserve and maintain genetic diversity, including threatened, endangered, and sensitive species."[1] To the degree possible, the Rio Grande National Forest should explain if and how it is meeting the objectives, and if additions to the RNA system could help do so.

C. **Special Interest Areas, page 15**. While the text states that commercial livestock grazing is allowed in a Research Natural Area, it does not explain why. Please provide an explanation.

D. **Potential Need and Opportunity for Additional Designated Areas**

The planning rule requires forests to identify and evaluate existing information in the assessment report relevant to the "potential need and opportunity for additional designated areas" and document how best available science was used to inform that assessment. Section 14(4) of the directives provides eight useful questions to guide the assessment of potential need and opportunity for additional designated areas. We are heartened that you asked and answered the questions in your assessment report, and in doing so, provided a thoughtful assessment of the potential for additional designated areas.

As the report explains, designated areas include those designated statutorily (e.g., Wilderness Area), executively (e.g., National Monument), administratively through a separate process to the land management planning process (e.g., Scenic Byways), and administratively within the land management planning process. Unlike the 1982 rule, the 2012 rule explicitly defines the term *designated area* and requires the responsible official to determine whether to recommend designated areas in addition to wilderness and wild and scenic rivers.[2]

By providing explicit authority to designate areas, the 2012 planning rule provides forests an important and useful tool for achieving the ecological mandates of the 2012 rule. These include protecting and maintaining ecosystem integrity, enhancing connectivity, and connecting people to nature. In particular, by designating areas, forests can simultaneously protect, highlight, and interpret places that are particularly important for species or ecosystem integrity and better meet the planning rule's substantive provisions. For example, establishing a zoological area that protects important habitat for a Species of Conservation Concern not only advances the protection of the species but also heightens people's awareness of the species and its plight, and forges more pride and connection between the public and the forest. We think that this concept is important and ask that you articulate it into this section.

Page 16. In the first paragraph of this section, the report states: "The evaluation of potential wilderness includes a detailed assessment of the capability, availability, and need for additional wilderness. The need for an area to be designated as wilderness is determined through an analysis of the degree to which it contributes to the overall National Wilderness Preservation System." While this was true for the 2007 version of the Forest Service handbook 1909.12, chapter 70, it is not true for the 2015 revision. The 2015 revision updated the wilderness evaluation process so that it exists of four steps: Inventory, Evaluation, Analysis, and Decision. The revision eliminated the assessment of the need for additional wilderness areas. Please update this section accordingly.

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[1] FSM 4063.02.

[2] 36 C.F.R.§219.7(c)(2)(vii)

The third paragraph discusses RNAs, and concludes that the Rio Grande National Forest "may need an update to the 1994 potential research natural area candidate inventory to determine if, based on changed conditions or new information, [the Rio Grande National Forest] should consider additional areas as potential candidate research natural areas." While it makes sense to look at changed conditions and new information to assess possible additions to the RNA network, the Rio Grande National Forest should also look at whether and how well the current network is achieving the articulated RNA objectives in FSM 4063.02. Please see our comments above on this topic.

E. Published Documents or Proposals that Identify an Important Need or Potential for a Designated Area, page 17. Please reference and incorporate the information in the two reports provided in the beginning of the letter. These are:

- Joanna Lemly, 2012. "Assessment of Wetland Condition on the Rio Grande National Forest." Colorado Natural Heritage Program, Colorado State University. 97 pages.
- Eco-Resolutions, Inc., 2009. "Ecologically-Based Travel Management Recommendations for the Rio Grande National Forest, Colorado, Parts I and II." Executive Summary and Full Report.

Both reports identify an important need or potential for additional designated areas as described above in this letter. The first report identifies the location of high quality wetlands in the Rio Grande National Forest that could be potentially designated as wetland complexes. The second identifies specific ecological zones on the forest where multiple ecological values coincide.

In addition, the Colorado Natural Heritage Program publishes a list of Potential Conservation Areas. The updated reports from the CNHP available at http://www.cnhp.colostate.edu/download/gis/pca_reports.asp should be included in this section.

F. Specific land types or ecosystems present in the plan area that are not currently represented or minimally represented, page 17.

We commend you for considering what ecosystems and land types are not well represented in protected areas. This is an important question to ask since representation is considered to be a fundamental element of biodiversity and sustainability. We are aggrieved, however, that the Rio Grande National Forest invoked data in the wilderness evaluation report associated with the 1996 land and resources management plan to answer the question. This information is considerably out of date. Moreover, The San Luis Valley Ecosystem Council et al. submitted a much more current analysis of ecosystem representation within protected areas on the Rio Grande National Forest in April 2015.[3] Our analysis, which was supported by a peer-reviewed methodology[4], showed that a significant number of inventoried roadless areas on the Rio Grande National Forest contain high proportions of inadequately

[3] Letter To Supervisor Dan Dallas from San Luis Valley Ecosystem Council, The Wilderness Society, Defenders of Wildlife, Quiet Use Coalition, Rocky Mountain Wild, and Rocky Smith dated April 13, 2015, pages 10-11 and Appendix 1.

[4] *See* Dietz, M., Belote, T., Aplet, G., Aycrigg, J, 2015. "The world's largest wilderness protection network after 50 years: An assessment of ecological system representation in the U.S. National Wilderness Preservation System." *in* Conservation Biology, 184, pages 431–438.

represented ecosystem types at both the forest-level and national scales (Appendix 4, Tables 1 & 2; Maps 2 & 3). We found that:

- Under-represented ecosystems (at both representation levels) cover over 50% of the acreage of 22 of the 53 inventoried roadless areas in the forest, and over 80% of 7 of the 53 areas. The ecosystem under-representation problem is particularly acute at the forest level, where severely under-represented ecosystem types (<5%) cover over 40% – and up to 71% – of the acreage of 10 of the 53 inventoried roadless areas.

- 20 of 31 ecosystems on the Rio Grande National Forest are under-represented at the forest level, and 21 of 31 are under-represented at the federal level. (Appendix 4, Table 3, Tabs 1 & 2; Map 3)

- 43% of the Rio Grande National Forest (788,000 acres) is comprised of under-represented ecosystem types. The leading under-represented systems at the forest level are:
    - Rocky Mountain Aspen Forest and Woodland (13.7% representation in Wilderness),
    - Southern Rocky Mountains Montane-Subalpine Grassland (3.4% representation in Wilderness),
    - Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland (5.4% representation in Wilderness),
    - Southern Rocky Mountain Ponderosa Pine Woodland (1.0% representation in Wilderness), and
    - Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland (3.5% representation in Wilderness).

- Of the 53 Colorado Roadless Areas (CRAs) on the Rio Grande National Forest, 22 have more than half of their acreage in under-represented ecosystems, and 13 have more than 70% of their acres in under-represented ecosystems at both the forest and federal levels. These are Butterfly, Spectacle Lake, Taylor Canyon, Cotton Creek, Ute Pass, Dorsey Creek, Miller Creek, Hot Springs, Antero Meadows-Bear Creek, Crestone, Sawlog, Pole Creek, and Conejos River-Lake Fork.

- The CRAs that contain the most acres of the top five under-represented ecosystems on the Rio Grande National Forest are: Bennet Mountain / Blowout / Willow Creek / Lion Point / Greenie Mountain; Trout Mountain / Elk Mountain; Chama Basin; Bristol Head; Antora Meadows / Bear Creek; Antora Meadows / Bear Creek; Middle Adler; Four Mile Creek; Snowshoe Mountain; Tewksberry; Taylor Canyon; Ute Pass; and Wason Park. See Tables 1 and 2.

Table 1. The Colorado Roadless Areas Containing the Highest Number of Acres of the Five Most Under-Represented Ecosystems (at the forest and federal level) on the Rio Grande National Forest.

Rocky Mountain Aspen Forest and Woodland	Est. Acres	Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland	Est. Acres	Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland	Est. Acres	Southern Rocky Mountain Ponderosa Pine Woodland	Est. Acres	Southern Rocky Mountain Montane-Subalpine Grassland	Est. Acres
Bennet Mountain / Blowout / Willow Creek / Lion Point / Greenie Mountain	16,120	Bennet Mountain / Blowout / Willow Creek / Lion Point / Greenie Mountain	3,992	Bennet Mountain / Blowout / Willow Creek / Lion Point / Greenie Mountain	2,875	Taylor Canyon	2,044	Trout Mountain / Elk Mountain	3,999
Trout Mountain / Elk Mountain	8,345	Trout Mountain / Elk Mountain	1,379	Trout Mountain / Elk Mountain	2,399	Ute Pass	1,770	Wason Park	3,811
Chama Basin	6,010	Sawlog	1,329	Snowshoe Mountain	1,305	Bennet Mountain / Blowout / Willow Creek / Lion Point / Greenie Mountain	1,643	Sawlog	2,649
Bristol Head	5,153	Middle Alder	1,033	Tewksberry	1,175	Trout Mountain / Elk Mountain	1,347	Bennet Mountain / Blowout / Willow Creek / Lion Point / Greenie Mountain	2,361
Antora Meadows / Bear Creek	4,657	Four Mile Creek	985	Four Mile Creek	1,155	Four Mile Creek	1,330	Four Mile Creek	2,275

Table 2. Colorado Roadless Areas with the Most Acres of Under-represented Ecosystems on the Rio Grande National Forest.

Ecosystem	Rocky Mountain Aspen Forest and Woodland	Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland	Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland	Southern Rocky Mountain Ponderosa Pine Woodland	Southern Rocky Mountain Montane-Subalpine Grassland	Totals
Bennet Mountain / Blowout / Willow Creek / Lion Point / Greenie Mountain	16,120	3,992	2,875	1,643	2,361	26,991
Trout Mountain / Elk Mountain	8,345	1,379	2,399	1,347	3,999	17,469
Snowshoe Mountain	4,553	909	1,305	236	2,158	9,160
Bristol Head	5,153	481	245	205	1,596	7,679
Sawlog	1,451	1,329	1,044	798	2,649	7,272
Antora Meadows / Bear Creek	4,657	339	368	583	906	6,853
Wason Park	1,945	472	286	302	3,811	6,816
Chama Basin	6,010	84	25	0	47	6,166

Four Mile Creek	383	985	1,155	1,330	2,275	6,128
La Garita	1,733	867	1,033	897	1,120	5,651
Deep Creek / Boot Mountain	2,898	391	181	35	1,685	5,190
Ute Pass	63	763	837	1,770	1,736	5,170
Taylor Canyon	141	983	481	2,044	1,263	4,912
Pole Mountain / Finger Mesa	3,448	0	0	0	842	4,290
Elkhorn Peak	3,113	67	86	84	819	4,168
Spruce Hole / Sheep Creek	2,540	95	433	86	923	4,076
Tewksberry	1,400	742	1,175	169	322	3,808
Beaver Mountain	1,751	792	549	169	395	3,655
Crestone	1,160	884	273	542	473	3,332
Middle Alder	808	1,033	400	725	315	3,280

Methodology Explained in Dietz, M., Belote, T., Aplet, G., Aycrigg, J, 2015. "The world's largest wilderness protection network after 50 years: An assessment of ecological system representation in the U.S. National Wilderness Preservation System." in Conservation Biology, 184, pages 431–438.

The story is similar at the national scale, with a total of 21 inadequately represented ecosystem types covering over 41% and 742,000 acres of the Rio Grande (Appendix 4, Table 3, Tab 3; Map 2). Further, only 6% of these under-represented ecosystems are protected in wilderness nationally. Notably, two of the most prevalent ecosystems on the Rio Grande are under-represented both at the forest and national levels (Appendix 4, Table 3, Tabs 2 & 3). The Southern Rocky Mountain Montane-Subalpine Grassland covers over 191,000 acres of the forest, yet only 3.4% of the ecosystem is protected as wilderness. The Rocky Mountain Aspen Forest and Woodland spans 209,000 acres on the Rio Grande, only 28,000 of which are protected in the forest's wilderness.

We are re-attaching our analysis along with the peer-reviewed article by Dietz et al (2015) in which the methodology is explained. We consider this representation analysis to be best available science, which the 2012 planning rule requires the agency to use,[5] and request that you incorporate it into the final Assessment Report.

The draft Assessment Report goes on to cite the conclusions from the 1996 planning process around the need for wilderness. While the historical context is interesting and useful, we take umbrage with the first two conclusions listed from 1996: that there is plenty of wilderness within a 100 mile radius of the Rio Grande National Forest representing a wide variety of land type associations, wildlife species and habitats; and wilderness areas and the opportunities that they provide are not in short supply on the forest. Regarding the former, the designated Wilderness on and around the Rio Grande National Forest at that time was predominantly in the very highest elevations, and did not represent a wide variety of land type associations. This situation continues today. Regarding the latter, similarly opportunities to experience wilderness in lower elevation lands are not abundant. We recommend that you document in the report the elevations encompasses by wilderness within and around the Rio Grande National Forest.

G. Rare and outstanding resources in the plan area appropriate to specific types of designated areas, page 18.

We agree that there are outstanding botanical, aquatic, and geologic resources that could be appropriate for specific types of designations, and that a logical first place to look for these are the areas considered and rejected for special designation in the 1996 plan. These areas, however, were predominantly geologic and historic, and did not capture the aquatic, zoological, or botanical unique or outstanding resources as well. To address the gap, we recommend that you reference Lemly et al. (2012) that identifies high quality wetlands and Eco-Resolutions (2009) that identifies specific ecological zones where multiple ecological values coincide. In addition, we suggest that you include examples of specific at-risk species that could likely benefit from a special designation – both from the protections and the opportunities to educate the public that a designation provides. Examples include:

- American Peregrine Falcon (*Falco peregrinus anatum*)
- Boreal Owl (*Aegolius funereus*)
- Boreal Toad (*Bufo boreas boreas*)
- Canada Lynx (*Lynx canadensis*)
- Great Basin Silverspot (*Speyeria nokomis nokomis*)

[5] 36 C.F.R. § 219.3 (agency "shall use the best available scientific information to inform the planning process" and "shall document how [that] information was used to inform the assessment").

- Gunnison Sage-grouse (*Centrocercus minimus*)
- Townsend's Big-eared Bat (*Plecotus townsendii*)
- Uncompahgre Fritillary (*Boloria improba acrocnema*)

See Appendix 1 for information on each of these species and the rationale for establishing a designated area for their protection and interpretation.

H. Known important ecological roles such as providing habitat or connectivity for species at risk that could be supported by designation, page 20.

In addition to providing habitat for specific species including those identified as species of conservation concern as discussed in the previous section, designated areas can contribute to connectivity within the forest and across the larger landscape. Properly designed networks of wildlife corridors represent one of the best strategies to mitigate the negative impacts of habitat fragmentation and help wildlife species adapt to climate change. Strategies that seek to maintain or restore connectivity between protected or otherwise intact natural areas are now considered critical to biodiversity conservation (Hilty et al. 2006, Miller & Hobbs 2002, Taylor et al. 2006). Conservation scientists have now long agreed that "the preponderance of evidence is that corridors almost certainly facilitate travel by many species" (Beier and Noss 1998). Many analytical frameworks for prioritizing specific habitat corridors to preserve landscape connectivity have been formulated (e.g., Bunn et al. 2007, Compton et al. 2007, Carroll et al. 2011, McRae et al. 2008, Walker & Craighead 1997), and this area of conservation science continues to see intense growth. Although the particulars of wildlife response to climate change are largely unknown (Root 2003, Travis 2003, Jarema et al. 2009), establishment of landscape connectivity via corridors is the most frequently cited strategy for combating the impacts of climate change on biodiversity (Heller & Zavaleta 2009). The preamble of the planning rule recognizes that providing corridors in order to connect habitat may be necessary to maintain viable populations of at-risk wildlife within the planning area.[6]

Designing, designating and protecting wildlife corridors should be a part of Forest Service land planning in order to mitigate the compounding and simultaneous impacts of habitat fragmentation and climate change. Wildlife corridors can be provided through a number of strategies under the 2012 planning rule. One strategy is to establish a designated area that spans the corridor. Another is to create a management or geographic area for wildlife corridors with correspondingly strong plan components that will disallow fragmentation and promote restoration of damaged sites within the corridor. Conceivably, a mix of these two strategies might be appropriate to holistically protect lands necessary for a species and provide interpretation of the value of linkages to the public.

Wildlife corridors will be internal to the Rio Grande National Forest in some instances, while in other instances will span across administrative boundaries. Several federal land management planning processes are currently underway in the larger Upper Rio Grande Basin. These include land management plan revisions for the Santa Fe National Forest, Carson National Forest, the Rio Grande del Norte National Monument, and the Valles Caldera National Preserve. See Figure 1 for a map that better illustrates the opportunity for landscape conservation. Meanwhile, outside of the Upper Rio Grande Basin, the Grand Mesa, Uncompahgre, and Gunnison National Forests will start the plan revision process this year. Plan direction that provides for connectivity at larger scales will be more successful if it is designed in coordination with planners on these adjacent federal units as well as land and game

[6] Forest Service Planning Rule Preamble, 77 Fed. Reg. 21,217 (Monday, April 9, 2012).

managers with the Tribes and the Colorado Department of Parks and Wildlife (CPW) and New Mexico Department of Game and Fish (NMDGF).

Below and in Appendix 2, we offer sources of scientific information pertaining explicitly to connectivity and corridors, and request that the Forest Service cite and utilize them in the final Assessment Report and subsequent analysis documents. Each may help to prioritize key linkage zones (specific geographies where the protection of connectivity should be a management priority) for designation within and around the Rio Grande National Forest, inform efforts to coordinate with adjacent federal units undergoing planning, and guide development of a revised management plan that fully supports connectivity based on the best available scientific information. The information provided in Appendix 2 represents the best available science, which the 2012 planning rule requires the agency to utilize.[7] We recognize that this scientific information may belong in other assessment chapters (e.g., ecological integrity, species at risk), and that it would make sense to include it there and cross-reference it in the Designations Chapter where the discussion can focus on the potential need and opportunity for designations that enhance connectivity.

Additionally, the New Mexico's Natural Heritage Program, a division of the Museum of Southwestern Biology and the University of New Mexico, is collecting and analyzing connectivity and wildlife movement information in northern New Mexico and southern Colorado to identify candidate areas in the Upper Rio Grande Basin that could serve as prime places to provide for connectivity across administrative boundaries. We encourage you to reach out to the New Mexico Natural Heritage Program to learn more about the work it is undertaking and the data that it has aggregated and analyzed, as the program may be able to assist in identifying potential corridors for designation. We encourage you to reach out to Rayo McCollough at University of New Mexico's Natural Heritage Program. Mr. McCollough's email is rayo@unm.edu.

a. Landscape integrity-based connectivity models for the Upper Rio Grande Landscape.

We are aware of two landscape integrity-based connectivity models available for the planning area. These models are designed to predict important corridors among intact blocks of natural habitat. These models are not species-specific; instead, they serve as a coarse-filter approach to identifying areas expected to support movement of a wide range of species as well as continuity of ecological processes. Both models are intended to provide a first-pass, "20,000 feet" view of areas expected to be important for connectivity, and should not form the basis for fine-scale, site level management decisions. Instead, these models can help to guide selection of general areas within which to prioritize collection of and/or use of finer-scale data.

While both models were designed with the same concept in mind, they employ different methodology, encompass different geographic extents, and are presented in different forms. Therefore, while similarities exist, predictions of important corridors will often disagree, particularly at finer scales. We suggest that both models offer a potentially valuable perspective on priorities in managing for connectivity, and that both should be considered, alongside other resources described below.

This is also a good time to highlight a recent study about landscape integrity-based connectivity models. Krosby et al (2015) compared focal species and naturalness-based corridor network models to ask

[7] 36 C.F.R. § 219.3 (agency "shall use the best available scientific information to inform the planning process" and "shall document how [that] information was used to inform the assessment").

"whether they identify similar areas, whether a naturalness-based approach is in fact more analytically efficient, and whether agreement between the two approaches varies with focal species vagility." Krosby found that "naturalness-based corridor models can offer an efficient proxy for focal species models but a multi-focal species approach may better represent the movement needs of diverse taxa." (Krosby 2015.) We highlight this particular study here because providing for connectivity, especially when taking a focal species approach, can be difficult to implement (i.e., time and resource intensive) at large-scales. Taking a naturalness approach can offer efficiencies and result in similar findings. Examples of naturalness-based models include Theobald's Wild Lifelines and the Western Governor's Association (WGA) connectivity analysis.

i. Theobald's Wild LifeLines[8]

Theobald's Wild Lifelines™ (2012) depict potential movement pathways in the U.S. between the Mexican and Canadian borders that emphasize the least human modification and highest extant connectivity for wildlife. Wild LifeLines™ provides a broad-scale look at landscape connectivity based on landscape naturalness, without a focus on any particular individual species. The authors assume that wildlife movement will be least restricted across "natural" areas and most restricted across "human-modified" areas. These pathways are the result of a modeling approach that is based on a map of Natural Landscapes built from layers of land cover types, distance to roads, traffic volume and housing density, and which then identifies the least fragmented connections between remaining natural areas. Wild LifeLines™ complement identification of cores and linkages within conservation planning boundaries that might secure landscape capacity for broad-scale wildlife movement within extant high-connectivity lands.

See Appendix 3 for Theobald's Wild Lifelines overlaid with all of the units in the Upper Rio Grande Basin. This analysis points to major connections between the southern boundary of the Rio Grande National Forest and the Carson National Forest as well as connections on the western side of the Rio Grande National Forest.

ii. Reed and Theobald's (2012) Developing Key Datasets to Support Prioritization of Wildlife Habitat Protection in Colorado and New Mexico[9]

Reed and Theobald modeled connectivity and development threats in the southern Colorado/northern New Mexico region as part of an effort to develop a pilot decision support model that could inform Colorado and New Mexico Wildlife Departments' and Western Governors Association's efforts to develop consistent modeling approaches for landscape connectivity. Modeling riparian and terrestrial connectivity for big game as well as species of high conservation concern, the authors developed a series of maps and data sets showing landscape permeability and flow lines. In addition, they modeled human development threats (residential, energy, and transportation development; dispersed recreation) to show spatially the severity of predicted landscape modification. They then used the outputs to demonstrate how habitat connectivity and threats datasets could be applied to target habitat protection and management activities. For instance, the authors created maps showing large intact

[8] David M. Theobald, Sarah E. Reed, Kenyon Fields & Michael Soule. 2012. "Connecting natural landscapes using a landscape permeability model to prioritize conservation activities in the United States" *in* Letters **5** (2012) 123–133.

[9] Reed, S.E., D.M. Theobald and D. Harrison-Atlas. 2012. Developing key datasets to support prioritization of wildlife habitat protection in Colorado and New Mexico. Colorado State University, Fort Collins, CO.

habitat blocks, corridor zones (least cost paths with one mile buffers), and areas of high conservation value (areas with high resource value for a species and that contribute to landscape connectivity). The report is attached.

b. Raw focal species telemetry and genetic data.

This type of data will help identify key sites supporting focal species movement at fine scales and/or confirm that a focal species does indeed utilize a particular site predicted to be important for movement by the models described above and below. We are not aware of any radio collar monitoring that has been collected in and around the Rio Grande NF; however, this does not mean none exist. Colorado Parks and Wildlife may have this type of information and be willing to share it with the agency. We encourage you to reach out to these entities to inquire about this type of data.

c. Other connectivity data

i. Colorado Parks and Wildlife Big Game Corridor and Movement Data

Colorado Parks and Wildlife Species Activity Data is available for download through ArcGIS Online here: http://www.arcgis.com/home/item.html?id=190573c5aba643a0bc058e6f7f0510b7. This has lots of information about wildlife movement and migration corridors for a wide range of species. These movement and migration data sets are available here:

- Bighorn Sheep - Click to Download
- Elk - Click to Download
- Mule Deer - Click to Download
- Pronghorn - Click to Download

In Appendix 3, you will find a series of maps showing this data for the Rio Grande National Forest.

ii. Southern Rockies Ecosystem Project's *Linking Colorado's Landscapes* Report[10]

In partnership with the Colorado Department of Transportation, the Federal Highway Administration, The Nature Conservancy, and Colorado State University, the Southern Rockies Ecosystem Project launched Linking Colorado's Landscapes in fall 2003. The purpose of this work was to identify and prioritize wildlife linkages across the state of Colorado to promote safe passage for wildlife. This report documents the process used to define the locations of important wildlife linkages and to prioritize these areas for further assessment, and describes the decision-making process that led to the selection of high priority linkages. The project took into consideration several species identified linkages on the Rio Grande National Forest. Map 3 in the report (pp. 41) displays the final prioritized linkages across the state. Maps 6-17 display species specific linkages across the state, including linkages on the Rio Grande National Forest. The report is available online here: http://rockymountainwild.org/_site/wp-content/uploads/LCL-Phase-1-Report.pdf. High priority linkages from this report are displayed on a map in Appendix 3.

[10] Southern Rockies Ecosystem Report. 2015. "Linking Colorado's Landscapes: A Statewide Assessment of Wildlife Linkages Phase II Report." 140 pages.

iii. Relevant Studies in New Mexico

The following species movement related data in New Mexico are relevant to the shared boundary between the Carson National Forest and the Rio Grande National Forest. These data sets clearly point to a "hotspot" of species movement between the two forests.

The BLM's Taos Field Office (FO) identified big game corridors in its 2012 Resource Management Plan (RMP).[11] While the corridors identified on this map are restricted to New Mexico, they do speak to the area in the northern part of the Carson National Forest's Tres Piedres Ranger District proximal to the Rio Grande National Forest. See Appendix 3 for a map showing the BLM's Taos FO Big Game Corridors overlaid with the Rio Grande National Forest and other units in the Upper Rio Grande Basin.

The BLM's (2014) San Luis Valley – Taos Plateau Ecoregion Landscape Pre-assessment identifies preliminary big game migration corridors in Colorado and New Mexico as part of the larger landscape assessment.[12] The data used to identify these corridors is from the BLM and Colorado Department of Parks and Wildlife. It appears as though the corridors in New Mexico that are identified in this report are identical to the corridors identified by the BLM's Taos FO in their RMP. See a map of these corridors in Appendix 3.

iv. Recommendation

Modeling data shows that there are a number of potential wildlife corridors within the Rio Grande National Forest, and between the forest and adjacent units. One area that clearly offers potential for larger landscape scale and cross-jurisdictional connectivity is the southern end of the Conejos Peak District that lies adjacent to the Carson National Forest. This area shows up as a wildlife movement zone in multiple studies, connecting the Rio Grande to the Carson and Rio Grande del Norte National Monument. Because of the importance of the Rio Grande National Forest to wildlife movement, we request that:

- Chapter 15 of the assessment report discuss the value of designated areas to connectivity and identify a potential need and opportunity for designated areas for key landscape linkages at multiple scales; and
- Relevant chapters of the Assessment Report (for instance, in the chapters on designations, species, and ecological integrity) acknowledge that the Rio Grande NF will coordinate its planning efforts, particularly as it relates to connectivity, with these equivalent planning efforts; and
- The assessment report include a statement that there is a need to provide plan direction for managing towards terrestrial, riparian, and aquatic habitat connectivity for species movement across the landscape. Plan management approaches should include connecting intact and functional habitats by establishing and maintaining wildlife corridors.

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[11] http://www.blm.gov/nm/st/en/fo/Taos_Field_Office/Taos_Planing/taos_rmp.html

[12] Leroy J. Walston, Heidi M. Hartmann, Konstance L. Wescott, Emily A. Zvolanek, Katherine E. Rollins, and Laura R. Fox, 2014. "San Luis Valley – Taos Plateau Level IV Ecoregion Landscape Assessment Phase I Report and Phase II Work Plan." Environmental Science Division, Argonne National Laboratory *prepared for* Department of Interior Bureau of Land Management. August 2014.

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Heller, N. E., E.S. Zavaleta. 2008. Biodiversity management in the face of climate change: A review of 22 years of recommendations. Biological Conservation **142**:14-32.

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Travis, J.M.J. 2003. Climate change and habitat destruction: a deadly anthropogenic cocktail. Proceedings of the Royal Society of Biological Sciences. 270: 467-473.

Walker, R. S., and L. Craighead. 1997. Analyzing wildlife movement corridors in Montana using GIS. Proceedings of the 1997 International ESRI Users Conference. Environmental Sciences Research Institute, Redlands, California.

I. Contribution of designated areas to social, economic, and ecological sustainability, pages 21-22.

This section concentrates on how wilderness (as opposed to other types of designations) contributes to sustainability on the forest, presuming that other types of designated areas offer similar benefits for sustainability. The first paragraph provides a list of these other types of designated areas but notably leaves roadless areas off. Roadless areas as documented in numerous sources including the preamble to the Roadless Area Conservation Rule contribute to social, economic, and ecological sustainability. We request that you add roadless areas to the list of areas at the end of paragraph 1.[13]

In addition to the excellent discussion about the economic benefits of wilderness to local economies, we suggest you cite available economic studies of the impact or projected impact of designations in the region. For instance, the Great Sand Dunes National Park contributes 19 million to the local economy and 234 jobs.[14] The Rio Grande del Norte National Monument, as discussed in the beginning of this letter, was projected to contribute $15 million and 279 jobs to the local economy.

J. Conclusion, page 23.

The third paragraph in this section refers to an outdated policy for evaluating and recommending wilderness areas as part of the land management planning process. The text states "An area recommended as suitable for wilderness must meet the tests of capability, availability, and need." Paragraph 3. We recommend that you replace the sentence with one that comports with the 2015 revision of FSH 1909.12, chapter 70. For instance, you could say: "An inventoried area (aka potential wilderness area) is one that meets the basic criteria for wilderness as established in the Wilderness Act: the imprints of man are substantially unnoticeable within the area as a whole, and the area provides outstanding opportunities for solitude or primitive unconfined recreation." We refer you to our comments above on this topic.

Recommended Technical Corrections

Introduction, Page 1. The text states that designated areas may include…those designated by the agency (critical habitat…experimental forest or range, inventoried roadless areas…). We recommend

[13] For a discussion of roadless area contributions to sustainability, *see* Letter To Supervisor Dan Dallas from San Luis Valley Ecosystem Council, The Wilderness Society, Defenders of Wildlife, Quiet Use Coalition, Rocky Mountain Wild, and Rocky Smith dated April 13, 2015, pages 7-10.

[14] Catherine Cullinane Thomas, Christopher Huber, and Lynne Koontz, 2015. "2014 National Park Visitor Spending Effects Economic Contributions to Local Communities, States, and the Nation." Department of the Interior, National Park Service, Natural Resource Report NPS/NRSS/EQD/NRR—2015/947. 50 pages. Available at http://www.nature.nps.gov/publications/nrpm/nrr.cfm.

that you add Recreation Areas to this list. The Secretary can designate areas over 100,000 acres that should be managed principally for recreation use substantially in their natural condition.[15]

Types, Purposes and Locations of Designated Areas on the Rio Grande National Forest, Page 3. Please state the acres of the Sangre de Cristo National Heritage Area.

Wild and Scenic Rivers, Pages 6. In the third paragraph, the text states "…an eligible river is a river that is classified and further evaluated in a suitability study to determine if it should be included in the national wild and scenic river system." This definition is not exactly correct, and should be replaced with the definition in the final planning directives, which defines an eligible river as "A river segment that has been evaluated, and found to be free-flowing and, in combination with its adjacent land area, possesses one or more outstandingly remarkable values."[16]

Wilderness, page 7. The second paragraph in this section says that "Per legislative direction, we manage wilderness on the forest to provide outstanding recreation opportunities for solitude or a primitive and unconfined type of recreation." This is an incorrect statement. The Wilderness Act directs that wilderness areas should be "administered for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness."[17] We request that you correct this.

Administratively Designated Areas, Page 8. The text states that "Administratively designated areas include critical habitat under the Endangered Species Act, experimental forest or range, inventoried roadless areas (under the Colorado Roadless Rule), national natural landmarks…" Because this list is not exhaustive, we recommend you change the text to say "Administratively designated areas include, but are not limited to,…"

Known opportunities to highlight unique recreational or scenic areas in the plan area to provide for sustainable recreation opportunities, page 18. In discussing Colorado Roadless Areas, the report states that the forest often allows motorized use in these area but frequently limits it to trail and any existing roads (first paragraph). We recommend that you modify this sentence so that it reflects existing travel management regulations. These require that motorized use is only allowed on designated roads, trails, and areas as depicted on a Motor Vehicle Use Map.[18]

Thank you very much for this opportunity to comment. We are pleased to be participating in this important process, and look forward to reviewing the final assessment report and draft need for change statement. Please note that we have included copies of many of the cited materials in a cd that we are

[15] 36 C.F.R. 294.1(a). ("Areas which should be managed principally for recreation use substantially in their natural condition and on which, in the discretion of the officer making the classification, certain other uses may or may not be permitted may be approved and classified by the Chief of the Forest Service or by such officers as he may designate if the particular area is less than 100,000 acres. Areas of 100,000 acres or more will be approved and classified by the Secretary of Agriculture.")
[16] FSH 1909.12, chapter 80, section 80.5.
[17] Sec. 2 of Public Law 88-577 (16 U.S. C. 1131-1136)
[18] 36 CFR 212 subpart B.

sending via US Post. Lastly, if you have any questions regarding these comments, please do not hesitate to contact us.

Sincerely,

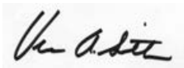

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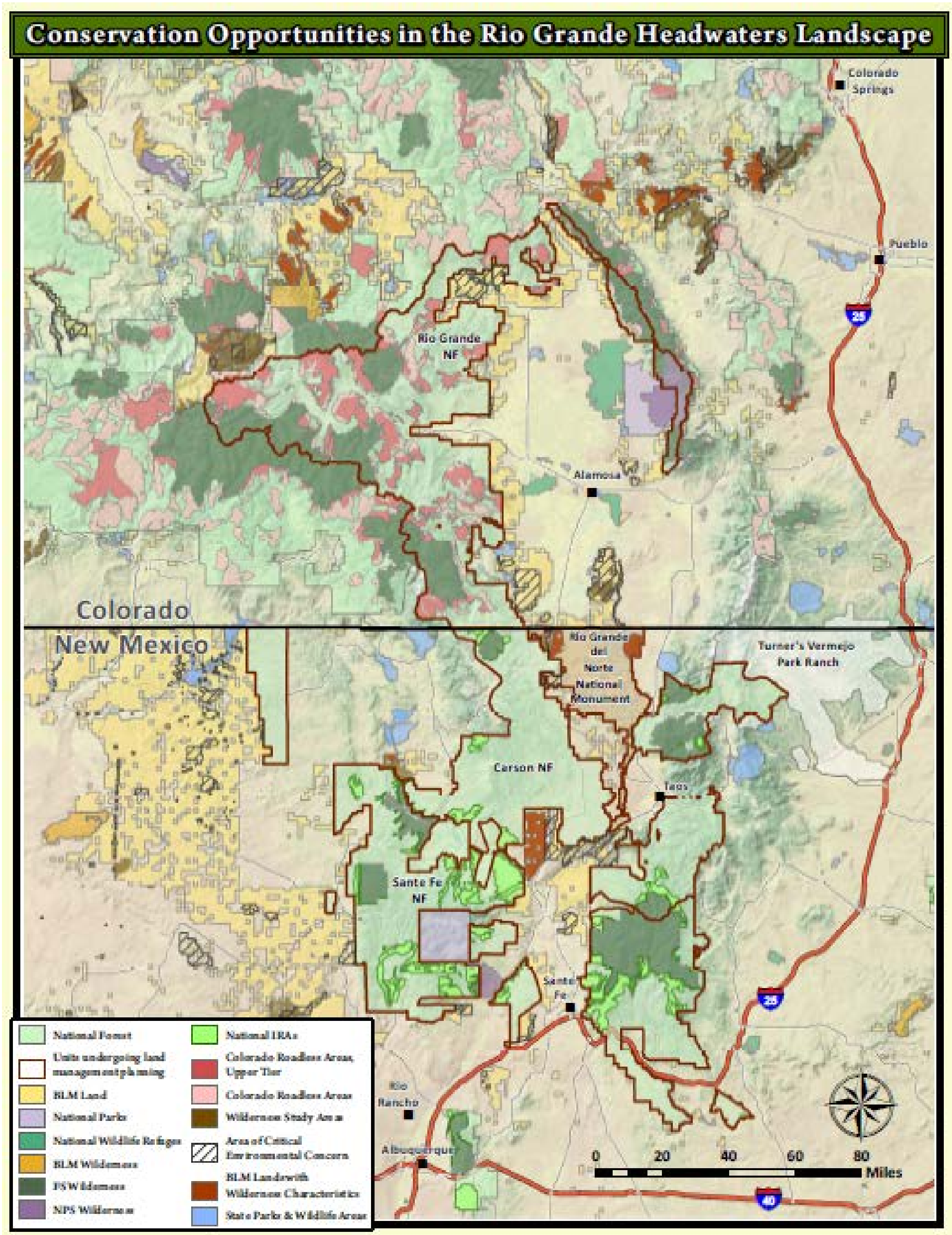
Figure 1.



Conservation Opportunities in the Rio Grande Headwaters Landscape
Colorado Springs
Pueblo
Rio Grande NF
Alamosa
Colorado
New Mexico
Rio Grande del Norte National Monument
Turner's Vermejo Park Ranch
Carson NF
Taos
Santa Fe NF
Santa Fe
Rio Rancho
Albuquerque
0
20
40
60
80
Miles
National Forest
Units undergoing land management planning
BLM Land
National Parks
National Wildlife Refuges
BLM Wilderness
FS Wilderness
NPS Wilderness
National IRAs
Colorado Roadless Areas, Upper Tier
Colorado Roadless Areas
Wilderness Study Areas
Area of Critical Environmental Concern
BLM Lands with Wilderness Characteristics
State Parks & Wildlife Areas

List of Appendices

Appendix 1 – Species that Could Benefit from the Establishment of a Designated Area

Boreal Owl (*Aegolius funereus*)

Boreal Owls are breeding residents of Colorado (Hayward 1994a) and occur in the Rio Grande National Forest (RGNF and SLRA-BLM 2003). They have been detected or likely detected in the following areas: Pinos Creek, Wolf Creek Pass, Spar City, Trout Mountain/Shaw Lake, Cumbres Pass, and Hunters Lake (RGNF and SLRA-BLM 2003). The Best Available Scientific Information indicates that there is a substantial concern about the species' viability. It is a Forest Service Region 2 Sensitive Species, a Species of Greatest Conservation Need as designated by Colorado Parks and Wildlife, and ranked as S2 (imperiled) in Colorado by NatureServe 2016, *Aegolius funereus*). In Colorado, Boreal Owls tend to spruce and lodgepole pine trees for nesting and spruce-fir forest for roosting and foraging (Hayward 1994a, 1994b). They require large patches of mature, uneven-aged spruce-fir forest with large diameter, high basal area trees (NatureServe 2016, *Aegolius funereus*) as well as snags. A report from 2003, stated that 580,190 acres of potential suitable Boreal Owl habitat occurred on the Rio Grande National Forest (RGNF and SLRA-BLM 2003: 18), however, it is likely that this has changed—perhaps significantly—with the continued spruce beetle outbreak affecting the forest. Protecting late-seral, uneven-aged spruce-fir forest patches via special management area designations for the Boreal Owl would contribute to global species viability and may be essential to maintaining a population on the forest.

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Great Basin Silverspot (*Speyeria nokomis nokomis*)

On January 12, 2016, the U.S. Fish and Wildlife Service determined that the Great Basin Silverspot may deserve listing under the Endangered Species Act (81 Federal Register 1368). NatureServe (2016, *Speyeria nokomis nokomis*) ranks this butterfly as T1 (imperiled) and, in Colorado, S1 (imperiled). It is a Forest Service Region 2 Sensitive Species and a Colorado Parks and Wildlife Species of Greatest Conservation Need. According to *The State of Colorado's Biodiversity* (Rondeau 2011) report, the Great Basin Silverspot is declining and under conserved in Colorado. The species is a bog violet (*Viola nephrophylla*) obligate, and the plant is the only known food source for larvae. Other habitat requirements include wet meadows, spring or sub-irrigated wetlands, and flower nectar sources (Selby 2007). Protecting bog violets in wetlands from damage, such as by livestock grazing, via botanical area designations may contribute significantly to the recovery of the Great Basin Silverspot.

Literature Cited

Selby, G. 2007. Great Basin Silverspot Butterfly (*Speyeria nokomis nokomis* [W.H. Edwards]): a technical conservation assessment. USDA Forest Service, Rocky Mountain Region. Available at: www.fs.fed.us/r2/projects/scp/assessments/greatbasinsilverspotbutterfly.pdf.

Townsend's Big-eared Bat (*Plecotus townsendii*)

According to *The State of Colorado's Biodiversity* (Rondeau 2011) report, the Townsend's Big-eared Bat is declining and only "weakly conserved," with very little habitat protected. NatureServe ranks the species as S2 (imperiled) in Colorado (NatureServe 2016, *Plecotus townsendii*). It is a Forest Service Region 2 Sensitive Species and listed as a Tier 1 Species of Greatest Conservation Need by Colorado Parks and Wildlife. The species has been located in the forest (RGNF 1999; Gruver and Keinath 2006; RGNF 2007). A survey conducted in 1999 recorded a bat in the Terrace Reservoir area (RGNF 1999) and another survey confirmed a colony on the forest in 2007 (RGNF 2008). Caves serve as natural roost sites for Townsend's Big-eared Bats. However, due to human disturbance, abandon mines have largely displaced caves as roosting sites; the bats are very sensitive to human disturbance (Gruver and Keinath 2006). The species exhibits a high level of fidelity to maternity roosts (Gruver and Keinath 2006) and foraging areas (Gruver and Keinath 2006, citing Clark et al. 1993, Adam et al. 1994, Ports and Bradley 1996, Fellers and Pierson 2002). The *Townsend's Big-eared Bat (Corynorhinus townsendii): A Technical Conservation Assessment* (Gruver and Keinath 2006) for the Forest Service's Rocky Mountain Region, recommends protecting roost sites. Designating species areas, such as zoological or Research Natural Areas, to protect known roost sites as well as mines and caves that serve as suitable habitat and potential recovery areas is likely essential to Townsend's Big-eared bat viability on the forest.

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Rondeau, R., K. Decker, J. Handwerk, J. Siemers, L. Grunau, and C. Pague. 2011. The state of Colorado's biodiversity. Prepared for The Nature Conservancy by the Colorado Natural Heritage Program. Colorado State University, Fort Collins, Colorado.

Canada lynx (*Lynx canadensis*)

The Canada Lynx is listed as threatened under the Endangered Species Act, and thus, the Rio Grande National Forest is obligated under the 2012 planning rule to contribute to the species' recovery. Contributing to the recovery of Canada Lynx requires a landscape approach where management considerations cross the forest's boundaries. The 2012 planning rule requires that national forests take a landscape approach to advancing natural resource sustainability, which means collaborating with adjacent and nearby landowners. Canada Lynx require large patches of connected habitat, given their large home ranges and specific habitat requirements. Generally, Southern Rockies lynx habitat occurs in the upper montane and subalpine forests. In Colorado, according to Shenk (2008; see also Theobald and Shenk 2011), lynx prefer the following habitat types:

- Mature forests dominated by Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*) with a 42-65% canopy cover and 15-20% of that characterized by tree canopies of conifer understory,
- Spruce-fir/aspen mixed forests, and
- Riparian and mixed riparian cover where willow dominated vegetative communities provide habitat for prey species, such as snowshoe hare, ptarmigan, grouse, and others.

Lynx also use lodgepole (*Pinus contorta*) pine forest areas, but to a lesser extent than spruce-fir (Squires et al. 2010). Lynx abundance may be dependent on sufficient densities of snowshoe hare. Zahratka and Shenk (2008) found that hare densities were greater in Engelmann spruce-subalpine fir forest, but they also use lodgepole pine.

The RGNF defined Lynx Linkage Areas (LLAs) in 2002. A review of additional potential lynx linkages should be undertaken during the plan revision process. At this time LLAs include: Poncha Pass, Cochetopa Hills/North Pass, Slumgullion/Spring Creek Pass, and Wolf Creek Pass (Ghormley 2011). Designating these areas as lynx corridor management areas with plan components protective of connected lynx habitat may be essential for contributing to the recovery of the species.

Literature Cited

Ghormley, R. 2011. Lynx Habitat Model and Mapping Criteria. Rio Grande National Forest and San Luis Valley BLM. October 7.

Shenk, T.M. 2008. Wildlife research report: post release monitoring of lynx (Lynx canadensis) reintroduced to Colorado. July 1, 2007–June 30, 2008. Colorado Division of Wildlife. http://wildlife.state.co.us/SiteCollectionDocuments/DOW/WildlifeSpecies/SpeciesOfConcern/Lynx/Reports/LynxAnnualReport2007-08.pdf.

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Zahratka, J.L. and T.M. Shenk. 2008. Population estimates of snowshoe hares in the Southern Rocky Mountains. Journal of Wildlife Management. 72: 906-912.

Boreal toad (*Bufo boreas boreas*)

The Boreal Toad is known to occur on the plan area, and there is substantial concern about the species' persistence by scientific authorities. NatureServe (2016, *Bufo boreas boreas*) ranks the species as critically imperiled (S1) in Colorado. Colorado Parks and Wildlife lists it as a Species of Greatest Conservation Need. It is a Forest Service Region 2 Sensitive Species. Rondeau et al. (2011) considered the species under conserved and declining in Colorado. Protecting Boreal Toad breeding sites via special designations, such as Zoological Areas or Research Natural Areas, would have a positive benefit on this species. Boreal Toads require shallow wetlands for breeding (BTRT 2001), which can be threatened by livestock grazing, timber harvest, and recreational activities. They are associated with the following Colorado Roadless Areas: Chama Basin, Cumbres, Red Mountain, Ruby Lake, Snowshoe Mountain, Sulpher Tunnel, and Trout Mountain/Elk Mountain.

<u>Literature Cited</u>

BTRT (Boreal Toad Recovery Team). 2001. Boreal toad conservation plan and agreement: revised February 2001. Boreal Toad Recovery Team, Colorado Division of Wildlife, Denver, CO.

Rondeau, R., K. Decker, J. Handwerk, J. Siemers, L. Grunau, and C. Pague. 2011. The state of Colorado's biodiversity. Prepared for The Nature Conservancy by the Colorado Natural Heritage Program, Colorado State University, Fort Collins, Colorado

American Peregrine Falcon (*Falco peregrinus anatum*)

American Peregrine Falcons are known to occur on the RGNF, and a substantial concern about their persistence exists among known authorities. They are ranked by NatureServe as imperiled (S2B) in Colorado, Colorado Parks and Wildlife as a Species of Greatest Conservation Need, and Forest Service Region 2 Sensitive Species. Nest sites are very vulnerable to human disturbance, such via recreation and the direct collection of eggs and habitat destruction (Richardson and Miller 1997). The birds are sensitive to noise related to human activities. Protecting nest sites within specially designated areas that enforce seasonal closures during the nesting period would greatly help achieve viability for this species. The bird is associated with Conejos River/Lake Fork, Fox Creek, Pole Mountain/Finger Mesa, Spruce Hole/Sheep Creek, and Taylor Canyon roadless areas.

Literature Cited

Richardson, C.T. and C.K. Miller. 1997. Recommendations for protecting raptors from human disturbance: a review. Wildlife Society Bulletin. 25: 643-638.

Uncompahgre Fritillary (*Boloria improba acrocnema*)

The Uncompahgre Fritillary butterfly is listed as endangered under the Endangered Species Act. The species occurs above treeline and requires microclimates that are moist and cool. Its larval host is the snow willow (*Salix nivalis*). Threats include butterfly collecting, trampling of snow willow by livestock and humans, predations, disease, parasitism, and climate change (Wallis et al. 1994). Surveys conducted in the early 2000s identified five populations on the Rio Grande National Forest (RGNF 2004). The forest noted in its Fiscal Year 2007 monitoring report that trespass cattle were a problem for one population area (RGNF 2008). According to monitoring reports, surveys conducted since 2007 reported the persistence of four populations but no observations of additional populations. However, the forest's 2010 monitoring report (RGNF 2011) reported that surveys found only one of the earlier identified five populations persisting. Roadless areas associated with the butterfly include Bristol Head and Pole Mountain/Finger Mesa. Under the 2012 planning rule, revised management plans must include components that contribute to the recovery of listed species. Locations of snow willow are known. Thus, protecting existing and former populations of the butterfly and suitable recovery areas under special designations, such as zoological areas or botanical areas that protect snow willow, would help contribute to the Uncompahgre Fritillary's recovery.

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RGNF (Rio Grande National Forest). 2011. Rio Grande National Forest Monitoring and Evaluation Report, FY 2010.

Wallis, B., H. Britten, J. Capodice, J. Coles, T. Holland, T. Ireland, and P.A. Opler. 1994. Uncompahgre Fritillary Recovery Plan. U.S. Fish and Wildlife Service, Region 6.

Gunnison Sage-grouse (*Centrocercus minimus*)

The Gunnison Sage-grouse is listed as threatened under the Endangered Species Act. There is one known population and lek site on the forest in the Poncha Pass area. With adjacent Bureau of Land Management and private land, suitable habitat for the bird is significant and worth protecting and restoring in a special management area that includes species-specific plan components. Recovering a viable population here could help contribute to the genetic diversity of the global Gunnison sage-grouse population.

Appendix 2 - Scientific Basis for Protecting Wildlife Corridors

Properly designed networks of wildlife corridors represent one of the best strategies to mitigate the negative impacts of habitat fragmentation and help wildlife species adapt to climate change. Strategies that seek to maintain or restore connectivity between protected or otherwise intact natural areas are now considered critical to biodiversity conservation (Hilty et al. 2006, Miller & Hobbs 2002, Taylor et al. 2006). Conservation scientists have now long agreed that "the preponderance of evidence is that corridors almost certainly facilitate travel by many species" (Beier and Noss 1998). Many analytical frameworks for prioritizing specific habitat corridors to preserve landscape connectivity have been formulated (e.g., Bunn et al. 2007, Compton et al. 2007, Carroll et al. 2011, McRae et al. 2008, Walker & Craighead 1997), and this area of conservation science continues to see intense growth. Although the particulars of wildlife response to climate change are largely unknown (Root 2003, Travis 2003, Jarema et al. 2009), establishment of landscape connectivity via corridors is the most frequently cited strategy for combating the impacts of climate change on biodiversity (Heller & Zavaleta 2009).

a. Ecosystem Function and Thresholds of Landscape Connectivity

Planning for corridors and connectivity requires an examination of the physical structure of the landscape as well as the functional response of wildlife and other landscape elements to that structure:

> (1) The structural (or physical) component: the spatial arrangement of different types of habitat or other elements in the landscape, and (2) The functional (or behavioral) component: the behavioral response of individuals, species, or ecological processes to the physical structure of the landscape (Crooks and Sanjayan 2006).

Habitat fragmentation leads to a reduction in landscape connectivity by reducing the occurrence or the effectiveness of natural ecosystem processes and preventing wildlife species from moving across the landscape (Crooks and Sanjayan 2006). Biologists are in agreement that habitat fragmentation is one of the greatest threats to the persistence of individual wildlife species and overall biodiversity (Wilcove 1998). Habitat fragmentation consists of two different processes that simultaneously and negatively affect wildlife species: (1) a reduction in the overall habitat available to wildlife species – habitat loss; and (2) the creation of isolated patches of habitat separated from what was once the contiguous landscape (Crooks and Sanjayan 2006).

Habitat loss and fragmentation can occur as a result of a variety of human activities on the landscape. On public lands, industrial energy development, logging, mining, off-road vehicle (ORV) trails (both designated and illegally created), and roads are the land use changes that drive fragmentation. These are associated with a complex of stressors that cause further fragmentation such as the introduction of invasive species; disease transmission and other issues related to the presence of pets; noise, light, and water pollution; change in wildfire regimes; power transmission lines; and others. When the total effect of the "human footprint" from all fragmentation is modeled across land ownerships in the West, it cumulatively covers approximately 48% of the landscape (Leu et al. 2008). This study defined the human footprint as any human development or activity on private or public land (everything from ORV trails to residential and industrial development); and includes direct habitat loss as well as habitat fragmentation and overall degradation. Fahrig (2002) suggested that each species tends to have an "extinction threshold" of minimum habitat necessary, meaning that when available habitat drops below the threshold, the risk of extinction increases. Habitat fragmentation may play an important role in adjusting this threshold level because as fragmentation increases, the amount of habitat necessary for the species to persist also increases. If habitat is connected, even when drastically reduced, there is a much higher probability of population persistence than if the available habitat is reduced and fragmented (Travis 2003).

A reduction in landscape connectivity does not just affect wildlife directly; it can also affect species indirectly through ecological processes that provide beneficial services to wildlife as well as humans (also known as "ecosystem services") (Kremen 2005, Ricketts et al. 2006). Examples of ecosystem services include water purification, oxygen production, erosion control, and insect pollination of important food crops. There is also a growing consensus in the scientific community that not only is biodiversity dependent on landscape connectivity, but also overall ecosystem health, as measured by biomass production, nutrient cycling, water and nutrient retention, community stability and other measures independent of biodiversity (Lyons et al. 2005).

b. Impacts of Habitat Fragmentation on Wildlife Migration, Movement and Resource Acquisition

When wildlife habitat patches become isolated and individual animals within a species are unable to move across the landscape, wildlife populations are affected by a multitude of harmful processes. According to Hilty et al (2006), there are six main adverse effects that may occur as a result of habitat fragmentation: (1) increased isolation leading to detrimental genetic and demographic effects; (2) changes in species richness or composition; (3) modification of energy flow, nutrient cycling, and hydrological regimes; (4) declines in populations of individual species or their geographic extent across the landscape; (5) edge effect problems that can lead to the introduction of exotic invasive species as well as increases in predation and competition among different wildlife species; and (6) increased human disturbance and associated direct and indirect mortality.

Wildlife population persistence, evolution, and speciation are all driven by genetic factors. As the areas between crucial wildlife habitat patches are converted to human use, fragmenting the landscape, individual wildlife populations become more isolated (Frankham 2006). When wildlife is not able to disperse from natal habitats or migrate throughout the landscape then the entire population may face genetic isolation. Genetic isolation increases the prevalence of negative genetic factors that can lead to a higher extinction risk. These genetic factors include "inbreeding depression, decreased ability to adapt to environmental factors, mutation accumulation, and outbreeding depression." Id. In contrast, if individual animals within populations are still able to migrate, even with decreased overall habitat, the genetic effects of isolation can be mitigated. Frankham (2006) estimates that "with sufficient migration, a fragmented population will have the same genetic consequences as a single large population of the same total size." This reflects Travis's (2003) observation that when habitat is connected, even when reduced overall, there is a higher probability of population persistence.

Changes in vegetation composition, energy flow, nutrient cycling, and microclimates may negatively impact wildlife if they are unable to find vital resources necessary for survival. Food, water, minerals, and other resources that individual animals require are not evenly dispersed throughout the landscape (Hobbs et al. 2008). For example, the most nutritious forage may be in a completely different location from a watering hole. Due to this isolation and inconsistent allocation, wildlife species need the ability to move unhindered throughout the landscape to find resources. Habitat fragmentation restricts wildlife from "matching their distribution to the resources they require to survive and reproduce" and these impacts can drastically affect wildlife; rendering "landscapes effectively unsuitable [for wildlife]" (Hobbs et al. 2008).

Human disturbance that causes and contributes to fragmentation is often associated with roads. Edge effects and human exploitation can influence individual animals and entire populations. According to Clevenger and Wierzchowski (2006), "roads cause changes to wildlife habitat that are more extreme and permanent than other anthropogenic sources of fragmentation." Edge-sensitive species will have declined nesting, production, and survival rates in highly fragmented locations. Additionally, edge-sensitive species may be exposed to interactions with edge generalist species, that can outcompete them for resources, and predators that can now prey on those species more effectively (Fletcher 2005). Fragmentation also allows for biologically diverse areas to be opened up to human activity (Ewers and Didham 2006). An increase in human activity can often have negative impacts on wildlife species. For example, motor vehicles can cause mortality through collision, ORV operators may illegally enter core habitat –further fragmenting the landscape, and legal and illegal hunters may access wildlife species more easily (Ewers and Didham 2006).

c. Landscape Connectivity and Mitigating Wildlife Impacts of Climate Change

It is unequivocal that warming of the earth due to human-induced climate change is rapidly occurring (IPCC 2007). The Intergovernmental Panel on Climate Change and the U.S. Global Change Research Program agree that global climate change will have drastic effects on biodiversity worldwide (IPCC 2007, Karl et al. 2009). Over the last twenty years, conservation biologists have firmly established that climate change may pose a significant threat to the future persistence of some wildlife species; wildlife species already have and will continue to respond to climate change in various ways as well (Hughes et al. 2000, Burns et al. 2003, Travis 2003, Pyke 2004). Climate change will also likely exacerbate stressors that wildlife already face, most notably habitat loss and fragmentation.

Researchers have noticed that some species have started to respond to climate change in significant ways (Root et al. 2002, Pyke 2004). Hughes (2000) and Root et al. (2003) predict that climate change will impact wildlife species in four specific ways: (1) Physiological – the metabolic and developmental rates of some species may be affected; (2) Distributional – species are already changing their distributions and will likely continue to do so even more; (3) Phenological – as the timing of environmental cues change, life cycle events triggered by those cues will also change; and (4) Adaptative – some species with short life cycles and rapid population growth may undergo microevolution in situ. Some wildlife species are already responding to climate change in many of the above ways, as are the plant species essential to support wildlife populations. Researchers have also recorded habitat distribution changes in several species (Hughes 2000; Barnosky et al. 2003, Burns et al. 2003). Range shifts occur dissimilarly throughout different latitudes, and some species may change only the density level within the metes and bounds of their traditional ranges. According to Jarema et al. (2009), beaver (*Castor canadensis*) habitat ranges in Quebec have not shifted in response to the climate, but the density of beavers within the range has shifted north. Romme and Turner (1991) have also speculated that in the Greater Yellowstone Ecosystem, many species that are alpine zone obligates will likely go extinct because their ranges will shift upward to a point where no more shifting can occur.

Observational studies of phenological changes occurring within multiple species demonstrate some of the best scientific evidence that climate change is already impacting wildlife species (Hughes 2000, Root et al. 2003). Various bird species are migrating from their winter habitats and arriving at their summer habitats earlier in the spring. For example, Inouye et al. (2000) illustrated that the average day of first sighting for the American Robin (*Turdus migratorius*) in Gothic, Colorado changed from April 14 to March 11 between 1974 and 1999. At the same time that bird species are arriving earlier, the winter snow pack is staying longer at higher elevations adding extra stress to birds who arrive early and are unable to find food (Inouye et al. 2000). Amphibian reproduction, insect peak flights, and flower budding are also taking place earlier (Hughes 2000). If the timing of insect peak flights and flower budding occurs at times when birds are not arriving, a rapid decoupling in the phenological relationship between species may result – compounding stress on species that depend on flowers and insects.

Research indicates that many species are capable of rapid evolution, or microevolution, in response to anthropogenic environmental changes such as climate change. Briggs (2009) presents a thorough examination of microevolution in a range of plant species. Case studies from around the world support that Darwinian evolution in many plant species is rapid and ongoing, and call into question the ability to conserve intact ecosystems or restore degraded ecosystems in this context through existing management frameworks. Microevolution in animal species has been also documented for invertebrates (Umina et al. 2005, Balanya 2006). Evidence for vertebrate animals is sparse to date, but the first case of microevolution in a vertebrate species has recently been documented (Karrell et al, 2011). The tawny owl in Finland has been shown to have shifted its feather coloration over the last decade from white towards brown in response to milder winters and resulting lack of snow cover. It is important to note that this genetic plasticity cannot be expected from all species, particularly organisms with long generation times and limited reproductive potential. For these species, arguably those that are considered the most highly evolved on the planet, adaptation to climate change must be facilitated by management, and this management must be innovative, adaptive, tailored to specific goals, and based on the very best available science.

As Root et al. (2003) state, "if such climatic and ecological changes are now being detected when the globe has warmed by an estimated average of only 0.6°C, many more far-reaching effects on species and ecosystems will probably occur in response to changes in temperature to levels predicted by IPCC, which run as high as 6°C by 2100." The West is changing rapidly, and land managers must become the leaders in working towards solutions that help wildlife species in the face of climate change, or the Intermountain West may lose the species for which it is known. Although scientists cannot know wildlife will respond to climate change, research supports that habitat ranges of some species will have to shift to avoid extinction, and this highlights the need to manage for a landscape that wildlife can easily traverse in order to adapt to a changing climate (Root et al. 2003, Botkin et al. 2007, Jarema et al. 2009). The measures land managers take to plan for climate change must include strategies that allow wildlife species to adapt to climate change. One particularly useful way for the USFS to help wildlife species adapt is by protecting wildlife corridors because "[l]andscape connectivity will play an increasingly important role in the persistence of many plant and animal populations in the face of global change and resultant shifts and restructuring of species distributions" (Taylor et al. 2006). In fact, in a review of 22 years of scientific literature in which strategies were recommended for managing biodiversity in the face of impacts from climate change, the top recommended strategy was to maintain habitat connectivity (Heller & Zavaleta 2009). As the second largest land manager in the U.S., the USFS must be particularly invested in producing and implementing useful climate change solutions.

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