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Forest Service

Grand Mesa, Uncompahgre, and Gunnison National Forests

DRAFT Forest Assessments: Identifying and Assessing At-Risk Species

December 2017

American marten observed resting in a northern goshawk nest, in a lodgepole pine-Engelmann spruce forest on the Gunnison Ranger District. Biologists were visiting the goshawk nest site to check for occupancy and found this marten instead.

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Chapter 1. Introduction

The Grand Mesa, Uncompahgre and Gunnison National Forests (GMUG NF) is on the Colorado Western Slope and encompasses the Grand Mesa, Uncompahgre Plateau, and surrounds the North Fork Valley and Upper Gunnison Basin. The GMUG NF supports a variety of habitat types that extend from the foothill zone at approximately 5,800 feet to a high of 14,310 feet in elevation in the alpine zone. Nineteen ecosystems were identified on the GMUG NF, fourteen of which were carried forward in the *Terrestrial Ecosystem Assessment* (hereafter referred to as the TEA). These ecosystems support over 300 wildlife and fish species that occur on the GMUG NF. The diversity of ecological conditions provides habitats essential for maintaining populations for a diverse array of native plant, animal, and fish species.

The GMUG NF is unique in its diversity of ecosystems and associated habitat types influenced by the elevational gradient and spatial distribution on over three million acres on the Colorado Western Slope. The ecosystem diversity provides habitat for large populations of mule deer and Rocky Mountain elk, which in turn attract a large number of hunters annually to Western Colorado. This influx of people provide a large economic benefit to businesses and communities in and around the GMUG NF.

The intermix of plant community types that define the GMUG NF ecosystems supports some species that may reside in select locations on the Forest and/or occur as peripheral populations (e.g., Gunnison sage-grouse, Gunnison's Prairie Dog). The fact that 46% of the GMUG NF occurs as Wilderness and Roadless designations contributes to the unique character and habitat conditions that support rare (e.g., Uncompahgre fritillary butterfly) or large-ranging species (e.g., Canada lynx). The Forest plays an important role in maintaining large, uninterrupted blocks of wildland habitat. Combined with a mix of local, state, other federal and private lands secured as open space, it helps form a regional system of connected habitat blocks.

Aquatic habitats account for approximately 22,100 wetlands, ponds and lakes totaling approximately 70,900 acres or approximately 2.4% of the total land area on the GMUG NF. The GMUG NF has about 3,600 miles of perennial streams and at least 7,000 miles of intermittent and ephemeral streams. The headwaters of several rivers that are major tributaries to the Colorado River begin on the GMUG NF. These include the Gunnison, San Miguel, and Little Dolores Rivers. Other major tributaries are the Uncompahgre, South Fork San Miguel, Taylor, East, Slate, Cimarron, West Fork Cimarron, Middle Fork Cimarron, East Fork Cimarron, and Little Cimarron Rivers. These aquatic habitats contribute significantly to the diversity of plant, animal, and aquatic species that occur across the landscape. The streams, lakes, reservoirs, wetlands and riparian areas support rare aquatic species, including Colorado River cutthroat trout and boreal toad.

Assessment 5 Development Process

In developing a Forest Plan Revision, the Forest Service planning rule requires the Forest Service to assess the GMUG National Forests' At-Risk species and to identify the subset of species of conservation concern (SCC) for the plan area. The purpose of assessing at-risk species is to help develop forest plans that maintain the diversity of plant and animal

communities and provide for the persistence of native species in the plan area. Most species will be maintained by plan components that provide for broad ecosystem integrity and ecosystem diversity.

Forest Service Handbook direction for Identifying and Assessing At-risk Species is found at 1909.12, Chapter 10, Section 12.5 – Identifying and Assessing At-risk Species. We used the following approach.

1. Staff at the GMUG National Forests and the Forest Service Region 2 office (RO) used the direction at FSH 1909.10 to develop an "initial" list of at-risk species on the GMUG. The list of at-risk species includes:
    - Species federally recognized under the Endangered Species Act as endangered, threatened, proposed or candidates (FSH 1909.12_10 sec. 12.51). Federally listed species appropriate to consider in the planning process were identified with the U.S. Fish & Wildlife Service.
    - Potential species of conservation concern (SCC). The existing Regional Forester's sensitive species list provided the starting point for the list of potential species of conservation concern to consider, and this was complemented by species that "must" be considered (NatureServe rankings G/T1, G/T2, G/T3 or S1 or S2, source Colorado Natural History Program) and those that "should" be considered from various other sources (sources for this assessment included the Bison Database, Intermountain Herbarium Consortium, Bird Conservancy of the Rockies, Xerces Society, and staff reports). Much of this information is geospatially referenced, allowing staff to determine which of these species were found within five miles of the GMUG boundary. Those species were then reviewed for documentation of presence/absence on the plan area. The requirements and criteria for considering a species as a potential SCC are specified in FSH 1909.10 section 12.52.
2. For each of the at-risk species that are known to occur on the GMUG, we completed a "species overview" based on details in FSH 1909.12. This overview is designed to capture the best available science information following current manual and handbook direction. These overviews highlight key elements of life history, distribution, risk factors and ecological conditions necessary for recovery, conservation and viability of at-risk species. Species overviews include key information gaps and uncertainties.
3. Resource specialists, including GMUG National Forests district wildlife biologists, Forest staff and RO staff, reviewed and refined species overviews.
4. For at-risk species, we used the species overviews to populate a species database that includes the ecosystem/s and ecological conditions required by each species, and risk factors that influence recovery, conservation, and viability. In developing the ecological conditions database, we captured information directly as it is reported in the scientific literature rather than develop an *a priori* list of ecological conditions and risk factors. As we populated the database, we aggregated information into common terminology across species as appropriate. Using these species overviews to populate the species database captures the ecosystems, key ecological conditions, and risk factors for each species.
5. We analyzed the species database to identify the select set of ecological conditions to assess. This process reveals ecological conditions that are important to multiple species as well those that are critical to individual species. This approach is consistent with the

concept of grouping species for assessment as described in FSH 1909.12 Chapter 10.12.54, but emphasizes ecological conditions and risk factors rather than species groups.

6. For the select set of ecological conditions and risk factors, staff used the following steps to assess their current status and likely future trends on the forest.
   A. Working with species from the "initial" list of at-risk species, we correlated ecosystems and ecosystem conditions and features with those described in the *Terrestrial Ecosystems* and *Aquatic and Riparian Ecosystems assessments*.
   B. We used ecosystem trends identified from step 6A and documented risk factors to identify the list of potential SCC for the GMUG, and to identify which species to potentially not carry forward as SCC.
   C. We identified the ecosystem conditions and features in the Species Overviews that were not described in the *Terrestrial Ecosystems* and *Aquatic and Riparian Ecosystems assessments*. We identified conditions and features that have potential to be monitored.
7. Staff from the GMUG National Forests and the Forest Service Region 2 office prepared this draft Assessment of At-Risk Species.
   A. This assessment focuses on the trends of the select set of ecological conditions and risk factors for the at-risk species considered. Assessments of ecological conditions and risk factors may be quantitative or qualitative and may be spatial or non-spatial.
   B. This draft assessment identifies the list of potential SCC for the GMUG, including rationale for their inclusion. The assessment also identifies those species that were considered, but for which best available science indicates they do not meet criteria to be included as SCC.
   C. Individual species overviews are available as supporting information.
   D. Using public comments on this draft assessment and the list of potential SCC within, we will recommend a refined list of species of conservation concern for the Regional Forester's approval for use in the Revised Forest Plan. Opportunities for public input on the SCC list will continue throughout the NEPA process for the Revised Forest Plan.

Summary Public Input

What We Asked

We held eight public meetings in the towns designated as county seats in each of the counties that overlap the plan area. Each was an open house format providing information for the Assessment phase of our Forest Plan Revision effort. This included collecting input specific to at-risk species and informing the public of the Species of Conservation Concern (SCC) process and what that means for the forest plan revision (https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd552197.pdf).

We asked the same questions at each of the public meetings and on-line to incorporate consistent input for the species assessment process. In particular, we wanted to know what species are important to individuals and groups, their concerns for those species, and what works well and what needs to change in terms of our Forest Plan direction.

- What plants, fish, animal, and invertebrate species are important to you on the Grand Mesa, Uncompahgre and Gunnison National Forests?
- What wildlife, fish or plant species do you feel may qualify as an SCC? Do you evidence to validate your concern?
- Do you have any resource conflict concerns that you feel might be impacted by SCC?
- What species are unique to the GMUG and what are your management concerns or habitat conditions that you've observed?
- Are you interested in becoming a Citizen Scientist and helping monitor SCC species?

What We Heard

Members of the public expressed a diversity of interests and perspectives. The GMUG National Forest's wildlife, fish, insect and plant resources are valued for wildlife viewing opportunities, photography, birding, fishing, hunting, research studies, and conservation education. The U. S. Fish and Wildlife Service values and encourages conservation of at-risk species, and recovery of species listed under the Endangered Species Act. The Colorado Parks and Wildlife manages the state's wildlife, fish, and aquatic species (all game and non-game species) for all Coloradoans and visitors to the state, and relies on hunting and fishing as tools to manage wildlife populations. Hunting and fishing license sales are the primary source of state income for wildlife conservation. The GMUG National Forests are critical to wildlife conservation and recovery efforts, and to local economies of the cities, towns, and counties in the planning area whose economies are influenced to a large degree by wildlife-related recreation. Common, broad themes that stood out at the public meetings include:

- Concerns of increased motorized and non-motorized recreation and human impacts on wildlife.
- High public interest and passion for specific areas of the plan area, such as the Muddy Creek area on the Paonia Ranger District, particularly related to energy development and residential development impacts on species such as purple martin, and the Hubbard Park area – emphasize wildlife values and habitat in the Forest Plan.
- Concern was expressed about potential wildfire risks and impacts of the spruce-beetle epidemic. Members of the public are concerned over the changed condition of the spruce-fir forests and potential associated effects or risks to people and wildlife.
- Education and citizen science – many people expressed interest in participating as citizen scientists and wanted to learn more on how they could become more engaged. There was expressed interest in seeing the GMUG develop a citizen science program.

In terms of concerns, recreation management stood out as being of significant concern. In general, people expressed concerns with perceived species disappearances/seeing less wildlife, and concerns about impacts of increased recreation, human pressure, and impacts of other management activities on wildlife habitat and corridors. Members of the public asked the question: "What species are at-risk that are not already protected?" In terms of public sentiment for species, protections for wildlife corridors was a major concern.

Recreation impacts is a major concern of Colorado Parks and Wildlife (CPW), particularly sustainability of recreation and wildlife. They would like to see us take an approach that

better balances competing resources in order to maintain economic benefits/values from big game hunting. CPW representatives expressed specific concerns on dispersed recreation management and associated displacement impacts to species. Greater education, enforcement and management emphasis is desired for recreation.

Individuals and groups emphasized the value of taking advantage of scientific studies and data from the Rocky Mountain Biological Laboratory (specifically pollinators, invasive species, and climate change) and the Audubon Society (bird survey and monitoring data, specifically documenting shifts in timing of species arrival and departure and changes in observed species composition).

A unique idea suggested by one individual was a recommendation to consider designating a Dark Sky Reserve in the plan area in the Lake City vicinity. This was expressed in the context of light pollution concerns in terms of how artificial light disrupts many amphibians, birds, mammals, invertebrates and plants. A strong desire to raise awareness on the effects of artificial light was expressed.

Use of Best Available Science

Sources of data for this assessment include various published and unpublished reports and data. Key sources include:

- Information compiled as part of the Rocky Mountain Region's Species Conservation Project (http://www.fs.usda.gov/detail/r2/landmanagement/?cid=stelprdb5177128)
- Peer-reviewed literature and other scientific reports
- Information on species distribution and abundance provided by the Colorado Natural Heritage Program (http://www.cnhp.colostate.edu/)
- NatureServe (http://www.natureserve.org/)
- GMUG NF species occurrence records as documented in the Forest Service Natural Resource Manager NRIS Wildlife databas
- The Intermountain Herbarium Consortium (http://www.intermountainbiota.org/portal/index.php)
- The Second Colorado Breeding Bird Atlas (http://www.cobreedingbirdatlasii.org/)
- Bird Conservancy of the Rockies (http://www.birdconservancy.org/)
- Local information – Local information includes the 2006 GMUG NF Comprehensive Evaluation Report and associated Comprehensive Assessments and the 2005 GMUG NF Management Indicator Species Assessments. Colorado Parks and Wildlife provided population trend and distribution data for some species. In addition, information was collected from the public during forest plan revision public engagement efforts beginning in 2017, as well as from Forest Service staff.

Information Gaps

The following habitats, feature and conditions are not addressed or are not fully addressed in the GMUG ecosystem assessments, so less is known about the conditions of these resources on the Forests:

- Caves and mines
- Lakes and reservoirs (surface area is mentioned in the *Watersheds, Water and Soil Resources* assessment in combination with watersheds, but not otherwise analyzed).
- Rock outcrops, cliffs, and talus slopes are mentioned in the Terrestrial Ecosystem Assessment, but there is no in-depth assessment.
- Substrates – shale, limestone, calcareous, etc.

In general, the process used to identify potential SCC appears to result in a greater emphasis on plants and insects than previous efforts to designate species for conservation-focused attention, such as the Regional Forester's Sensitive Species list. More information regarding rare plant species, as well as plant species required by insects for nectar or to host caterpillars, may be warranted.

Pollinator decline is an increasingly severe issue. The causes are still under debate, the impact is still being determined, but the general trend is apparent. Domestic honeybees get much of the attention, but native bee species such as the western bumblebee (*Bombus occidentalis*) are also impacted as are butterflies, moths, and other pollinator insect species. There is little to no active population or habitat monitoring of these species.

Scale of Analysis Area

For most species, the scale of assessment is the plan area. For select wide-ranging species (e.g., Canada lynx), the scale of assessment may be larger than the plan area. For the determination of whether or not a given species should be considered as an SCC, assessment must be limited to the plan area. With respect to federally listed threatened and endangered species, as well as proposed and candidate species, the assessment may include species not present immediately within the plan area, such as endangered Colorado River fish downstream from the GMUG NF. They are not within the plan area, but are affected by management of water within the plan area.

Federally Recognized Species

Species analyzed in the Assessment as Threatened, Endangered, Proposed and Canditate (TEPC) are determined partly by the U.S. Fish and Wildlife Service, through application of the Information and Planning for Consultation (IPaC) system (currently a web-based application, U.S. Fish and Wildlife Service, 2016). This can include species that are not known to occur in the plan area, but which may be affected by management of the plan area (such as Colorado River fish species). IPaC may also identify TEPC species that have potential to be reintroduced or to recolonize the plan area if those species were formerly present in the plan area. In addition, any plant or animal species known to be present on the forest that are listed as TEPC by the FWS through its implementation of the Endangered Species Act (ESA) and announced through Federal Register notices must also be analyzed, whether or not their presence in the plan area is highlighted in IPaC.

The following TEPC species are currently or formerly known to occur in the plan area, or may be impacted by management of the GMUG (Table 1).

Table 1. Threatened, endangered, or candidate species

Species	ESA Status	Occurrence data
Uncompahgre fritillary butterfly *Bolaria acrocnema*	Endangered	Known from several locations in the plan area
Gunnison sage-grouse *Centrocercus minimus*	Threatened; identified critical habitat on the GMUG	15 known leks in the plan area
Yellow-billed cuckoo (western) *Coccyzus americanus*	Threatened	Not documented in the plan area
Southwestern willow flycatcher *Empidonax traillii extimus*	Endangered	Not documented in the plan area
Mexican spotted owl *Strix occidentalis lucida*	Threatened	Not documented in the plan area
North American wolverine *Gulo gulo*	Proposed Threatened	Not documented in the plan area
Canada lynx *Lynx canadensis*	Threatened	Multiple records from plan area
Humpback chub *Gila cypha*	Endangered	ESA listed species. Species is present in the Colorado River system downstream from the planning area. It is subject to the downstream impacts from management of the plan area, but is not found in the plan area
Bonytail chub *Gila elegans*	Endangered	ESA listed species. Species is present in the Colorado River system downstream from the planning area. It is subject to the downstream impacts from management of the plan area, but is not found in the plan area
Greenback cutthroat trout (as listed) Green lineage Colorado River cutthroat trout *Oncorhynchus clarkii pleuritcus*	Threatened lineage (green) of the *O. clarkii pleuritcus* subspecies. The blue lineage of the species (*Oncorhynchus clarkii stomias*) is not native and is not listed as threatened	There are 25 "Conservation Populations" of green lineage CRCT on the GMUG
Colorado pikeminnow *Ptychochelus lucius*	Endangered	ESA listed species. Species is present in the Colorado River system downstream from the planning area. It is subject to the downstream impacts from management of the plan area, but is not found in the plan area
Razorback sucker *Xyrauchen texanus*	Endangered	ESA listed species. Species is present in the Colorado River system downstream from the planning area. It is subject to the downstream impacts from management of the plan area, but is not found in the plan area
DeBeque phacelia *Phacelia submutica*	Threatened; identified critical habitat on the GMUG	Known from 30 to 50 sites on the GMUG

Species	ESA Status	Occurrence data
Colorado hookless cactus *Sclerocactus glaucus*	Threatened	Known from up to 4 populations on the GMUG.
Clay-loving wild buckwheat *Eriogonum pelinophilum*	Endangered	Not documented in the plan area
Skiff milkvetch *Astragalus microcymbus*	Candidate	Not documented in the plan area
Ute ladies'-tresses *Spiranthes diluvialis*	Threatened	Not documented in the plan area

We compiled information regarding the TEPC species for the plan area, presented in "Appendix 1: Threatened, Endangered, Proposed and Candidate species ecosystems and habitat characteristics". For those TEPC species documented as present on the GMUG, they were grouped with information regarding other at-risk species to compile the "Key Ecosystem Characteristics" in the following section.

Chapter 2. Conditions and Trends: Key Ecosystems and Characteristics

Species that are under consideration for inclusion within the SCC list use a variety of ecosystems, as well conditions and features within those ecosystems. The condition or trend of these ecosystems and their features and conditions is a component of the determination of whether or not a given species is at-risk in the plan area. To aid in this determination, GMUG and RO staff compiled lists of the habitats, habitat features and conditions used by the species under consideration, and crosswalked those to terrestrial, riparian, wetland, and aquatic ecosystems identified and assessed in other sections of the GMUG Plan Revision Assessment. These include the *Terrestrial Ecosystems Assessment* (TEA), the *Aquatic and Riparian Ecosystems Assessment* (AREA), and the *Watersheds, Water, and Soil Resources Assessment* (WWSRA).

The sections below specify which SCC candidate species occur in which ecosystems on the GMUG. Information on condition and trend of ecosystems that may have implications for their component at-risk species is also summarized from other assessments. However, often our ecosystem-level condition and trend data is not fine-scale enough to be easily applied to conditions and habitats needed by at-risk speci

The following ecosystems, features, and conditions are used by one or more TEPC or potential SCC which are known to occur on the GMUG.

Terrestrial Ecosystems

These ecosystems were evaluated for key ecosystem characteristics, departure, and trend in the *Terrestrial Ecosystems Assessment* (TEA).

Alpine Uplands – Grasslands and Forblands; Rocky Slopes, Screes, Cliffs

Specific Community or Habitat	Associated At-risk Species
General alpine uplands	alpine braya (*Braya humilis*) American marten (*Martes americana*) Avery Peak twinpod *(Physaria alpina)* black swift (*Cypseloides niger*) bog stitchwort (*Minuartia stricta*) brown-capped rosy finch (*Leucosticte australis*) Colorado Divide whitlow-grass *(Draba streptobrachia)* Colorado wild buckwheat *(Eriogonum coloradense)* globe sedge (*Carex perglobosa*) Harbour's beardtongue *(Penstemon harbourii)* House's sandwort (*Alsinanthe macrantha*) least moonwort (*Botrychium simplex*) narrow-leaf grapefern *(Botrychium lineare)* Rocky Mountain bighorn sheep (*Ovis canadensis canadensis*) Uncompahgre fritillary butterfly white-tailed ptarmigan (*Lagopus leucurus*) Osterhout's thistle (*Cirsium osterhout* Ritter's coraldrops *(Besseya ritteriana)* Rothrock townsend-daisy *(Townsendia rothrockii)* Sierra hare sedge (*Carex leporinella*) thickleaf draba *(Draba crassa)* tundra buttercup (*Ranunculus gelidus*) tundra draba (*Draba ventosa*) tundra saxifrage (*Muscaria monticola*) whitlow-grass (*Draba malpighiacea*)
Calcareous substrate	arctic braya (*Braya glabella var. glabella*) Colorado tansy-aster (*Machaeranthera coloradoensis*) lime-loving willow *(Salix calcicola)* rockcress draba *(Draba globosa)* woods draba (*Draba oligosperma*) Yellowstone whitlow-grass *(Draba incerta)*
Fell-fields	low fleabane (*Erigeron humilis*) wooly fleabane (*Erigeron lanatus*)
Moist, late-snow areas	capitate sedge (*Carex capitata ssp. arctogena*) Nelson's sedge (*Carex nelsonii*) San Juan draba (*Draba graminea*) showy draba (*Draba spectabilis*)

Specific Community or Habitat	Associated At-risk Species
Alpine talus, scree, rocky slopes and cliffs (non-specific substrate)	Avery Peak twinpod bog stitchwort brown-capped rosy finch Colorado Divide whitlow-grass globe sedge House's sandwort low fleabane Osterhout's thistle Rothrock townsend-daisy San Juan draba stonecrop gilia (*Aliciella sedifolia*) thickleaf draba tundra buttercup tundra draba whitlow-grass (*Draba malpighiacea*) Wooly fleabane
Alpine talus, scree, rocky slopes and cliffs (limestone or dolomite substrate)	arctic braya woods draba Yellowstone whitlow-grass
Large patches of snow willow	Uncompahgre fritillary butterfly white-tailed ptarmigan

Conditions and Trends

The alpine upland ecosystem covers about 121,000 acres on the GMUG, almost 4% of its total area. Unfortunately our geospatial data does not allow us to estimate with confidence the area covered by alpine talus, scree, rocky slopes and cliffs. Like most of our non-forested ecosystems, we have relatively little information regarding reference conditions for key ecosystem characteristics and ecological integrity of this cover type.

The majority of alpine areas within the GMUG are currently designated as either wilderness or roadless areas and therefore subject to less contemporary human disturbance than other ecosystems. However, alpine environments are highly susceptible to soil disturbance (compaction, erosion) and are slow to revegetate due to a limited growing season, strong winds, drought, and high evaporation rates. Because of their susceptibility and ever-increasing visitor levels on the GMUG, recreation is one of the biggest stressors to alpine ecosystems. In particular, alpine areas on the GMUG that have remnant roads from historic mining development now see high levels of OHV use (some of it illegal off-trail use) that causes significant soil impacts.

A second major stressor in alpine ecosystems is climate change. Both xeric and mesic alpine uplands are considered to be highly vulnerable to climate change related impacts (CCVI, Neely et. al, 2011). Alpine areas are likely to be highly susceptible to rising temperatures and a shorter duration of snow cover, with a resulting longer growing season that may allow shrubs and trees to encroach. Range shifts in response to warmer temperatures may be impossible for alpine species, as they have no higher elevation areas to migrate to

Montane-Subalpine Grasslands

Specific Community or Habitat	Associated At-risk Species
General	American peregrine falcon (Falco peregrinus anatum) mountain wild mint (Monardella odoratissima) narrow-leaf grapefern Rothrock townsend-dais small-winged sedge (Carex stenoptila)
Montane	Crandall's rock-cress (Boechera/Arabis crandallii) Gunnison milkvetch (Astragalus anisus)
Subalpine	House's sandwort least moonwort northern moonwort (Botrychium pinnatum) Osterhout's thistle Ritter's coraldrops western bumblebee (Bombus occidentalis)
Moist meadows	Brandegee's fumewort (Corydalis caseana ssp. brandegeei) Colorado wild buckwheat King's clover (Trifolium kingii) Nelson's sedge peculiar moonwort (Botrychium paradoxum) showy draba
Calcareous substrate	Colorado tansy-aster
Disturbed areas	Grand Mesa penstemon (Penstemon mensarum)

Conditions and Trends

Montane and subalpine grasslands are analyzed together in the TEA; they cover 300,000 acres and 9.5% of the GMUG. These grasslands are found interspersed between forested vegetation types at elevations of 7,000-10,500 ft. A variety of factors including topography, geology, soil, climate, and disturbances (fire, mass movement, and snow) are responsible for the presence of meadows in between forested vegetation (TEA).

Pre-Euroamerican settlement, natural drivers of these grasslands were herbivory by native ungulates and fire. Domestic livestock use and fire suppression in the past century have altered the character of these natural drivers, but we do not know enough about pre-settlement reference conditions to assess how departed these systems are.

Roads and trails are a major human impact on this ecosystem on the GMUG, affecting almost 13% of the total area of montane and subalpine grasslands (TEA). We do not have data on specific impacts of specific roads or trails in the plan area, but known deleterious effects of roads in general include creating barriers to species mobility, acting as corridors for non-native and edge adapted species, and increasing human access to interior habitats (Baker and Knight 2000). Roads also impact natural sediment and hydrologic regimes. They affect hydrologic processes by intercepting rainfall on the road surface and subsurface water moving down the hillslope, by concentrating flow on the road surface or adjacent ditch, and by diverting water from natural flow paths. This in turn can affect meadow hydrology, in some cases leading to drying out of meadows and causing soil loss.

Invasive species are another known stressor in this ecosystem. Approximately half of the 25,000 acres of invasive species inventoried on the GMUG occur in either montane-subalpine grasslands or ponderosa pine ecosystems. Invasive species can have serious ecological impacts, including reduction of biodiversity, elimination of habitat and forage for wildlife and livestock, and the alteration of fire regimes (TEA).

Montane-Subalpine grasslands have an important role in: carbon sequestration (especially subalpine meadows); flowering plant production which provides habitat for pollinator species such as the western bumblebee; forage production for wildlife and livestock; and function as small mammal habitat. The role of mesic meadows in carbon sequestration cannot be understated, and management actions that result in increased carbon sequestration in the long-term provide opportunities for climate change mitigation.

Montane Shrubland, Oak-Serviceberry-Mountain Mahogany

Specific Community or Habitat	Associated At-risk Species
General montane shrubland	American peregrine falcon bald eagle Grand Mesa penstemon Gunnison's prairie dog (*Cynomys gunnisoni*) northern harrier sage sparrow
Green River formation substrate	Piceance bladderpod (*Physaria parviflora*) sun-loving meadowrue (*Thalictrum heliophilum*) Utah fescue (*Argillochloa dasyclada*)
Moist sandstone benches	minute rush (*Juncus bryoides*)

Conditions and Trends

This ecosystem covers about 325,000 acres and 10.3% of the GMUG. Fire is a major driver in this ecosystem, and results in a system with a mosaic of dense shrub clusters and openings dominated by herbaceous species.

Mid and late seral stages are strongly over-represented relative to modeled reference conditions in montane shrublands, suggesting that this ecosystem may be impacted by fire exclusion, which is also supported by a comparison of contemporary fire on the GMUG with pre-settlement fire return intervals.

The Gunnison basin CCVA suggests that this vegetation type may be stable under climate change scenarios, or even experience a moderate increase in range (Neely et. al 2011). Bioclimate models for gambel oak under projected climate conditions support this prediction,

with only 7% of current gambel oak dominant shrublands projected to be lost or threatened habitat due to climate conditions in 2060 (TEA)[1].

Sagebrush Shrubland

Specific Community or Habitat	Associated At-risk Species
General	American peregrine falcon Brewer's sparrow Crandall's rock-cress Gunnison sage-grouse logger-head shrike (*Lanius ludovicianus*) mountain draba (*Draba rectifructa*) mountain wild mint Northern harrier Rothrock townsend-daisy Sage sparrow Weber's catseye (*Cryptantha weberi*)
Sagebrush winter range areas used by big game species	Bald eagle
Disturbed areas	Grand Mesa penstemon
Clay soils	Gunnison milkvetch Oregon biscuitroot (Lomatium bicolor var. leptocarpum)
Moist sandstone benches	minute rush (*Juncus bryoides*)
Shale slopes	Colorado wild buckwheat
Calcareous substrate	Colorado tansy-aster

Conditions and Trends

Sagebrush shrublands cover 96,000 acres and 3% of the GMUG. Sagebrush is generally found on flat to rolling hills with well-drained clay soils and is characterized by dense shrubs with a significant herbaceous understory of bunch and sod grasses.

Historically, fire in sagebrush systems reduces decadent sagebrush stands, promotes understory growth and nutrient cycling and creates a mosaic of sagebrush structures and community types across a broad landscape. Presettlement stand-replacing fire frequency in sagebrush vegetation types is highly debated, and is likely dependent on fuels structure (i.e. open sagebrush vs. sagebrush-woodland ecotone) and sagebrush species (Baker 2006, Wright et al. 1979, Welch and Criddle 2003).

In the plan area, the sagebrush ecosystem has been influenced over the last 100+ years from livestock grazing, which is an important ecosystem service critical to ranching livelihoods. Additionally, past management actions were implemented to reduce shrub cover and increase grass and forb production. This includes brush mowing, prescribed burning, and chemical

[1] Predictions of lost suitable habitat by 2060 do not suggest that these areas will hit a climate threshold where immediate large-scale mortality occurs; a more realistic scenario will likely involve gradual declines in tree health and below- average levels of regeneration and recruitment.

treatments. These past actions influence current conditions and trends in the sagebrush landscape.

Non-native plants are a concerning risk factor in this ecosystem. Species such as cheatgrass, yellow toadflax, and Canada thistle have the potential to spread and increase, degrading habitat quality for sagebrush dependent species and causing reduced ecosystem resiliency and resistence. Infrastructure such as roads and powerline corridors are vectors for weed transmission. Wildlife species, especially big game animals, and livestock may also facilitate weed transmission. Weed treatment activities have been ongoing in the plan area and will remain necessary to address this risk factor.

Roads and livestock have contributed to erosion, soil compaction, soil loss, and a loss in proper hydrologic function in riparian and wet meadow habitats in the sagebrush ecosystem. In collaboration with partners and grazing permittees, the GMUG has successfully implemented erosion control restoration actions over the past decade. Due to these efforts with partners across land ownership boundaries, soil condition and hydrologic function is improving. The Gunnison Basin Climate Change Vulnerability Assessment rated the relative vulnerability of two distinct sagebrush ecosystem types, Montane sagebrush and low-elevation sagebrush (Neely, et al. 2011). Montane sagebrush received a vulnerability score of Moderate Increase, and low-elevation sagebrush received a score of Presumed Stable. However, several sagebrush dependent species were found to be highly or extremely vulnerable to the changes that could occur with the sagebrush ecosystem due to climate change. The primary impacts of a changing climate affecting the sagebrush landscape are projected to be: increased severity of drought, proliferation of invasive species (especially cheatgrass), dieback of Wyoming sagebrush, montane sagebrush shifting upwards in elevation, reduced productivity at drier sites, aspen mortality, and altered succession. In general, the Wyoming sagebrush occupies more xeric sites and are likely to experience more change than the mesic mountain big sagebrush sites (Rondeau et al. 2016).

Desert Alluvial Saltshrub

Specific Community or Habitat	Associated At-risk Species
General	Phacelia submutica *Sclerocactus glacus*

Conditions and Trends

The desert alluvial saltshrub ecosystem comprises 331 acres within the GMUG, making it very rare on the forest, though it is quite prevalent in lower elevations within the context area. Desert alluvial saltshrub is generally found on marine shales with poorly drained, saline soils (Floyd-Hanna et al. 1996). In areas with extreme concentrations of salt, these shrubs are generally unable to grow and bare ground is abundant or the greasewood vegetation type replaces them.

Livestock grazing has had the most impact on this ecosystem since Euro-American settlement, altering the dominant vegetation towards non-palatable species. Because of the typically sparse vegetation cover, fires in this ecosystem were historically rare (West and Young 2000). Recently, fire has become more prevalent in this ecosystem across the Western US due to the establishment of non-native annual grasses, primarily cheatgrass. Areas that

have experienced grazing, increases in non-native annuals, and increases in fire frequency are outside their Historic Range of Variability.

Spruce-Fir

Specific Community or Habitat	Associated At-risk Species
General Spruce-Fir	boreal owl Canada lynx hoary bat olive-sided flycatcher (*Contopus cooperi*) pygmy shrew (*Sorex hoyi*)
Mature stands	American marten boreal owl Northern goshawk northern twayblade (*Listera borealis*)
Openings	King's clover least moonwort mountain wild mint narrow-leaf grapefern Nelson's sedge northern moonwort peculiar moonwort
Openings; barren shale slopes	Colorado wild buckwheat
Rocks, cliffs, and breaks	New Mexico cliff fern (*Woodsia neomexicana*)
Shaded, moist to wet rocks, cliffs, and breaks	green spleenwort (*Asplenium trichomanes-ramosum*) Hanging Garden sullivantia (*Sullivantia hapemanii var. purpusii*) mountain bladder fern (*Cystopteris montana*) Slender rock-break (*Cryptogramma stelleri*)
Seeps	Sierra hare sedge
Moist environments/wet meadows and edges of wetlands	pygmy shrew
Wetlands within spruce-fir ecosystem	boreal toad

Conditions and Trends

Spruce-Fir forests are the most common vegetation type on the GMUG, covering 534,000 acres and 17% of the plan area. Major disturbances in this ecosystem include fire and bark beetle outbreaks; the GMUG is currently being impacted by an extensive and severe spruce beetle outbreak, with 328,000 cumulative acres affected by spruce beetle from 1996 through 2016 (some of this acreage is likely within areas classified as the "Spruce-Fir-Aspen" ecosystem).

Prior to the spruce beetle outbreak, modelling indicates that early seral stages were underrepresented and late seral stages overrepresented on the GMUG. Change detection efforts to quantify contemporary conditions have not yet been completed, but we expect that late seral stages are now underrepresented in areas heavily affected by spruce beetles in the plan area. This has implications for species that rely on mature stand habitat, as well as those found in deeply shaded and moist areas within spruce-fir forests. There is active and ongoing timber harvest taking place in spruce-fir forest on the GMUG as part of the SBEADMR

(Spruce Beetle Epidemic and Aspen Decline Management Response), though the overall acres impacted by these activities is a small percentage of all spruce-fir forests on the GMUG.

Spruce-fir forests are rated as moderately vulnerable to climate change with low confidence (Neely et al. 2011). Secondary impacts of climate change through the influence of warming temperatures and increased droughts on the frequency, extent, and severity of landscape disturbances such as wildfires and insect outbreaks may have significant impacts on spruce-fir forests. Realized impacts of climate change on spruce-fir forest may be mediated by the ability of these species and ecosystems to migrate to higher elevations in response to warming temperatures. Bioclimate models predict that Engelmann spruce and subalpine fir will be threatened or lost in 47% of the area of their current extent by 2060 (TEA)[2].

Spruce-Fir-Aspen

Specific Community or Habitat	Associated At-risk Species
General	American marten pygmy shrew boreal owl flammulated owl northern goshawk Olive-sided flycatcher
Openings	King's clover mountain wild mint northern moonwort Olive-sided flycatcher
Moist to wet rocks, cliffs, and breaks	Hanging Garden sullivantia (*Sullivantia hapemanii var. purpusii*) mountain bladder fern (*Cystopteris montana*) Slender rock-break (*Cryptogramma stelleri*)
Moist roadsides/disturbed areas	large-flower globe-mallow (*Iliamna grandiflora*)
Moist environments/wet meadows and edges of wetlands	pygmy shrew
Wetlands within this ecosystem	boreal toad

Conditions and Trends

Spruce-Fir-Aspen forests cover 426,000 acres and 13.5% of the GMUG. Like spruce-fir forests, this ecosystem is currently being impacted by a large-scale spruce beetle outbreak. Current conditions in spruce-fir-aspen on the GMUG are fairly homogeneous in terms of age,

[2] Predictions of lost suitable habitat by 2060 do not suggest that these areas will hit a climate threshold where immediate large-scale mortality occurs; a more realistic scenario will likely involve gradual declines in tree health and below- average levels of regeneration and recruitment.

size class, and stand density, as a result of large scale fires that burned through these systems in the 1850s and again in 1878 to 1879 (TEA), followed by a century of fire exclusion.

Spruce-fir and aspen forests are both rated as moderately vulnerable to climate change with low confidence (Neely et al 2011). Like spruce-fir forests, actual impacts of climate change may be mediated by the ability of these component species to move upwards in elevation or to cooler and wetter aspects. Bioclimate models predict that Engelmann spruce and subalpine fir and aspen will be threatened or lost in 56% of the area of their current extent by 2060[3].

Aspen

Specific Community or Habitat	Associated At-risk Species
General	Cassin's finch (Haemorhous cassinii) purple martin (*Progne subis*)
Mature aspen forest	boreal owl (Aegolius funereus) Northern goshawk (*Accipiter gentilis*)
Openings	Grand Mesa penstemon King's clover showy draba
Sagebrush openings	mountain draba (Draba rectifructa)
Moist roadsides/disturbed areas	large-flower globe-mallow (*Iliamna grandiflora*)
Aspen trees (regardless of surrounding ecosystem)	boreal owl Flammulated owl (*Otus flammeolus*) Northern goshawk
Mature aspen stands next to openings and water	purple martin
Wetlands within this ecosystem	Boreal toad northern leopard frog

Conditions and Trends

Aspen Forest covers roughly 460,000 acres and 14.6% of the GMUG. Early seral aspen is under-represented on the GMUG, with a corresponding over-representation of mid-seral aspen. This is likely due at least in part to fire exclusion over the past century. Aspen forests have recently been impacted by a variety of diseases in the plan area, with 229,000 acres affected from 2000 to 2010. This vegetation type could benefit from increased levels of wildland or prescribed fire.

Aspen forests are rated as moderately vulnerable to the impacts of climate change, with low confidence (Neely et al. 2011). Specifically aspen forests may, over time, be impacted by increased pest (insect and fungal) attacks, drought, and the inability to colonize new areas

[3] Predictions of lost suitable habitat by 2060 do not suggest that these areas will hit a climate threshold where immediate large-scale mortality occurs; a more realistic scenario will likely involve gradual declines in tree health and below- average levels of regeneration and recruitment.

fast enough to offset lost habitat elsewhere; grazing may also begin to have a greater impact. Insect pest attacks may benefit some aspen-dependent wildlife species, as insect pests make a major portion of the diet of many woodpeckers, bats, and other species. The TEA suggests that as much as 93% of the aspen forests in the GMUG may eventually be threatened or lost by 2060 due to changes in climate conditions, although this may be offset by expansion of aspen into new areas as those new areas become climatically suitable[4].

Overall, this suggests that aspen forests in the GMUG face uncertainty, but may not experience decline. The adjacent Rio Grande NF has experienced a significant increase in aspen forests due to large spruce tree die-off – this balances against the effects of fire exclusion, which often favors conifers over aspen. Aspen is an early colonizer of areas where forests have died due to fire or insect outbreaks, both of which are somewhat difficult to predict on the scale of a single National Forest.

Bristlecone-Limber Pine

Specific Community or Habitat	Associated At-risk Species
General	flammulated owl
Openings, calcareous substrate	Colorado tansy-aster

Conditions and Trends

Bristlecone-Limber pine forest is a small component of the GMUG, occupying 8,200 acres (0.3%), with its entire range in the Gunnison Basin geographic area. Fire frequency in this ecosystem is highly variable, and insect and disease information for this cover type is minimal. Bristlecone and limber pine are both subject to mountain pine beetle caused mortality, though the small extent of this ecosystem on the GMUG makes it unlikely to initiate an outbreak in the plan area. White pine blister rust is another potential threat to these species, though it is not yet known to be present on the GMUG.

Bristlecone pine forests are predicted to be highly vulnerable to climate change, with low confidence (Neely et al 2011). This ecosystem is limited in its distribution, and bristlecone pines are known to recruit very slowly and may be unable to colonize new areas that are more climatically suitable in the future. Warmer conditions and more frequent drought may also increase the susceptibility of trees to white pine blister rust. Bioclimate models indicate that 88% of the current extent of bristlecone pine will be threatened or lost by 2060, and 25% of the current extent of limber pine (TEA)[5]. As most of the bristlecone/limber forests on the

[4] Predictions of lost suitable habitat by 2060 do not suggest that these areas will hit a climate threshold where immediate large-scale mortality occurs; a more realistic scenario will likely involve gradual declines in tree health and below- average levels of regeneration and recruitment.

[5] Predictions of lost suitable habitat by 2060 do not suggest that these areas will hit a climate threshold where immediate large-scale mortality occurs; a more realistic scenario will likely involve gradual declines in tree health and below-average levels of regeneration and recruitment.

GMUG are dominated by bristlecone pine, and its current extent is small, this supports the Neely et al assessment of high vulnerability of these ecosystems to climate change.

Cool-Moist Mixed Conifer

Specific Community or Habitat	Associated At-risk Species
General	boreal owl flammulated owl northern goshawk Olive-sided flycatcher
Openings	King's clover mountain wild mint Olive-sided flycatcher
Rocks, cliffs, and breaks	Hanging Garden sullivantia (*Sullivantia hapemanii var. purpusii*) New Mexico cliff fern (*Woodsia neomexicana*)
Moist roadsides/disturbed areas	large-flower globe-mallow (*Iliamna grandiflora*)

Conditions and Trends

Cool-moist mixed conifer occupies 39,800 acres on the GMUG (1.3%). This ecosystem is dominated by Douglas-fir, and various combinations of white fir, Colorado blue spruce, Engelmann spruce, subalpine fir, or quaking aspen with ponderosa pine occurring incidentally or absent. The primary disturbance in cool-moist mixed conifer forests are infrequent, stand-replacing fires, with occasional small, less severe fires. Root disease and insect outbreaks, such as Douglas-fir beetle (*Dendroctonus pseudotsugae*), also play a role in stand dynamics. Because of their mixed composition, these stands are unlikely to initiate insect outbreaks, but they may be affected by outbreaks that initiate in nearby homogenous stands, or by endemic levels of insects.

Like many forested ecosytems on the GMUG, this system has an underrepresentation of early seral and overrepresentation of mid-seral stages, likely due at least in part to fire suppression throughout the 20th century.

Douglas-fir forests are predicted to be highly vulnerable to climate change, but with low confidence (Neely et al 2011). Bioclimate modelling of future conditions suggest that this ecosystem may shift away from Douglas fir dominance, with Douglas-fir predicted to be threatened or lost in 86% of the current extent of cool-moist mixed conifer forests by 2060 (TEA). As with other ecosystems, the degree of climate change impacts on this ecosystem may be either exacerbated by secondary impacts on warming temperatures on disturbance events or mitigated by the ability of component species to expand to new areas on the GMUG as those become climatically suitable.

Warm-Dry Mixed Conifer

Specific Community or Habitat	Associated At-risk Species
General	flammulated owl northern goshawk Olive-sided flycatcher
Openings	mountain wild mint Olive-sided flycatcher
Moist rock crevices	Rocky mountain polypody (*Polypodium saximontanum*)
Open Douglas-fir forests	Crandall's rock-cress Olive-sided flycatcher flammulated owl

Conditions and Trends

Warm-dry mixed conifer occupies 19,000 acres on the GMUG (0.6%) and is dominated by ponderosa pine, Douglas-fir, white fir, and occasionally aspen. This ecosystem has an under-representation of early seral stages and uncharacteristically low amounts of fire in the past 50 years, with contemporary average annual acres burned around 5-13% of reference conditions. General patterns of change post-settlement are well documented in stand structure within the warm-dry mixed conifer forest type in the western U.S. (White and Vankat 1993; Mast and Wolf 2004). Specifically, there has been a shift in species composition and abundance to shade tolerant species such as white fir and Douglas-fir at the expense of the shade intolerant but more fire resistant ponderosa pine.

Douglas-fir forests are predicted to be highly vulnerable (low confidence) to climate change, while ponderosa pine forests are expected to show moderate increases (also with low confidence) (Neely et al 2011). Similarly to cool-moist mixed conifer, bioclimate modelling of future conditions suggest that this ecosystem may shift away from Douglas fir dominance, with Douglas-fir predicted to be threatened or lost in 85% of the current extent of warm-dry mixed conifer forests by 2060 (TEA)[6]. The degree of climate change impacts on this ecosystem may be either exacerbated by secondary impacts of warming temperatures on disturbance events or mitigated by the ability of component species to expand to new areas on the GMUG as those become climatically suitable.

[6] Predictions of lost suitable habitat by 2060 do not suggest that these areas will hit a climate threshold where immediate large-scale mortality occurs; a more realistic scenario will likely involve gradual declines in tree health and below- average levels of regeneration and recruitment.

Lodgepole Pine

Specifc Community or Habitat	Associated At-risk Species
General and mature stands	American marten boreal owl Grace's warbler (*Setophaga graciae*) Northern goshawk
Sagebrush openings	mountain draba (Draba rectifructa)

Conditions and Trends

Lodgepole pine covers about 280,000 acres and 9% of the plan area, almost entirely in the Gunnison Basin GA. Similar to other forest types on the GMUG, early-mid successional trees are somewhat over-represented in this type. Low elevation lodgepole pine forests are within reference conditions in terms of amount of fire, but higher elevation (>9,500 ft) lodgepole pine forests have between 20 and 40% as much fire in contemporary times as is characteristic of the ecosystem.

Major insects and pathogens that affect this ecosystem are mountain pine beetle and dwarf mistletoe. While mountain pine beetle has gotten a lot of attention in the Rocky Mountain Region, the GMUG has not experienced large outbreaks of mountain pine beetle like other parts of Colorado. Approximately 17,000 acres on the GMUG were affected by mountain pine beetle in the last 20 years. Dwarf mistletoe is a naturally occurring parasite that impacts forest health but is also an important ecosystem process. Many wildlife species use mistletoe brooms for nesting, resting, and hiding cover. Mistletoe is estimated to impact up to ¾ of the lodgepole pine stands north of highway 50 in the Gunnison Basin, to varying degrees (Haines pers. comm. 2017). Lodgepole stands with mistletoe infestations are more susceptible to stand replacing wildfire. Dwarf mistletoes are regulated by stand-replacing fire, so fire exclusion has likely led to increased spread and intensification of the parasite, facilitating conditions that may be outside of NRV (TEA).

Lodgepole pine forests are predicted to be moderately vulnerable to climate change (with medium confidence; Neely et al 2011). Bioclimate models suggest that this ecosystem may be unable to persist in its current range, with 99% of the current extent of lodgepole pine forests predicted to be threatened or lost by 2060[7]. The ability of lodgepole pine to expand to new areas on the GMUG as those become climatically suitable may be crucial in the long-term persistence of this ecosystem on the landscape.

[7] Predictions of lost suitable habitat by 2060 do not suggest that these areas will hit a climate threshold where immediate large-scale mortality occurs; a more realistic scenario will likely involve gradual declines in tree health and below- average levels of regeneration and recruitment.

Ponderosa Pine

Specific Community or Habitat	Associated At-risk Species
General	Flammulated owl hoary bat Lewis's woodpecker (*Melanerpes lewis*), northern goshawk pinyon jay
Openings	mountain draba (*Draba rectifructa*) Rothrock townsend-daisy
Lower elevations, sandy or stony soils	Wetherill's milkvetch (*Astragalus wetherillii*)
Moist rock crevices	Rocky mountain polypody (*Polypodium saximontanum*)

Conditions and Trends

The ponderosa pine vegetation type covers 105,000 acres and around 3% of the GMUG, and is predominantly found on the Uncompahgre Plateau. This forest type has an underrepresentation of early seral and late fire-maintained open stages, with a corresponding overrepresentation of mid-seral stages. Three main anthropogenic influences are responsible for dramatic alterations in the structure and function of ponderosa pine forest ecosystems since Euro-American settlement: grazing, logging, and fire exclusion (Covington et al. 1997, Romme et al. 2009). These factors have led to ponderosa pine forests that have a relatively uniform and dense stand structure, with most trees small to medium-size and between 70-100 years old (Romme et al. 2009). This structure is associated with a high vulnerability to outbreaks of insects and disease, risk of high-severity wildfire, and concerns about regeneration (Romme et al. 2009). The GMUG has recognized this and undertaken various restoration projects, including the ongoing Uncompahgre Plateau Collaborative Forest Landscape Restoration Project (CFLRP).

In addition to fire, insects and disease play a role in the dynamics of this ecosystem type. A mountain pine beetle (*Dendroctonus ponderosae*) outbreak occurred on the Uncompahgre Plateau in the 1980s. Dwarf mistletoe (*Arceuthobium vaginatum* ssp. *cryptopodum*) and root disease also operate in this ecosystem.

This ecosystem is one of the most heavily influenced and actively managed by humans on the GMUG. Ponderosa pine forests on the GMUG are relatively heavily roaded, with 12.1% of the ecosystem area impacted by roads (3rd highest in the plan area after sagebrush shrublands and montane-subalpine grasslands). Roads are an ecosystem stressor that can have a large impact on landscape patterns and processes. This ecosystem is also impacted by invasive species; approximately half of the 25,000 acres of invasive species inventoried on the GMUG are found in either ponderosa pine or montane-subalpine grassland ecosystems. Ponderosa pine forests also have the highest extent of past vegetation management of any ecosystem on the GMUG (due in part to recent Uncompahgre Plateau CFLRP restoration activities, which are beneficial for this ecosystem over the long-term), and the greatest percent of rangeland that is in "fair" condition (mid-seral successional stage; 49%).

Ponderosa pine is predicted to show moderate increases (with low confidence) due to climate change (Neely et al 2011). Bioclimate models suggest that these potential increases will depend on the ability of ponderosa pine to expand to new areas as they become climatically

appropriate, as 97% percent of the current extent of ponderosa pine forest is predicted to be threatened or lost by 2060 (TEA)[8].

Pinyon-Juniper

Specific Community or Habitat	Associated At-risk Species
General	desert green (Comstock's) hairstreak (*Callophrys comstocki*) ferruginous hawk (*Buteo regalis*) Hoary bat (*Lasiurus cinereus*) juniper titmouse (*Baeolophus ridgwayi*) Olive-sided flycatcher pinyon jay (*Gymnorhinus cyanocephalus*) sage sparrow
Openings	Adobe Hills thistle (*Cirsium perplexans*) Colorado desert-parsley (*Lomatium concinnum*)
Disturbed areas	western mouse-tail (*Myosurus cupulatus*)
Shale substrates	adobe beardtongue (*Penstemon retrorsus*) Grand Junction milkvetch (*Astragalus linifolius*) Piceance bladderpod (*Physaria parviflora*) Wetherill's milkvetch (*Astragalus wetherillii*)
Sandstone substrates	Naturita milkvetch (*Astragalus naturitensis*) Wetherill's milkvetch (*Astragalus wetherillii*)
Calcareous substrates	Colorado tansy-aster

Conditions and Trends

The pinyon-juniper ecosystem occurs on around 110,000 acres (~3%) of the GMUG, predominantly on the Uncompahgre Plateau with a smaller extent on the Grand Mesa.

Pinyon-juniper woodlands on the GMUG have an under-representation of early seral stages and over-representation of mid-seral stages. This lower-elevation system is highly accessible to humans and therefore has seen significant influences related to grazing, tree removal, fire suppression, and development. Heavy, year-round grazing started occurring in the late 1800s throughout pinyon-juniper systems and persisted until the mid-1950s. This contributed to the current tree dominated conditions by removing competing understory species and allowing the woody overstory species to prosper (Manier et al. 2003). Livestock grazing also led to tree removal (chaining) for better livestock forage, and reseeding with non-native crested wheatgrass, which caused significant fragmentation to pinyon and juniper systems (Knight et al. 2000) and unknown ecological consequences. Second only to ponderosa pine, pinyon-juniper ecosystems have a significant portion (42%) of their area rated as “fair” rangeland condition.

[8] Predictions of lost suitable habitat by 2060 do not suggest that these areas will hit a climate threshold where immediate large-scale mortality occurs; a more realistic scenario will likely involve gradual declines in tree health and below- average levels of regeneration and recruitment.

Climate change may cause pinyon-juniper woodlands to shift towards juniper dominance (CNHP 2015). Pinyon pine trees in particular are expected to be sensitive to secondary impacts of climate change on frequency and severity of landscape disturbances as we have seen past evidence of drought-driven disturbances affecting this species on the GMUG. For example, the drought in 2002 enabled the ips beetle to attack large tracts of pinyon pine in the western part of the GMUG in 2003 (USDA FS GMUG 2004).

Bioclimate models for pinyon-juniper are relatively positive, with *all* component species predicted to be threatened or lost in 4% of the current extent of this ecosystem[9]. Individual component species are predicted to be threatened or lost in greater proportions of this ecosystem, suggesting that we may see shifts in dominance to pinyon pine, Rocky mountain juniper, and Utah juniper in different parts of this ecosystem's current extent.

Riparian and Wetland Ecosystems

Riparian and wetland ecosystems were assessed in the Aquatic & Riparian Ecosystem Assessment (AREA) for ecosystem integrity based on the condition of four key ecosystem characteristics: vegetation condition and function, hydrologic regime and floodplain connectivity, lack of anthropogenic stressors, and physical sensitivity. All key characteristics were assessed at a subwatershed (6^{th} level HUC) scale based on assessments from 2005 and 2011, and thus *cannot be correlated precisely at the ecosystem level*. In the AREA assessment we used area-weighted subwatershed key characteristic ratings to estimate current conditions by ecosystem type, and these results should be interpreted with care.

[9] Predictions of lost suitable habitat by 2060 do not suggest that these areas will hit a climate threshold where immediate large-scale mortality occurs; a more realistic scenario will likely involve gradual declines in tree health and below- average levels of regeneration and recruitment.

Fens

Vegetation Community or Habitat Type	Associated At-risk Species
Fens (non-specific chemistry)	Altai cottongrass (*Eriophorum altaicum var. neogaeum*) Canadian single-spike sedge (*Carex scirpoidea*) capitate sedge Chamisso's cottongrass (*Eriophorum chamissonis*) Colorado wood-rush (*Luzula subcapitata*) dark blue (*Plebejus ideas sublivens*) Feathermoss (*Pleurozium schreberi*) green sedge (*Carex viridula*) lesser bladderwort (*Utricularia minor*) lesser panicled sedge (*Carex diandra*) Livid sedge (*Carex livida*) mud sedge (Carex limosa)Reindeer lichen (*Cladina arbuscula*) Sierra hare sedg slender cottongrass (*Eriophorum gracile*) variegated scouringrush (*Hippochaete variegata*) water awlwort (*Subularia aquatica*) woollyfruit sedge (*Carex lasiocarpa*)
Edges of fens	pygmy shrew
Iron fens	Girgensohn's sphagnum (*Sphagnum girgensohnii*) roundleaf sundew (*Drosera rotundifolia*) sphagnum (*Sphagnum angustifolium*)
Calcareous fens	little bulrush (Trichophorum pumilum) simple kobresia (Kobresia simpliciuscula)

Conditions and Trends

There are approximately 4000 acres of fens on the GMUG. Compared to other aquatic and riparian ecosystems analyzed by AREA, fens have the highest sensitivity to physical disturbance. The vegetative functional condition of fens on the GMUG is generally good; 71% of the area of fens are within subwatersheds that score as 'functioning properly' for vegetation condition and function, with 29% of fen area in subwatersheds that are 'functioning at risk', and 0% of fen area in subwatersheds with impaired function. Subwatershed ratings for hydrologic regime and water quantity have 58% of fen area in functioning properly subwatersheds, 20% in functioning at risk watersheds, and 22% in impaired watersheds. However, because these ratings are spatially explicit only to the scale of a subwatershed, we cannot say with certainty that 22% of fens have impaired hydrologic function; it is possible that these subwatersheds were rated as impaired due to water quantity issues in non-fen ecosystems.

As grouped in the broader category of high-elevation groundwater dependent wetlands, fens are expected to be low to moderately vulnerable to climate change (high confidence; Neely et al 2011).

Fens face uncertainty over tin Changes in groundwater levels can have a large impact on fens, but there is a sort of buffering effect as changes in precipitation level can take time to translate into changes in groundwater levels, with the rate of correlation varying from place to place (CNHP 2015). Fens make up a small portion of the plan are nd are relatively well-

mapped on the GMUG, making them practical places to implement protective measures such as cattle exclusion fencing. This balances against the current risk factors impacting some fens, such as nearby roads, water diversions, or other infrastructure. Additionally, if groundwater flow into fens begins to decrease, there is little the USFS could do to address the problem.

Montane-Alpine Wet Meadows and Marshes

Vegetation Community or Habitat Type	Associated At-risk Species
General	Balsam groundsel (*Packera paupercula*) Feathermoss (*Pleurozium schreberi*) Gunnison sage-grouse (brood-rearing, summer-fall use of wet meadows within the sagebrush ecosystem) Nelson's sedge nokomis fritillary, aka Great Basin silverspot (*Speyeria nokomis nokomis*) Northern harrier Northern leopard frog showy draba slender cottongrass (*Eriophorum gracile*) water awlwort (*Subularia aquatica*) Northern leopard frog
Montane	Nokomis fritillary, aka Great Basin silverspot Northern harrier woollyfruit sedge (*Carex lasiocarpa*)
Montane to subalpine	boreal toad Brandegee's fumewort mud sedge (*Carex limosa*) pygmy shrew variegated scouringrush (*Hippochaete variegata*)
Subalpine to alpine	boreal toad Altai cottongrass (*Eriophorum altaicum var. neogaeum*) Canadian single-spike sedge (*Carex scirpoidea*) Colorado wood-rush (*Luzula subcapitata*) Osterhout's thist pygmy shrew (subalpine) yellow-dotted alpine white-veined arctic (*Oeneis bore*)

Conditions and Trends

Montane-alpine wet meadows and marshes cover approximately 45,000 acres on the GMUG. 58% of the area of this ecosystem is in subwatersheds with properly functioning ratings for vegetative function and condition, 39% is in subwatersheds that are functioning at risk, and 3% is in impaired watersheds. Ratings for hydrologic function and water quantity are similar, with 63% of the area of this ecosystem in subwatersheds with properly functioning ratings for vegetative function and condition, 27% in subwatersheds that are functioning at risk, and 10% in impaired watersheds. Of anthropogenic stressors assessed, roads and trails have the greatest impact on wet meadows and marshes.

Vulnerability of these ecosystems to climate change depends on the elevation. High elevation groundwater dependent wetlands are rated as low to moderately vulnerable to climate change (high confidence), while montane groundwater-dependent wetlands are rated as highly vulnerable to climate change (high confidence; Neely et al 2011). Wet meadows may be groundwater dependent, but can also be associated with snowmelt or overland flow; these wet meadow subtypes were not explicitly assessed for climate change vulnerability.

Montane-Subalpine Riparian Shrublands

Specific Community or Habitat Type	Associated At-risk Species
Willow carrs	Canada lynx Canadian single-spike sedge (*Carex scirpoidea*) showy draba
Riparian areas and wet meadows in sagebrush shrubland (brood-rearing habitat)	Gunnison sage-grouse

Conditions and Trends

Montane-subalpine riparian shrublands occupy around 110,000 acres on the GMUG. 59% of the area of this ecosystem is in subwatersheds with properly functioning ratings for vegetative function and condition, 41% is in subwatersheds that are functioning at risk, and 1% is in impaired watersheds. Ratings for hydrologic function and water quantity are better, with 81% of the area of this ecosystem in subwatersheds with properly functioning ratings for vegetative function and condition, 13% in subwatersheds that are functioning at risk, and 6% in impaired watersheds. Of anthropogenic stressors assessed, roads and trails have the greatest impact on montane-subalpine riparian shrublands.

Climate change vulnerability of this ecosystem depends on the elevation; high elevation riparian is rated as low to moderately vulnerable to climate change, while mid-elevation riparian is rated as moderately vulnerable to climate change (both with medium confidence; Neely et al 2011).

Montane-Subalpine Riparian Woodlands

Vegetation Community or Habitat type	Associated At-risk Species
General	Balsam groundsel (*Packera paupercula*)
Streambanks in subalpine forests	mountain bladder fern (*Cystopteris montana*) northern twayblade (*Listera borealis*) Slender rock-break (*Cryptogramma stelleri*)

Conditions and Trends

Montane-subalpine riparian woodlands occupy approximately 30,000 acres on the GMUG. 58% of the area of this ecosystem is in subwatersheds with properly functioning ratings for vegetative function and condition, 39% is in subwatersheds that are functioning at risk, and 3% is in impaired watersheds. Ratings for hydrologic function and water quantity are similar, with 66% of the area of this ecosystem in subwatersheds with properly functioning ratings for vegetative function and condition, 27% in subwatersheds that are functioning at risk, and 8% in impaired watersheds. Of anthropogenic stressors assessed, roads and trails have the greatest impact on montane-subalpine riparian woodlands.

Climate change vulnerability of this ecosystem depends on the elevation; high elevation riparian is rated as low to moderately vulnerable to climate change, while mid-elevation riparian is rated as moderately vulnerable to climate change (both with medium confidence; Neely et al 2011).

Cottonwood Riparian Woodlands

Vegetation Community or Habitat Type	Associated At-risk Species
General	bald eagle Lewis's woodpecker willow hawthorn (*Crataegus saligna*)
Edges of cottonwood on substrate derived from Chinle or Morrison sandstone	Grand Junction milkvetch (*Astragalus linifolius*)

Conditions and Trends

Cottonwood riparian woodlands cover only a small portion of the plan area, at around 3,500 acres. These ecosystems are dependent on a hydrologic regime that includes annual to episodic flooding. Flooding erodes and deposits sediment, influencing the distribution of riparian vegetation and providing a bare alluvium substrate which is critical for the germination of cottonwood and willow seedlings. 32% of the area of this ecosystem is in subwatersheds with properly functioning ratings for vegetative function and condition, 64% is in subwatersheds that are functioning at risk, and 4% is in impaired watersheds. Ratings for hydrologic function and water quantity are better, with 59% of the area of this ecosystem in subwatersheds with properly functioning ratings for vegetative function and condition, 26% in subwatersheds that are functioning at risk, and 15% in impaired watersheds. Of anthropogenic stressors assessed, roads and trails have the greatest impact on cottonwood riparian ecosystems, followed by livestock grazing.

Cottonwood riparian systems are fairly rare on the GMUG, and may merit special plan direction due to their dependence on a specific hydrologic regime in combination with the relatively high rates of anthropogenic stressors this ecosystem experiences (likely connected to its occurrence at lower elevations). This ecosystem is rated as highly vulnerable to climate (albeit with low confidence; Neely et al 2011).

Aquatic Ecosystems

Fully aquatic ecosystems are described in the Watershed, Water, and Soils Ecological Analysis (WWSEA). This lists condition classes for 235 watersheds, rated by condition class, Condition Class 1 (Functioning Properly), Condition Class 2 (Functioning At Risk), or 3 (Impaired Function). Within the GMUG, 158 watersheds ranked Condition Class 1, 76 ranked Condition Class 2. No water sheds were ranked as "Impaired Function", one watershed was not rated.

Overall, watersheds on the GMUG ranked very well in terms of the lack of "Impaired waters" (211 watersheds listed as "Good"), water quality (201 "Good"), and life form presence (205 "Good"). In specific indicators of watershed health, invasive species are an issue, with 192 of the watersheds ranking as "Poor" in that category, and 149 ranking as "poor" for native species. Non-native fishes are economically and recreationally important on

the GMUG, but still have detrimental impacts on native species through hybridization, predation, and disease transmission.

Rivers and Streams

Vegetation Community or Habitat Type	Associated At-risk Species
General	bald eagle black swift Bluehead sucker (*Catostomus discobolus*) Northern leopard frog river otter Lewis's woodpecker green lineage Colorado river cutthroat trout Boreal toad

Conditions and Trends

The GMUG has an estimated 3,657 miles of perennial streams and rivers, 1,390 miles of major (named) intermittent streams, and 5,815 miles of minor (unnamed) intermittent streams. Life in streams on the GMUG has adapted to relatively low water temperatures and commensurate low productivity. While many streams support 30 or 40 species of invertebrates (e.g. insects) there are few fishes that are native to the area. From 2004 – 2005, benthic macroinvertebrates were collected from a representative sample of streams on the GMUG. Analysis of these samples using a Benthic Index of Biological Integrity (IBI), indicated that macroinvertebrate communities and the streams they inhabit on the forest are generally close to reference conditions, and are not experiencing broad-scale negative changes resulting from human use of the surrounding environment. While broad-scale conditions are generally good, streams and rivers on the GMUG and their component species are still impacted and at risk due to ecosystem stressors, including dams and diversions, roads, mining, invasive species, disease, and climate change.

Dams associated with human-made impoundments affect stream connectivity and aquatic organism passage. Small dams on non-NFS land and instream structures, such as "perched" culverts at road-stream crossings and irrigation diversions, also exist, fragmenting the stream network and blocking fish passage. In streams where these structures are present fish are often able to move downstream but are precluded from returning by the structure. There are no watersheds on the GMUG NF that are not affected by human-caused aquatic fragmentation. See the Risk Factor: Habitat fragmentation section for further information.

Based on State Water Supply Initiative projections, surface water diversion from NFS lands is expected to stay at its current level. There is little indication there will be many proposals to develop new diversions on NFS lands, but there may be greater interest in developing more surface water storage on the GMUG. The SWSI report also indicated that many of the major river basins on the east side of the Continental Divide have much greater unmet water demands than the Gunnison River sub-basin. These findings have continued to fuel speculation and interest in the potential of the Gunnison River sub-basin to provide additional water to the eastern slope basins where future water demands are much greater than in the Gunnison.

Unpaved road surfaces are a long-term source of fine sediment input into waterbodies. Roads within Water Influence Zones (WIZs), which are typically the area within 100 feet of a waterbody, and road-stream crossings are generally higher contributors of fine sediment. There is an average of approximately 1 road crossings per 3 miles of stream on the GMUG NF, and there are 689 miles of road within WIZs. According to the watershed ratings for the Watershed Condition Framework, the North Fork of the Gunnison River and Gunnison Basin geographic areas have approximately 75 percent of their watersheds rated as "poor" (Class 3) for the road and trail "proximity to water" attribute. In the Uncompahgre Plateau geographic area, almost half of the watersheds were rated as "fair" (Class 2) and about one-quarter were rated as "poor" for this attribute.

Although surface water quality is generally excellent within the GMUG's boundaries, the State of Colorado identified segments in 21 streams totaling approximately 141 miles that do not meet water quality standards. Elevated metals concentrations related to historic mining activities are most often the reasons for failure to meet water quality standards. See the Risk Factor: Mining section for further information.

The Gunnison Basin CCVA lists small high-elevation streams as low to moderately vulnerable to climate change (high confidence), and mid-size streams and rivers as moderate to highly vulnerable (medium confidence; Neely et al 2011). The exact effect of climate change on streams and rivers on the GMUG is unknown, but potential direct effects include reduced precipitation, earlier and shorter periods of snowmelt runoff, attenuated base flows in streams, and increased stream temperatures (Reiman and Isaak 2010). Potential indirect effects include increased erosion and sedimentation after uncharacteristic wildfires, changes in the hydrologic regime due to extensive and severe insect outbreaks, and impacts associated with more frequent extreme weather events including droughts and floods (Vose et al. 2012).

Lakes and Reservoirs

Vegetation Community or Habitat Type	Associated At-risk Species
General	boreal toad Northern leopard frog (*Lithobates pipiens*) Colorado wood-rus bald eagle (*Haliaeetus leucocephalus*)

Conditions and Trends

There are approximately 11,650 acres of lakes and reservoirs across the GMUG. Lakes and reservoirs are not directly assessed in AREA or WWSRA, though lake and reservoir conditions were incorporated in the Watershed Condition Framework assessment (discussed above). Gunnison Basin CCVA lists high-elevation lakes as low to moderately vulnerable to climate change (high confidence), with reservoirs and associated wetlands as moderately vulnerable (medium confidence). The Colorado BLM CCVA indicates that high altitude lakes should be less at-risk from the effects of climate change, with lower elevation lakes being more vulnerable. Warmer temperatures, nitrogen deposition and the timing of snowmelt runoff may pose difficulties for some species (CNHP 2015).

Lakes and reservoirs, particularly those that allow for gas-powered motorized watercraft, are susceptible to aquatic nuisance species (ANS). ANS has not yet been detected in lakes or reservoirs on the GMUG. The Colorado Parks and Wildlife and the GMUG coordinate

preventative measures, including jointly funding ANS inspectors that check watercraft. ANS inspectors have been in place for several years. If ANS does arrive, the impact to native aquatic species and ecosystems would be devastating.

Special Habitat Features

Special habitat features refer to unique or very specific habitat elements that are not described as individual ecosystems in this document, but rather key components that occur across multiple ecosystems. The species associated with these features are highly dependent upon them; the features are essential to their persistence.

Caves and Mines

Vegetation Community or Habitat Type	Associated At-risk Species
General	Townsend's big-eared bat (*Corynorhinus townsendii*)

Conditions and Trends

There are few large underground caves and mines on the GMUG. Bat species such as Townsend's big-eared bat prefer caves large enough to form stable interior temperatures for hibernation and maternity colonies. However, these deep underground habitats are very susceptible to white-nose syndrome (WNS). WNS has not been detected in Colorado yet, and the spread of the pathogen has been markedly slowed. If WNS does arrive, the impact to bat populations could be extensive. This is an uncertain but potentially high risk for which preventative measures should be prioritized.

Caves and mines were not analyzed in the TEA/AREA assessments.

Non-Alpine Rock Outcrops and Cliffs

Vegetation Community or Habitat type	Associated At-risk Species
General	American peregrine falcon bald eagle Black Canyon gilia (*Gilia penstemonoides*) Ferruginous hawk Flammulated owl Golden eagle (*Aquila chrysaetos*) mountain wild mi Rocky Mountain bighorn sheep Desert bighorn sheep (*Ovis canadensis nelsoni*) western polypody (*Polypodium hesperium*)
Montane to subalpine	New Mexico cliff fern (*Woodsia neomexicana*) Osterhout's thist Rocky mountain polypody (*Polypodium saximontanum*)
Limestone substrate	Hanging Garden sullivantia (*Sullivantia hapemanii var. purpusii*) lime-loving willo purple-stem cliffbrake (*Pellaea atropurpurea*)

Conditions and Trends

Rock outcrops and cliffs are described in TEA, but not analyzed. Due to limitations in geospatial data, we are unable to identify the total area of these features on the GMUG. Threats to species dependent upon rocks and outcrops are difficult to quantify. Recreational rock climbing may be the biggest threat to these species, due to the harassment (intentional or not) of wildlife, and the removal of vegetation from cracks and crevices in order to secure handholds and fall-protection equipment. However, impacts of rock climbing are limited to areas on the GMUG with developed climbing routes.

Snags and Down Woody Material

Vegetation Community or Habitat Type	Associated At-risk Species
Snags	American marten bald eagle boreal owl flammulated owl Lewis's woodpecker osprey
Down woody material	American marten lynx

Conditions and Trends

The TEA indicates that the number of snags in the planning area is increasing over time. This is supported from stand exam data and Forest Inventory and Analysis (FIA) information. Overall, snag density in the plan area is greater than the minimum amounts set in the current Forest Plan.

Snags are a key ecosystem characteristic for a variety of species, especially primary and secondary (flammulated owl, boreal owl) cavity nesters. The American marten uses hollow snags as den sites. The osprey builds nesting platforms in snags, which has been documented on the GMUG. Bald eagles use snags as roost sites, and as perch sites to look for prey.

Snags contribute to future recruitment of down woody material, also referred to as course woody debris. Course woody debris, in the form of logs in a diversity of sizes and decay, function as cover and habitat for insects and small mammals that are prey for potential SCC species. Course woody debris also functions as denning habitat for the Canada lynx and American marten, and helps to retain soil moisture.

Substrates

Vegetation Community or Habitat Type	Associated At-risk Species
Limestone/Dolomite/Calcerous substrates	alpine braya arctic braya Avery Peak twinpod Colorado tansy-aster green spleenwort (*Asplenium trichomanes-ramosum*) hanging garden sullivantia lime-loving willow Piceance bladderpod purple-stem cliffbrak Rothrock townsend-daisy slender rock-break tundra buttercup tundra draba woods draba
Shale derived substrates	adobe beardtongue Adobe Hills thistle Colorado desert-parsley Colorado wild buckwheat DeBeque phacelia hanging garden sullivantia sun-loving meadowrue (*Thalictrum heliophilum*), Utah fescue (*Argillochloa dasyclada*)
Volcanic tuff	Weber's catseye Colorado wild buckwheat

Conditions and Trends

Some plants require specific substrates, which may occur in isolated patches. Species dependent upon them can experience genetic isolation, sometimes leading to rapid speciation. The primary threats to species on these types of soils is the disturbance of the soils themselves. This could a be a large scale event such as road construction or tillage, or small scale events such as a single off-road vehicle travelling illegally through a sensitive area, or dispersed camping.

Prey

Ecosystem feature (Prey groups)	Associated At-risk Species
Insects	Boreal toad Black swift Hoary bat Townsend's big-eared bat
Small Mammals (prairie dogs, shrews, voles, squirrels, hares, rabbits) Passerines Waterfowl Woodpeckers Galliformes	American marten Boreal owl Canada lynx flammulated owl golden eagle Northern goshawk

Conditions and Trends

Prey species are subject to a number of impacts, as variable as the species themselves. Some prey species may themselves be SCC or TEPC. The other assessments analyze some resources or conditions that impact prey species. Predator-prey relationships influence ecosystem pattern and process, which in turn influences vegetation and habitat conditions, species population dynamics, nutrient cycling, and a host of other dynamic ecosystem processes. The landscape-scale disturbance event from spruce bark beetles is likely the most influential natural ecological process affecting prey species on the GMUG National Forests at this time. Other factors influencing prey species and their habitat include vegetation management activities, particularly timber harvest, prescribed fire, habitat manipulation by mechanical treatments (e.g., removal of encroaching pinyon-juniper and/or other vegetation types to promote a desired condition), soil loss from erosion in riparian areas and meadows, non-native species invasions, and roads. In general, actions that maintain and enhance prey species' habitat would benefit the associated at-risk species. Likewise, actions that maintain and enhance key ecosystem characteristics and conditions for associated at-risk species will benefit their prey species. This ecological relationship is important to incorporate in Forest Plan direction to maintain species viability and persistence.

Risk Factors

The following are extrinsic risk factors that are associated with the specific ecosystems and habitats that the Species Potentially Impacted depend upon, with some risk factors directly affecting the species but not habitat, and others affecting the species habitat. Direct habitat conditions are discussed above for key ecosystems, and in detail in the assessment of Terrestrial Ecosystems: Integrity and System Drivers and Stressors (TEA). Note that some extrinsic risk factors exist independent of the habitat condition (i.e., whirling disease, active management like grazing and timber), whereas the severity of other risk factors may be amplified by poor habitat conditions (i.e. spread of invasives is more likely in disturbed areas).

Small and Isolated Populations

Risk Factors	Species Potentially Impacted
Genetic drift, stochastic events, and anthropogenic disturbances	adobe beardtongue basalm groundsel Black Canyon gilia bog stitchwort Canadian single-spike sedge Colorado desert-parsley draba ventosa feathermoss grass sedge Girgensohn's sphagnum Grand Junction milk vetch Gunnison sage-grouse Gunnison's prairie dog large-flower globe-mallow lesser panicled sedge least moonwort lime loving willow little bulrush livid sedge low fleabane minute rush narrow leaf grapefern nokomis fritillary, aka Great Basin silverspot northern moonwort peculiar moonwort piceance bladderpod purple-stem cliffbrake reindeer lichen rockcress draba roundleaf sundew simple kobresia slender rock-break sphagnum (Sphagnum angustifolium) stonecrop gilia sun-loving meadowrue tundra buttercup Uncompahgre fritillary butterfly Utah fescue water awlwort Weber's catseye white-veined arctic whitlow-grass woolly fleabane yellow-dotted alpine Yellowstone whitlow-grass

Small and isolated populations are susceptible to threats from genetic drift and stochastic events. Species with single or few occurrences are a concern for viability and long-term persistence because a single event can remove the species entirely from the GMUG National Forests. These species are particularly vulnerable to anthropogenic disturbances.

Climate Change

Risk Factors	Species Potentially Impacted
High or extreme vulnerability to climate change (high or very high confidence)	boreal owl boreal toad brown-capped rosy finch Colorado desert-parsley Colorado wild buckwheat Colorado wood-rush Gunnison milkvetch Hanging Garden sullivantia Naturita milkvetch Nokomis fritillary, aka Great Basin silverspot peculiar moonwort piceance bladderpod slender rock-break sun-loving meadowrue white-tailed ptarmigan
High or extreme vulnerability to climate change (unspecified confidence)	house's sandwort San Juan draba whitlow-grass
High or extreme vulnerability to climate change (low or medium confidence)	altai cottongrass arctic braya bluehead sucker boreal toad Colorado Divide whitlow-grass Crandall's rock-cress Leadville milkvetch low fleabane rockcress draba Rothrock townsend-daisy roundleaf sundew simple kobresia small-winged sedge stonecrop gilia tundra buttercup wooly fleabane

Risk Factors	Species Potentially Impacted
Habitat is highly vulnerable to climate change (high or very high confidence)	alpine braya American marten Avery Peak twinpod black swift bog stitchwort brown-capped rosy finch Colorado Divide whitlow-grass Colorado wild buckwheat globe sedge Harbour's beardtongue House's sandwort least moonwort narrow-leaf grapefern Osterhout's thistle Ritter's coraldrops Rocky Mountain bighorn sheep Rothrock townsend-daisy Sierra hare sedge thickleaf draba tundra buttercup tundra draba tundra saxifrage white-tailed ptarmigan whitlow-grass
Habitat is highly vulnerable to climate change (low or medium confidence)	bald eagle Colorado tansy-aster Lewis’s woodpecker willow hawthorn

Information regarding potential climate change impacts is pulled primarily from the Gunnison Basin Climate Change Vulnerability Assessment (Neely et al. 2011); additional data is pulled from the Climate Change Vulnerability Assessment for Colorado BLM (CNHP 2015), and the Climate Change Vulnerability Assessment for Rare Plants of the San Juan Region of Colorado (CNHP 2014). Where these assessments disagreed, we deferred to the Gunnison Basin CCVA followed by the San Juan CCVA, as those are specific to the geographic vicinity of the GMUG.

Disease

Risk Factors	Species Potentially Impacted
Chytrid fungus	northern leopard frog boreal toad
Sylvatic plague	Gunnison's prairie dog
White-nose syndrome	Townsend's big-eared bat
Pneumonia/Respiratory disease	Rocky Mountain bighorn sheep
Pneumonia/Respiratory disease	Desert bighorn sheep

Chytrid fungus is present in streams and wetlands in the GMUG, and has been a major contributing factor to the decline of boreal toad and northern leopard frog in Colorado. A fungal infection, chytrid is caused by the flagellated zoospore Batrachochytrium dendrobatidis (Bd, Daszak et al. 2000). Chytrid can be transmitted from host to host through direct contact (territorial or breeding encounters), movement of surface water, in damp or moist soil and in laboratory tests it has been found to live on the feathers of birds, especially waterfowl, long enough to be transported between waterbodies (Johnson and Speare, 2003; 2005). Although mammalian body temperatures preclude Bd infection both migrating aquatic and terrestrial mammals may serve as vectors of this disease.

This disease is a limiting factor to population viability for amphibians on the GMUG. The Forest Plan Revision provides an opportunity to further coordinate with Colorado Parks and Wildlife to develop management direction that helps prevent the spread of Chytrid fungus. Notably, frogs have an innate immune response that renders them less susceptible to chytrid, suggesting that there may be other factors at play in chytrid-related declines of northern leopard frog. In the Sierra Nevada Mountains of California, the volatilization of persistent organic pollutants (POP) has been documented as a factor in northern leopard frog decline. Research (Taylor et al. 1999) suggests that immunosuppression due to POPs could have aided in the mass die-offs of northern leopard frog and boreal toad caused by red leg disease and chytrid observed in the West Elk Mountains in the 1970s (Carey 1993).

Colorado Parks and Wildlife (CPW) applies treatments to reduce the incidence of sylvatic plague in prairie dog colonies in and around the GMUG. That treatment (dusting burrows with insecticide and administration of an oral vaccine) has been effective in controlling the intensity and frequency of plague. CPW's success and continued commitment in plaque management was a contributing factor in U. S. Fish and Wildlife Service's "not warranted" decision to list the species as threatened or endangered under the Endangered Species Act (https://www.fws.gov/mountain-prairie/es/species/mammals/gunnisonprairiedog/78FR68660.pdf).

White-nosed syndrome is not yet present in Colorado. The Forest Service, in cooperation with other land and wildlife management agencies, has implemented a number of precautionary measures to decrease the chance of the disease arriving or infecting caves and mines in the area. However, the arrival of the disease may still occur, despite precautions. If it arrives, the impact to cave and mine-dependent bat populations would be significant.

Hunting or Other Intentional Mortality (Legal or Illegal)

Risk Factors	Species Potentially Impacted
General	American marten American peregrine falcon bald eagle golden eagle Gunnison's prairie dog northern harrier river otter white-tailed ptarmigan

Legal hunting is regulated by Colorado Parks and Wildlife (CPW). One goal of that is to maintain stable populations of game species. As such, legal hunting is unlikely to create risk for continued persistence of these species in the plan area. Hunting permits are issued by CPW, an agency of the Colorado State government, but the final SCC designation is made by the USFS, an agency of the federal government. This makes it possible for some potential SCC species to be legally hunted – the fact that CPW allows hunting of a given species does not disqualify that species for inclusion as SCC. This is the result of different agencies making different determinations, based on different criteria.

Illegal hunting (poaching) is hard to quantify, as it is hard to determine how often it actually occurs. Among species that may be At-Risk on the GMUG: eagles are poached for feathers; prairie dogs are poached because they are viewed as pests; other rare species may be poached out of a perception that their presence on the land may lead to unreasonable government regulation. Again, it does not appear possible to clearly identify any numbers or trends associated with poaching on the GMUG.

Habitat Fragmentation

Risk Factors	Species Potentially Impacted
General	American marten bluehead sucker Brewer's sparrow Canada lynx Great Basin silverspot greenback-lineage cutthroat trout Gunnison sage-grouse nokomis fritillary, aka Great Basin silverspot Northern leopard frog northern moonwort reindeer lichen Rocky Mountain bighorn sheep sage sparrow Western bumblebee (*Bombus occidentalis*)

Habitat fragmentation affects different species in very different ways and can at times be protective of some species (such as protecting from hybridization). WWSRA describes watershed connectivity - there are a total of 352 dams on the GMUG, and additional fish barriers constructed to protect native species from hybridization. These aquatic barriers have both positive and negative impacts on fishes, negatively impacting bluehead suckers, and both negatively and positively impacting greenback-lineage cutthroat trout. In terms of native cutthroat trout, fish barriers prevent hybridization, but also create genetic bottlenecks and increase susceptibility to stochastic events.

TEA analyzes patch size and habitat connectivity of terrestrial ecosystems. Neither assessment was able to provide any clear trend on connectivity but several ongoing species-specific efforts to assess habitat connectivity will provide some insight and inform Forest Plan direction for this key ecosystem characteristic. Habitat fragmentation and connectivity is a complex and species-specific issue, but a consistent major factor in habitat fragmentation

are roads. Roads create sharp edges in otherwise intact habitats and create barriers to species mobility.

Invasive or Non-Native Terrestrial Species

Risk Factors	Species Potentially Impacted
Invasive Plants	Brewer's sparrow feathermos Gunnison sage-grouse Sage sparrow variegated scouringrush
Miscellaneous	western bumblebee (parasites; honey bees, which are non-native and spread disease to bumble bees and other native bees)

To date on the GMUG, there are approximately 25,500 acres of inventoried invasive plant infestations. Invasive plants can have serious ecological impacts by altering plant species composition that reduces biodiversity and ecosystem resilience. Climate change is expected to increase the impacts of invasive plant species by causing invasives to increase and expand. Control of invasive species can also have negative impacts on at-risk species. For example, some native- thistles are adversely impacted by biocontrol weevils released to manage non-native thistles. Or, native species that grow in disturbed roadside areas may have population declines due to herbicide spraying. For more information, see the invasive species section in Drivers and Stressors in the Terrestrial Ecosystem Assessment, and the Invasive Plants assessment.

Livestock and Wildlife Grazing, Browsing, and Trampling

Risk Factors	Species Potentially Impacted
General	Brewer's sparrow Canadian single-spike sedge feathermoss green sedge green-lineage Colorado River cutthroat trout Gunnison sage-grouse Lesser bladderwort lesser panicled sedge Lewis's woodpecker logger-head shrike Nokomis fritillary, aka Great Basin Silverspot simple kobresia western bumblebee white-tailed ptarmigan willow hawthorn Rocky Mountain bighorn sheep Desert bighorn sheep

Livestock and wildlife grazing can impact different species in different ways. The more relevant impacts for at-risk species we assessed include increased erosion, changes in plant species composition, and disease transmission (domestic sheep/bighorn sheep). Fen, wetland,

and riparian species are especially vulnerable to increased sedimentation or hydrologic alteration that can be associated with improper grazing or uncharacteristically high use by wild ungulates. Species that occur on highly erodable soils may also be impacted by high levels of ungulate use and associated atypical rates of erosion. Rangeland management is addressed in the Rangeland Management Assessment. The Terrestrial Ecosystem Assessment also provides information on herbivory, including livestock grazing and wildlife grazing and browsing, in the Management Influences section.

Hard Rock Mining

Risk Factors	Species Potentially Impacted
General	green-lineage Colorado River cutthroat trout Gunnison sage-grouse white-tailed ptarmigan

Mining and minerals extraction is managed cooperatively with the U.S. Bureau of Land Management, and is addressed under the Renewable and Non-renewable Energy, Resources, and Mineral Resources and Geological Hazards Assessment.

Past mining practice have had negative impacts on many plant and animal species. Current mining practices have potential to have negative impacts as well – erosion, potential chemical contamination (including leaching from mines and spoils, as well as spillage of industrial chemicals), road impacts, and direct habitat destruction. Potential effects on aquatic and riparian ecosystems in particular include changes in hydrologic regimes due to physical channel modifications, interception and rerouting of groundwater, decreases in base flow with accompanying increases in runoff, and consumptive water use. Surface and groundwater quality can be decreased due to contamination from acid runoff, dissolved metals, and sediment production, which in turn can impact aquatic community composition and structure. Wetland and riparian areas may be lost due to mine operations or groundwater interception, and can show changes in structure and function due to water contamination.

Current mining practices are subject to environmental review under NEPA, NHPA, ESA, and multiple other laws and regulatory systems. As such, the risk of current mining practices is limited and subject to review. Consequently, the current ecological impacts of mining across the GMUG are largely related to legacies of historic mineral development. A total of 63 sub-watersheds of the GMUG include abandoned mine land (AML) sites, with variable impacts on surface water quality and aquatic habitat. The four sub-watersheds with the highest density of AML sites contain all state-listed impaired waters due to water quality impacts from historic mining activities found on the GMUG (segments in 21 streams totaling aprroximately 141 miles).

Non-Native Fish

Risk Factors	Species Potentially Impacted
General	bluehead sucker boreal toad green-lineage Colorado River cutthroat trout Northern leopard frog

Non-native fish can impact native fish through predation, competition, and hybridization. Fish can impact amphibians through predation, disturbance of egg masses, and introduction of chytrid fungus or other diseases. Of the 231 watersheds analyzed in the WWSRA, 192 were rated as "Poor" in regards to invasive species, although the WWSRA makes no distinction between non-native fish, plants, or other organisms. The presence of such non-native species is a clear risk factor for multiple native species on the GMUG.

Vegetation Management and Alteration

Risk Factors	Species Potentially Impacted
Timber harvest	bluehead sucker boreal toad Canada lynx flammulated owl green-lineage Colorado River cutthroat trout hoary bat Lewis's woodpecker Northern goshawk Weber's catsey
Herbicide use - General	Gunnison sage-grouse hoary bat
Herbicide use – loss or contamination of nectar producing species	Nokomis fritillary, aka Great Basin silverspot western bumblebee white-veined arctic yellow-dotted alpine
Herbicide Use – direct mortality	Feathermos Grand Mesa penstemon variegated scouringrush Western mouse-tail
Wildland Fire	American marten Brewer's sparrow boreal owl Canada lynx flammulated owl Gunnison sage-grouse Northern harrier western bumblebee

Timber harvest could impact species that require large trees, including cavity nesting species.

In addition to animal species, any potential SCC plant species could be impacted by herbicide application, especially herbicide applications that might be designed to favor grazing by reducing dicot/broadleaved plants and favoring monocot/grass and sedge species. See also Invasive species section, above.

Stand-replacement fire could impact many species that require dense cover or large trees. Depending on the timing, fire could also disrupt nesting.

Recreation (Non-Hunting)

Risk factors	Species Potentially Impacted
Peak bagging, alpine foot travel	brown-capped rosy finch low fleabane Rothrock townsend-daisy roundleaf sundev stonecrop gilia tundra draba Uncompahgre fritillary butterfly white-tailed ptarmigan
Rock climbing	Peregrine falcon
Illegal off-road/trail motorized vehicle use	alpine braya altai cottongrass arctic braya Avery Peak twinpod Canadian single-spike sedge Chamisso's cottongrass Colorado wood-rush Crandall's rockcress DeBeque phacelia green sedge lesser bladderwort lesser panicled sedge mud sedge Rothrock townsend-daisy Sierra hare sedge simple kobresia water awlwort woods draba wooly fleabane Yellowstone whitlow-grass
Ski area management	altai cottongras Canada lynx slender cottongrass wooly fleabane
miscellaneous	brown-capped rosy finch (human presence in winter) mountain draba (campground management) Northern twayblade (foot travel in subalpine riparian areas) Townsend's big-eared bat (caving) water awlwort (winter recreation)
General/non-specific	white-tailed ptarmigan boreal toad

Recreation is assessed in the Recreation Assessment. As the population of Colorado continues to grow, recreational activities on the GMUG are likely to increase. Species that are impacted by recreational activities can expect to see increased impacts unless management action is taken. The Forest Plan Revision provides an opportunity for balanced management direction that provides for recreation opportunities and in conjunction with consideration of species needs.

Species Not Recommended as Potential Species of Conservation Concern

In all, a total of 224 at-risk species were reviewed. The results of the assessment process follows:

- 17 Threatened, Endangered, Proposed, and Candidate (TEPC) species reviewed; these species, by definition, are not Forest Service "species of conservation concern" but are instead to be managed per the higher standards established by the Endangered Species Act and the 2012 Forest Service Planning Rule. (TEPC species are not counted in the following summary bullets.)
- 76 species are not "known to occur" based on best available science (see list in Appendix 2)
- 131 species identified as "Known to Occur"
- 50 species that are known to occur in the plan area, for which significant concern regarding the ability to persist in the plan area is *not* documented/concluded (see Table 2 and Table 3).
- 81 species constitute the draft potential species of conservation concern for the GMUG (see Table 4). These species are known to occur in the plan area, and for which significant concern regarding the ability to persist in the plan area is documented.

We used four primary criteria/information sets to identify potential Species of Conservation Concern:

- Known to occur
- Key ecosystems and characteristics, conditions and trends (assessed above)
- Risk factors (assessed above)
- Information unique to each species (summarized in the individual species overviews).

It is important to note that the USFS can develop plan components that are protective of any species. We are ***required*** to develop plan components that contribute towards the recovery of Threatened and Endangered species, to conserve Proposed and Candidate species, and to maintain a viable population of SCC present in the plan area. There is ***no prohibition*** on developing plan components for other species as well. In addition, the designation of focal species can also contribute to the further protection of the habitat needs of non-SCC species.

The following species (Table 2 and Table 3) are known to occur in the plan area but are not currently identified as potential SCC, as the review of best available science did not indicate there is substantial concern for the species ability to persist over the long-term in the plan area. Table 3 identifies the subset of these species that are Regional Forester's sensitive species, but are not currently identified as potential SCC.

Table 2. Species considered, but not currently identified as potential SCC

[Known to occur on the GMUG. None are Regional Forester's sensitive species for Region 2.]

Category	Species	Evidence of Occurrence	Lack of Substantial Concern About the Species Capability to Persist over the Long Term
Birds	Golden eagle *Aquila chrysaetos*	There are seven records of golden eagle on the GMUG, most recently from 2016	This species is secure on the Forest, occupying low-elevation grasslands, shrublands, and rocky outcrops and consistently occupying these areas and re-using known cliff nest sites over long time periods, in areas and locations not susceptible to or at risk from disturbances. The Forest also provides abundant and well-distributed winter range used by this species. This species is protected under the Bald and Golden Eagle Protection Act. Our compliance with these Acts and associated conservation measures implemented at a project-level are one way this maintains persistence in the plan area. No known substantial conservation concern on the GMUG National Forests.
Birds	Juniper titmouse *Baeolophus ridgwayi*	There is one record of this species on the GMUG, from 2009	No known substantial conservation concern on the GMUG National Forests. PJ encroachment into the sagebrush ecosystem is considered a risk factor for sagebrush dependent species. Management actions on the GMUG National Forests do include PJ removal through mechanical treatments. These treatments are confined to encroaching PJ. The PJ ecosystem is well-distributed and maintained on the GMUG National Forests. The PJ ecosystem, as a whole, is not at risk from vegetation management actions that remove PJ encroaching into other ecosystem types.
Birds	Pinyon jay *Gymnorhinus cyanocephalus*	Pinyon jay has been documented many times on the GMUG, most recently in 2014	Pinyon jay is a Bird species of Conservation Concern, but it is also rated G5S5 and has no discernable threats on the GMUG National Forests. PJ encroachment into the sagebrush ecosystem is considered a risk factor for sagebrush dependent species. Management actions on the GMUG National Forests do include PJ removal through mechanical treatments. These treatments are confined to encroaching PJ. The PJ ecosystem is well-distributed and maintained on the GMUG National Forests. The PJ ecosystem, as a whole, is not at risk from vegetation management actions that remove PJ encroaching into other ecosystem types.
Birds	Cassin's finch *Haemorhous cassinii*	Cassin's finch has been documented at least 86 times on the GMUG, most recently in 2016	Cassin's finch is a Bird species of Conservation Concern, but it is also rated G5S5 and has no discernable threats in the plan area. Plentiful habitat occurs in plan area.
Birds	Grace's warbler *Setophaga graciae*	Grace's warbler has been documented twice on the GMUG as recently as 2013	There is not substantial scientific information suggesting that there are threats to long-term persistence in the plan area. Data from the Breeding Bird Survey and Colorado Breeding Bird Atlas II suggest a significant upward population trend and range expansion. The species' range is limited in the plan area primarily to ponderosa pine and pine-oak woodlands, with few birds documented in mixed conifer, Douglas fir, aspen-conifer, and pinyon-juniper with pockets of ponderosa pine. These ecosystem types are well-distributed on the GMUG National Forests.

Category	Species	Evidence of Occurrence	Lack of Substantial Concern About the Species Capability to Persist over the Long Term
Insect	Desert green (Comstock's) hairstreak (butterfly)	Desert green hairstreak was documented once on the GMUG in 1982	No known substantial conservation concern on the GMUG National Forests. Its host plant is not considered uncommon and it appears likely that its rarity is due to habitat being on the periphery of the plan area. Though rare on the Forest, its holarctic distribution is more secure. The Xerces Society indicates "Due to the relative isolation and inaccessibility of its habitats, there are few identified threats."
Insect	Dark blue (butterfly)	The dark blue has been documented four times on the GMUG, most recently in 1982.	The dark blue faces no defined risks in the plan area, and no scientific evidence suggesting a threat to long-term persistence. There is no known substantial conservation concern on the GMUG National Forests.
Plant	Grand Junction milkvetch *Astragalus linifolius*	Grand Junction milkvetch was documented on the GMUG once in 2014	The GMUG occurrence is small and isolated and small and isolated populations are susceptible to negative impacts from genetic drift and stochastic events. However, this alone is not enough to substantiate local concern for continued persistence on the GMUG NF.
Plant	Leadville milkvetch *Astragalus molybdenus*	Leadville milkvetch has been documented 12 times on the GMUG, as recently as 2009	Leadville milkvetch is not uncommon on the GMUG. The alpine habitat of this species is highly vulnerable to climate change, however the range of these plants extends into the subalpine, so climate change impacts alone do no constitute substantial concern for long-term persistence of this species. Illegal off-road vehicle use has been documented in several occurrences of this plant, however, most occurrences are not in areas of OHV activity. Thus, while risk factors for this species exist on the GMUG, these factors are not enough to substantiate local concern for continued persistence.
Plant	Wetherill's milkvetch *Astragalus wetherillii*	Wetherill's milkvetch has been documented four times on the GMUG as recently as 1999	There are no known threats to populations of Wetherill's milkvetch on the GMUG. This species benefits from active management and expected stability in the face of climate change.
Plant	Ritter's coraldrops *Besseya ritteriana*	Ritter's coraldrops have been documented 15 times on the GMUG, as recently as 1971	Ritter's coraldrops is found in abundant populations on the GMUG. The alpine habitat of this species is highly vulnerable to climate change, however the range of these plants extends into the subalpine, so climate change impacts alone do no constitute substantial concern for long-term persistence of this species.
Plant	Northern moonwort *Botrychium pinnatum*	Northern moonwort has been documented four times on the GMUG as recently as 1999	The GMUG occurrences are small and isolated and small and isolated populations are susceptible to negative impacts from genetic drift and stochastic events. However, this alone is not enough to substantiate local concern for continued persistence on the GMUG NF.
Plant	Least moonwort *Botrychium simplex*	Least moonwort has been documented three times on the GMUG, as recently as 2005	The GMUG occurrences are small and isolated and small and isolated populations are susceptible to negative impacts from genetic drift and stochastic events. However, this alone is not enough to substantiate local concern for continued persistence on the GMUG NF.
Plant	Capitate sedge *Carex capitata* ssp. *arctogena*	Capitate sedge has been documented three times on the GMUG and as recently as 2012	Capitate sedge is common where it occurs on the GMUG, with no known threats to long-term persistence within the plan area.

Category	Species	Evidence of Occurrence	Lack of Substantial Concern About the Species Capability to Persist over the Long Term
Plant	Wollyfruit sedge *Carex lasiocarpa*	Wollyfruit sedge has been documented on the GMUG seven times, as recently as 2008	Woolyfruit sedge is common where it occurs on the GMUG. Potential threats to this species are not documented at known occurrences on the GMUG, so there is nothing to substantiate concern for continued persistence on the GMUG.
Plant	Mud sedge *Carex limosa*	Mud sedge has been documented on the GMUG 10 times and as recently as 2005	While mud sedge is uncommon in Colorado, it is fairly common within the plan area, with 29 known occurrences and an estimated total population of ~935,000 plants. This fen species is at risk from impacts of hydrologic alteration; however due to population sizes on the GMUG this threat does not substantiate concern for long-term persistence on the plan area.
Plant	Nelson's sedge *Carex nelsonii*	Nelson's sedge has been documented 10 times on the GMUG, most recently in 1965	Nelson's sedge faces no known threats to long-term persistence on the GMUG.
Plant	Small-winged sedge *Carex stenoptila*	Small winged sedge has been documented twice on the GMUG, most recently in 2013	Small-winged sedge is known from 9 herbarium occurrences on GMUG; no population size data. This species faces no known substantial threats to long-term persistence.
Plant	Adobe hills thistle *Cirsium perplexans*	Adobe hills thistle has been documented five times on the GMUG, most recently in 2009.	Adobe hills thistle faces no known substantial threats to long-term persistence on the GMUG. This species is known to be unaffected by biocontrol of invasive thistles on the GMUG.
Plant	Brandegee's fumewort *Corydalis caseana* ssp. *brandegeei*	Brandegee's fumewort has been documented more than twenty times on the GMUG, most recently in 2010	Brandegee's fumewort faces no known substantial threats to long-term persistence in the plan area.
Plant	Weber's catseye *Cryptantha weberi*	Weber's catseye has been documented twice on the GMUG, most recently in 2009.	The GMUG occurrences of Weber's catseye are isolated and small and isolated populations are susceptible to negative impacts from genetic drift and stochastic events. However, this alone is not enough to substantiate local concern for continued persistence on the GMUG NF.
Plant	Thickleaf draba *Draba crass*	Thickleaf draba has been documented on the GMUG at least 35 times, most recently in 2014	Thickleaf draba is known from 35 occurrences on the GMUG. The alpine habitat of this species is highly vulnerable to climate change, however the elevational range of these plants extends into lower alpine (10,600 feet), suggesting this species may have more tolerance for warming temperatures than other alpine plants. There is no species-specific climate change vulnerability assessment for thickleaf draba.
Plant	Mountain draba *Draba rectifructa*	Mountain draba has been documented on the GMUG more than 25 times, most recently in 1999.	Mountain draba is fairly common on the plan area, and its habitats are projected to become more widespread due to climate change.

Category	Species	Evidence of Occurrence	Lack of Substantial Concern About the Species Capability to Persist over the Long Term
Plant	Showy draba *Draba spectabilis*	Showy draba has been documented at least 35 times on the GMUG, most recently in 2014	Showy draba is common on the GMUG and occurs in wide range of habitats. This species faces no known substantial threats to long-term persistence in the plan area.
Plant	Black Canyon gilia *Gilia penstemonoides*	Black Canyon gilia has been documented four times on the GMUG, most recently in 1998	The GMUG occurrences are small and isolated and small and isolated populations are susceptible to negative impacts from genetic drift and stochastic events. However, this alone is not enough to substantiate local concern for continued persistence on the GMUG NF.
Plant	Minute rush *Juncus bryoides*	Minute rush has been documented one on the GMUG in 1979	This species occurs at a single known location on the GMUG and small and isolated populations are susceptible to negative impacts from genetic drift and stochastic events. However, this alone is not enough to substantiate local concern for continued persistence on the GMUG NF.
Plant	Oregon biscuitroot *Lomatium bicolor* var. *leptocarpum*	Oregon biscuitroot has been documented 12 times on the GMUG, most recently in 1980.	Oregon biscuitroot faces no known substantial threats to long-term persistence in the plan area.
Plant	Mountain wild mint *Monardella odoratissima*	Mountain wild mint has been documented twice on the GMUG, most recently in 1998.	Mountain wild mint grows in a wide range of habitats and faces no known substantial threats to long-term persistence in the plan area.
Plant	Balsam groundsel *Packera paupercula*	Balsam groundsel has been documented once on the GMUG, in 1998.	This species occurs at a single known location on the GMUG and small and isolated populations are susceptible to negative impacts from genetic drift and stochastic events. However, this alone is not enough to substantiate local concern for continued persistence on the GMUG NF.
Plant	Purple-stem cliffbreak *Packera paupercula*	Purple-stem cliffbreak was documented once on the GMUG in 1998.	This species occurs at a single known location on the GMUG and small and isolated populations are susceptible to negative impacts from genetic drift and stochastic events. However, this alone is not enough to substantiate local concern for continued persistence on the GMUG NF.
Plant	Harbour's beardtongue *Penstemon harbourii*	Harbour's beardtongue has been documented 30 times on the GMUG, most recently in 2011	Harbour's beardtongue is known from at least 30 occurrences on the GMUG. The alpine habitat of this species is highly vulnerable to climate change, however the elevational range of these plants extends into lower alpine (10,500 feet), suggesting this species may have more tolerance for warming temperatures than other alpine plants. There is no species-specific climate change vulnerability assessment for Harbour's beardtongue.
Plant	Patch phacelia *Phacelia splendens*	Patch phacelia has been documented 20 times on the GMUG, most recently in 1998.	Patch phacelia is known from at least 20 occurences on the GMUG. This species faces no known substantial threats to long-term persistence in the plan area.

Category	Species	Evidence of Occurrence	Lack of Substantial Concern About the Species Capability to Persist over the Long Term
Plant	Western polypody *Polypodium hesperium*	Western polypody has been documented on the GMUG five times, most recently in 2003.	Western polypody faces no known substantial threats to long-term persistence in the plan area.
Plant	Rocky mountain polypody *Polypodium saximontanum*	Rocky mountain polypody has been documented eight times on the GMUG, most recently in 2011	Rocky mountain polypody faces no known substantial threats to long-term persistence in the plan area
Plant	King's clover *Trifolium kingii*	King's clover has been documented 11 times on the GMUG, most recently in 2005.	King's clover faces no known threats to long-term persistence on the GMUG; the species appears to tolerate moderate site disturbances and moderate to heavy grazing.
Plant	New Mexico cliff fern *Woodsia neomexicana*	New Mexico cliff fern has been documented 12 times on the GMUG, most recently in 2006.	New Mexico cliff fern is known from 12 sites on the GMUG. This species is found on large cliffs and breaks in lower spruce-fir and upper elevation Cool-Moist Mixed Conifer ecosystems. There is no evidence that this species relies on shade from spruce-fir forests and thus would be adversely affected by the ongoing spruce beetle outbreak. One location is in an area with rock climbing, but this alone is not enough to substantiate concern for long-term persistence in the plan area.

Table 3. Species considered that are Regional Forester's Sensitive Species for Region 2, but are not currently recommended as potential SCC

[Known to occur on the GMUG.]

Category	Species	Evidence of Occurrence	Rationale
Bird	Sage sparrow *Amphispizia belli*	Sage sparrow has been seen at least once on the GMUG in 1993	The Gunnison Basin Climate Change Vulnerability Assessment has an index score of "Increase Likely", with very high confidence, for this species. Occupies low elevation shrubland habitats primarily outside the Forest boundaries. Occurrence is peripheral. Only one documented occurrence on the GMUG National Forests. There is a very limited ability to influence this species through GMUG management actions.
Bird	Ferruginous hawk *Buteo regalis*	Ferruginous hawk is a non-breeding resident on the GMUG, passing through during migration	Observed on the Forest only during migration. No known substantial conservation concern on the GMUG. Gunnison's prairie dog colonies on and outside the Forest are closely monitored and managed for plaque by Colorado Parks and Wildlife. Ferruginous hawks have not been documented at any of the colonies within the GMUG National Forests boundaries.
Bird	Northern harrier *Circus cyaneus*	Northern harrier has been documented on the GMUG at least five times, most recently in 2009	This species is commonly observed year-round in grassland and shrubland habitats, although no nest sites have ever been documented on the Forest. No known substantial conservation concern on the GMUG National Forests.
Bird	Olive-sided flycatcher *Contopus cooperi*	Olive-sided flycatcher has been documented on the GMUG at least 29 times, most recently in 2009	Species is commonly observed/heard on the Forest and very-well documented from sources including the Bird Conservancy of the Rockies and the Colorado Breeding Bird Atlas I and II. Breeding habitat consists of late-successional coniferous forest with 0 - 39% canopy cover and fragmented landscapes with high-contrast edges (Verner 1980; McGarigal and McComb 1995). They may also use early-successional forest types, depending on availability of snags and remnant mature trees (Altman and Sallabanks 2012). These conditions are likely to increase at a landscape scale due to the spruce beetle disturbance, potentially supporting the rationale as to why the changed conditions are not a concern for the species in the plan area.

Category	Species	Evidence of Occurrence	Rationale
Bird	Black swift *Cypseloides niger*	Black swift has been documented on the GMUG at least 16 times, most recently in 2005.	The Gunnison Basin Climate Change Vulnerability Assessment determined this species to be "Presumed stable", with very high confidence, to climate change. Recent surveys on the adjacent Rio Grande National Forest have found those populations to be stable. No population information available for the GMUG, however there are no substantial conservation concerns identified locally.
Bird	American peregrine falcon *Falco peregrinus anatum*	American peregrine falcon has been documented twice on the GMUG, most recently in 2014.	Cliff habitat is exposed to recreation activities, primarily climbing. However, most of the known peregrine nest sites on the GMUG National Forests are in remote locations, including Wilderness areas, and are not exposed to recreation pressures, at least not currently. Where they have been, we have implemented timing restrictions to avoid activities at nest sites to prevent disturbance and nest abandonment. Compliance with Migratory Bird Treaty Act and associated conservation measures, including timing restrictions to protect nest sites, implemented at a project-level are one way this maintains persistence in the plan area. No known substantial conservation concern on the GMUG National Forests.
Bird	Bald eagle *Haliaeetus leucocephalus*	Bald eagle has been documented at least five times on the GMUG, most recently in 2000	Cottonwood trees along river corridors are used primarily as roosting trees on the plan area. Conifer snags are also used for roosting. No documented nest sites on the Forest at this time, although there are documented nest sites peripheral to the Forest. This species is not considered a specialist or limited to cottonwood habitat. Compliance with the Bald and Golden Eagle Protection Act and associated conservation measures, including timing restrictions to protect nest sites and winter range (often due to overlapping concerns of impacts to big game using the same winter range), implemented at a project-level are one way this maintains persistence and conservation of the species in the plan area. Bald eagles are expanding into areas on the GMUG National Forests, particularly the Gunnison River Corridor. They are commonly seen during the winter along major river corridors and in big game winter range areas. There is no clear evidence of a concern for persistence.
Bird	Loggerhead shrike *Lanius ludovicianus*	Loggerhead shrike has been documented once on the GMUG, in 2009	No known substantial conservation concern on the GMUG. Presence on the GMUG is peripheral to a larger, stable population.

Category	Species	Evidence of Occurrence	Rationale
Mammal	Hoary bat *Lasiurus cinereus*	Hoary bat has been documented at least four times on the GMUG, most recently in 2011	Individuals commonly detected locally during acoustic and mist netting bat surveys. Rangewide, windfarms are primary threat; none occur or are planned locally. Specific information regarding degree of local conservation concern unclear. This species is documented as fairly common in aspen and cottonwood habitats on the GMUG National Forests, and also common outside the Forest boundaries. This species is unlikely to be affected by white-nose syndrome due to its avoidance of caves as roost sites (NatureServe 2015). The landscape disturbance from spruce beetle, and associated salvage harvest, may affect habitat for this species, particularly roosting habitat; however hoary bats use a variety of forested habitat for roost sites and are not limited to spruce-fir forests but rather make use of lower elevation habitat types on the GMUG National Forests, particularly aspen and cottonwood.
Mammal	River Otter *Lontra canadensis*	River otter has been documented in five rivers or streams on the GMUG	There does not appear to be long-term threats to the persistence of river otter on the GMUG National Forests. This species is documented in the plan area where portions of major streams occur. Documented occurrences on and near the plan area include the following rivers: Uncompahgre, San Miguel, East, Taylor, North Fork Gunnison, and Gunnison Rivers. Except for these rivers, the majority of streams on the GMUG National Forests do not contain the key ecosystem characteristics to support the species (streams/riparian habitats with >50 cfs). The plan area does contains abundant high quality headwater streams that feed into the rivers and large streams that contain the species. Much of the species' range is outside the plan area, based on Colorado Parks and Wildlife Species Activity Mapping data. Where they occur on the GMUG, they have access to clean streams with high water quality and abundant fish populations. At this time, there are no threats (pollution, upland land-use practices, human encroachment, or agricultural practices) that would cause their habitat to become unfavorable on the GMUG National Forests.
Mammal	Pygmy shrew *Sorex hoyi*	Pygmy shrew has been documented twice on the GMUG, most recently in 1971	There does not appear to be substantial scientific information supporting threats to long-term persistence of Pygmy shrew in the plan area. Specific information regarding degree of local conservation concern unclear. The Gunnison Basin Climate Change Vulnerability Assessment determined this species to be "Presumed stable", with very high confidence, to climate change impacts. Habitat for this species is well distributed on the GMUG National Forests, including wet meadows and edges of wetlands in subalpine and upper montane conifer forests. Population trend information is not available for this species on the plan area. Shrew populations are generally cryptic and understudied. Good estimates of current population levels and fluctuations are rare; historical population sizes and fluctuations are essentially unknown (USDA Forest Service R2 Evaluation Form (https://www.fs.usda.gov/detail/r2/landmanagement/?cid=stelprdb5390116)
Plant	Colorado tansy-aster *Machaeranthera coloradoensis*	Colorado tansy-aster has been observed on the GMUG NFs at least 15 times, most recently in 2012	Colorado tansy-aster is not very rare on the GMUG. This species is limited to calcareous soils, but occurs in multiple ecosystems where these soils are present. Habitats used by this species are presumed stable in regards to climate change. Colorado tansy-aster has proved to be resistant to other potential threats on the GMUG (it is unpalatable and trample-resistant).

Potential Species of Conservation Concern

The following species (Table 4) appear to meet criteria to be Species of Conservation Concern on the GMUG. They are known to occur, and review of the best available scientific information indicates substantial concern regarding the ability of the species to persist over the long-term in the plan area.

This list may be revised over time. It may be revised during the development of the Forest Plan Revision and the Environmental Impact Statement that will analyze the revision. It may be revised after that as well. Triggers for additions or subtractions to the list are many:

- Changes in our scientific understanding of one or more species or their environments.
- Changes in the environment of one or more species, such as the introduction of disease or non-native species.
- Population declines of a given species, even if we don't yet understand the cause of the decline.
- An increase or decrease in the probability or severity of threat factors identified for one or more species.
- Documentation of a species presence in the plan area, if the species did not previously meet the "known to occur" criteria.

Table 4. DRAFT potential species of conservation concern and evaluation criteria

Category	Species	Evidence of Occurrence	Substantial Concern About the Species Capability to Persist over the Long Term
Birds	Northern goshawk *Accipiter gentilis*	Northern goshawk has been documented on the GMUG at least 214 times, as found in a records search in 2013.	Long-standing conservation concerns are present on the Forest, leading to a substantial concern about the species capability to persist in the plan area over the long-term. There is uncertainty/unknowns on how the landscape scale disturbance of spruce beetle will affect this species, its habitats, and its prey in the long-term. The rationale for this species being a R2 Sensitive Species is also applicable to the GMUG.
Birds	Boreal owl *Aegolius funereus*	Boreal owl has been documented on the GMUG 180 times, as found in a records search in 2013	Boreal owls are threatened by loss of nesting habitat and changes in prey base resulting from substantial beetle killed spruce-fir habitat on the Forest, resulting in a reduction of closed canopy habitat available. Dramatic change in spruce-fir landscape conditions suggest potential declining habitat trend and viability. Other risk factors that may affect species density and distribution are likely to include large-scale stand replacement fire, and large-scale insect outbreaks. The Gunnison Basin CCVA indicates that this species is “Highly Vulnerable” to changes resulting from changes in temperature and precipitation regimes. Colorado Natural Heritage Program S2 (Imperiled), Colorado Parks and Wildlife Species of Greatest Conservation Need Tier 2.
Birds	White-tailed ptarmigan *Lagopus leucurus*	There are seven CNHP EO’s for white-tailed ptarmigan on the GMUG, most recently from 2013	Long-standing conservation concerns are present on the Forest, leading to a substantial concern about the species capability to persist in the plan area over the long-term. The rationale for this species being a R2 Sensitive Species is also applicable to the GMUG. The Gunnison Basin Climate Change Vulnerability Assessment determined White-tailed ptarmigan to be highly vulnerable (with very high confidence) to climate change; there was a positive 90-day finding from USFWS on a petition to list this species as threatened or endangered under the ESA (the species is currently under review by USFWS to determine if listing is warranted); risk factors in the planning area including climate change, livestock grazing, recreation, mining, and limited range restricted to alpine areas.

Category	Species	Evidence of Occurrence	Substantial Concern About the Species Capability to Persist over the Long Term
Birds	Brown-capped rosy finch *Leucosticte australis*	There are at least four records for brown-capped rosy finch on the GMUG, as recent as 2008	Brown-capped rosy finch nests at a higher elevation than any other bird species in the U.S., its nests are in rocky terrain, snow fields and cliffs. The species has documented declines in population (according to the Audubon Christmas Bird Count) and is nearly endemic to Colorado. If climate change reduces snowfields and timberline moves up in elevation, a reduction in the species habitat is likely. Winter recreation may also be a threat to this species.
Birds	Lewis's woodpecker *Melanerpes lewis*	There are 12 records for Lewis's woodpecker on the GMUG, most recently from 2014	Lewis's woodpecker population declines have been documented by the Breeding Bird Survey and the Colorado Breeding Bird Atlas. There is also restricted range in the plan area, primarily limited to ponderosa pine and cottonwood habitats. This species has been documented expanding into riparian cottonwood habitats in the plan area, consistent with statewide observations. Cottonwood riparian areas are at risk due to a dominance of old trees and a loss of cottonwood regeneration, overgrazing by ungulates, changes in flood regimes and reduced water retention. This is a concern for this species due to their dependency on this habitat type for nesting; riparian cottonwood provides suitable nest sites due to the soft nature of decaying cottonwood and frequent rot conditions in cottonwood trees, and abundance of aerial insects in cottonwood riparian habitats.
Birds	Flammulated owl *Otus flammeolus*	There is one record for flammulated owl on the GMUG, from 2013	Flammulated owl has a small population size and restricted range in the plan area. Best available scientific information suggests that populations are declining due to loss of mature forest. Forest insect and disease outbreaks are affecting habitat by causing widespread coniferous tree mortality, affecting key ecosystem conditions for this species (mature coniferous forests with a mosaic of large-diameter, old trees). Wildfire risk is also a concern. Nesting has been documented in few places on the GMUG National Forests from past survey efforts.
Birds	Purple martin *Progne subis*	There are 237 records of purple martin from the GMUG, most recently in 2014	Purple martin has experienced documented population declines and has restricted range. The condition of the aspen habitat combined with very specific key ecosystem characteristics that this species depends on is at risk and in a declining trend, particularly within the areas of this species' occurrence and distribution in the plan area. Aspen stands where this species occurs on the GMUG National Forests are old, decaying and falling resulting in a decline in the trees used for nesting.

Category	Species	Evidence of Occurrence	Substantial Concern About the Species Capability to Persist over the Long Term
Birds	Brewer's sparrow *Spizella breweri*	There are seven records of Brewer's sparrow on the GMUG, most recently from 2013	Although common in the sagebrush ecosystem, best available science indicates there is a local and rangewide conservation concern about the Brewer's sparrow's capability to persist over the long-term due to: significant threats to habitat; documented long-term population declines within Region 2 and in Colorado; and restricted breeding range and habitat highly dependent on large, intact sagebrush habitat which is limited in the plan area. Trend estimates show significant decreases in relative abundance from 1966 to 2002. Detection frequencies during this period on routes in southern and eastern Colorado declined. Sauer et al. (2011) report significant declining trends of this species in the Southern Rockies/Colorado Plateau for the period 1966-2010. The sagebrush ecosystem on the GMUG National Forests is vulnerable to climate change (The Climate Change Vulnerability Assessment for Colorado BLM show that Brewer's sparrow may experience a "Greatly Increased" vulnerability" due to the impacts that changes in temperature and precipitation may have on habitat features), wildfire, conifer encroachment and habitat degradation from noxious and invasive weeds. This species is vulnerable to many of the same threats affecting the federally threatened Gunnison sage-grouse.
Fish	Bluehead sucker *Catostomus discobolus*	Bluehead sucker has been documented on the GMUG at least 12 times, most recently in 2017	Bluehead sucker is threatened by hybridization with non-native white sucker and water depletions due to developments. Long-term persistence is a concern for these reasons.
Amphibian	Boreal toad *Bufo boreas*	Boreal toads have been documented on the GMUG at least 16 times, as recently as 2017	On the Forest, the primary localized threats involve chytrid fungus. Other local concerns involve nonnative species, recreation management and potentially fire and timber management in localized areas. This species is "highly vulnerable" to negative impacts from changes in temperature and precipitation regimes. The declining population trend is a concern for viability and persistence over the long-term.
Amphibian	Northern leopard frog *Lithobates pipiens*	Multiple records, as recent as 2010	Northern leopard frog is at risk due to pollutant risk, chytrid fungus, and apparent declines.

Category	Species	Evidence of Occurrence	Substantial Concern About the Species Capability to Persist over the Long Term
Insects	Western bumblebee *Bombus occidentalis*	Western bumblebee has been recorded once on the GMUG, in 2016	This species has undergone a severe, range-wide population decline over the past decade, estimated at 40-90 percent. (Cameron et al. 2011). We do not have trend data for the Forest. Monitoring of this species on the Forest is done annually by Rocky Mountain Biological Laboratory scientists in the Gothic area of the Gunnison Ranger District. Their observations and data suggest that numbers are low, and rare compared to other bumblebee species. The Fish and Wildlife Service currently has this species under review for possible listing under the Endangered Species Act. The subspecies occidentalis found in the Rocky Mountain Region has declined about 70-99 percent since the late 1990s. The main cause of declines is thought to be the effects of a microsporidian Nosema bombi and an imported protozoan parasite from Europe. Other causes of decline include land use changes and habitat loss, changes in nectar flora, overgrazing, poorly timed fire in suitable nesting habitat, changes to temperature and precipitation regimes, competition with honey bees, and effects of pesticides especially persistent neonicotinoids. All of these threats operate on or adjacent/peripheral to the GMUG NF.
Insects	Yellow-dotted alpine (butterfly) *Erebia pawlowskii*	There are ten records of Yellow-dotted alpine on the GMUG as recently as 2003	Yellow-dotted alpine is at-risk due to climate change vulnerability of habitat and limited range in the plan area, leading to a substantial concern about the species capability to persist on the GMUG National Forests over the long-term.
Insects	White-veined arctic (butterfly) *Oeneis bore*	There are four records of White-veined arctic on the GMUG, as recently as 1996.	White-veined arctic is at risk on the GMUG and elsewhere due to limited habitat which is susceptible to the effects of climate change. Habitat for this species overlaps with the federally endangered Uncompahgre fritillary which is undergoing a documented decline in population trend. In addition, pollinators and insects in general are undergoing documented declines in abundance.

Category	Species	Evidence of Occurrence	Substantial Concern About the Species Capability to Persist over the Long Term
Insects	Nokomis fritillary, aka Great Basin Silverspot (butterfly) *Speyeria nokomis nokomis*	There is one record of Nokomis fritillary on the GMUG, from 1985. There are more recent, anecdotal sightings from lepidopterists who study other species of butterflies	Nokomis fritillary/Great basin silverspot is at risk on the GMUG Nqational Forests due to rarity, limited range, and risks to long-term persistence. Threats rangewide and on the GMUG National Forests include habitat loss, altered hydrology, climate change, and grazing. Based on the NatureServe database, colonies are known in Mesa, Montrose, and Ouray Counties; in close proximity to the GMUG. The Unaweep Canyon population in Mesa County is thought to be the largest and most secure population in Colorado. One record is known from a location on the GMUG, on the Uncompahgre National Forest between Telluride and Ouray. Throughout Colorado, colony presence has not been found in many places where they previously occurred. On January 12, 2016, there was a Substantial 90-day finding from USFWS on a petition to list this species as threatened or endangered under the ESA. The species is currently under review by USFWS to determine if listing is warranted.
Mammals	Townsend's big-eared bat *Corynorhinus townsendii*	There is one record of Townsend's big-eared bat on the GMUG, from 1955	Concern for the persistence of this species on the Forest stems from white-nose syndrome. Although not yet detected within Colorado, the disease continues to spread west. The Region and Forest have measures in place to protect bat roost and maternity sites from white-nose syndrome, but it remains possible for the disease to infect colonies despite these measures. This would cause a loss of 80 to 90 percent of the affected bat species over a broad area, including the loss of entire colonies. In addition, Climate change vulnerability assessments for the state indicate that this species may experience a slight increase in vulnerability due to changes in its physiological hydrological niche and physical habitat due to changes in temperature regimes and precipitation patterns.
Mammals	Gunnison's prairie dog *Cynomys gunnisoni*	There are multiple sightings of Gunnison's prairie dog on the GMUG, as recently as 2017 – this species is actively monitored by CPW	The main persistence concern for this species is sylvatic plague, which has the potential to wipe out entire colonies infected by it. Active management by CPW occurs annually on and off the plan area, however the threat remains. There are few colonies (most of which are small) and restricted range on the GMUG National Forests. The threat of sylvatic plaque is cause for substantial concern about the species capability to persist on the GMUG National Forests over the long-term.

Category	Species	Evidence of Occurrence	Substantial Concern About the Species Capability to Persist over the Long Term
Mammals	American marten *Martes americana*	American marten has been detected on the GMUG	he conservation concerns described as a rationale for this species being a R2 Sensitive Species applies to the GMUG National Forests. Large-scale loss of habitat from spruce-beetle is a concern over the long-term. Since this species depends on closed-canopy stands and large areas of mature or old growth interior forest habitat, given the extent of the landscape disturbance these specific ecosystem conditions are in a declining trend. One of their important prey species, red squirrels, is also significantly impacted, experiencing declines in spruce-fir forests due to the loss of cone-producing trees (food source for squirrels).
Mammals	Rocky mountain bighorn sheep *Ovis canadensis canadensis*	There are multiple records of Rocky Mountain bighorn sheep on the GMUG – this species is very visible and is actively monitored by CPW	Long-standing conservation concerns are present on the Forest, due to small population size and restricted range in the plan area, and due to risk of contact with domestic sheep and disease transmission. Lamb survival and population recruitment has been in a declining trend for some of the herds in the plan area. Lack of recruitment due to poor lamb survival is a cause of concern for long-term persistence.
Mammals	Desert bighorn sheep *Ovis canadensis nelsoni*	There is one desert bighorn herd range known to overlap the GMUG on the east side of the Uncompahgre Plateau - this species is actively monitored by CPW	Conservation concerns are present on the Forest, due to small population size and restricted range in the plan area, and due to risk of contact with domestic sheep and disease transmission. Lamb survival and population recruitment has been in a declining trend for some of the herds in the plan area. Lack of recruitment due to poor lamb survival is a cause of concern for long-term persistence.
Plant	Stonecrop gilia *Aliciella sedifolia*	Stonecrop gilia was last observed on the GMUG NFs in 2010 at 2 locations	Stonecrop gilia is a current Regional Forester's Sensitive Species and is very rare as evidenced by a G1S1 NatureServe Rank. Two of five total known populations of this species occur on the GMUG. The species is at risk in the plan area due to rarity and disturbance from peak bagging.
Plant	House's sandwort *Alsinanthe macrantha*	House's sandwort was last observed on the GMUG NFs in 2012 at 17 locations	House's sandwort is at risk in the plan area due to extreme vulnerability to climate change. Its alpine habitat is also rated as highly vulnerable to climate change. Impacts to the species and its habitat from climate change indicate substantial concern for the species' capability to persist over the long-term on the GMUG.

Category	Species	Evidence of Occurrence	Substantial Concern About the Species Capability to Persist over the Long Term
Plant	Crandall's rock-cress *Arabis crandallii*	Crandall's rock-cress was last observed on the GMUG NFs in 2010 at 3 locations.	Crandall's rock-cress is a G2 species that is extremely vulnerable to climate change. Species that have G/T1 or G/T2 NatureServe rankings are expected to be included as SCC unless it can be demonstrated and documented that the threats for those species are currently not present or relevant in the plan area (FSH 1909.12.12.52d). NatureServe notes that this species is threatened by habitat degradation and road construction. Many of the occurrences on the GMUG are proximate to roads and in sagebrush habitat which is altered.
Plant	Utah fescue *Argillochloa dasyclada*	Utah fescue was last observed on the GMUG NFs in 1998 at a single location.	Utah fescue is found on steep, loose clay shale slopes, and may be at risk due ongoing soil movement of these slopes associated with wildlife movement. Additionally, this species has only one known occurrence on GMUG. Species with single occurrences have inherent viability concerns because a single event can remove the species entirely from the Forest, particularly those with ongoing habitat alteration.
Plant	Green spleenwort *Asplenium trichomanes-ramosum*	Green spleenwort was last observed on the GMUG NFs in 1991 at a single location. Analysis of aerial imagery indicates that the spruce-fir cliff habitat where this species is found has already begun to be impacted by spruce beetle canopy loss. As such it is unreasonable to assume that the species is not extant on the GMUG.	Green spleenwort is found in shaded cliff habitats within spruce-fir forest. Spruce-fir forests on the GMUG are undergoing a major spruce beetle outbreak that has caused significant canopy loss across the plan area, altering this species' habitat. Significant habitat loss is an indication of substantial concern for the species' capability to persist over the long-term on the GMUG.
Plant	Gunnison milkvetch *Astragalus anisus*	Gunnison milkvetch was last observed on the GMUG NFs in 1998 at 26 locations	Gunnison milkvetch is a G2 species that is known to be impacted by trampling from concentrated wildlife and livestock on the GMUG. Species that have G/T1 or G/T2 NatureServe rankings, are expected to be included as SCC unless it can be demonstrated and documented that the threats for those species are currently not present or relevant in the plan area (FSH 1909.12.12.52d).
Plant	Naturita milkvetch *Astragalus naturitensis*	Naturita milkvetch was last observed on the GMUG NFs in 2010 at 4 locations	Naturita milkvetch is a G2 species that is rare on the GMUG, and is at-risk from effects of herbivory and hoof action from common wildlife species (mule deer) which the state manages with the goal of increasing populations and is extremely vulnerable to climate change.
Plant	Narrow-leaf grapefern *Botrychium lineare*	Narrow-leaf grapefern was last observed on the GMUG NFs in 1998 at 2 locations	Narrow-leaf grapefern has a G2 ranking and is known from two locations on the GMUG, with a total counted population of ten stems. One occurrence is adjacent to the Cottonwood Pass Road and may be negatively impacted by ongoing road paving.

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Plant	Peculiar moonwort *Botrychium paradoxum*	Peculiar moonwort was last observed on the GMUG NFs in 20[illegible] a single location	Peculiar moonwort is a current Regional Forester's Sensitive Species which is considered extremely vulnerable to climate change within the plan area. It has only one known occurrence on GMUG. Species with single occurrences have inherent viability concerns because a single event can remove the species entirely from the Forest, particularly for a species that is extremely vulnerable to climate change.
Plant	Arctic braya *Braya glabella var. glabella*	Arctic braya was last observed on the GMUG NFs in 2005 at 5 locations	Ar[illegible]aya is a current Regional Forester's Sensitive Specie which is uncommon on the plan area, at-risk due to illegal off-trail OHV use, and is extremely vulnerable to climate change and occurs in an alpine habitat which is rated as highly vulnerable to climate change.
Plant	Alpine braya *Braya humilis*	Alpine braya was last observed on the GMUG NFs in 1985 at 9 locations. Analysis of aerial imagery indicates that the alpine habitat where this species is found is unaltered since 1985. As such it is unreasonable to assume that the species is not extant on the GMUG.	Alpine braya is considered extremely vulnerable to climate change within the plan area, and grows in an alpine habitat which is rated as highly vulnerable to climate change. On the GMUG, this species is also at risk due to illegal off-road vehicle use.
Plant	Lesser panicled sedge *Carex diandra*	Lesser panicled sedge was last observed on the GMUG NFs in 20[illegible] 2 locations	Lesser panicled sedge is a current Regional Forester's Sensitive Species which is very rare on the GMUG (known from a single site). The location may be impacted by improper grazing and illegal off-road vehicle use. Species with single occurrences have inherent viability concerns because a single event can remove the species entirely from the Forest, particularly those already at-risk from habitat alteration.
Plant	Sierra hare sedge *Carex leporinella*	Sierra hare sedge was last observed on the GMUG NFs in 2012 at 4 locations	Sierra hare sedge occurs in fens which are currently being impacted by historic peat mining, ditching of wetlands and flooding of reservoirs, and illegal off-trail vehicle use. This species also occurs in alpine uplan[illegible]nd seeps in spruce-fir forests, where its alpine habitat is at risk due to high vulnerability to climate change.
Plant	Livid sedge *Carex livida*	Livid sedge was last observed on the GMUG NFs in 2005 at 10 location[illegible]	Livid sedge is a current Regional Forester's Sensitive Species which is known from a single occurrence on the GMUG. This species is subject to several threats at the regional level, at least one of which (moose trampling) may impact its single known GMUG location. Species with single occurrences have inherent viability concerns because a single event can remove the species entirely from the Forest, particularly for those already known to be at risk from habitat alteration.

Category	Species	Evidence of Occurrence	Substantial Concern About the Species Capability to Persist over the Long Term
Plant	Globe sedge *Carex perglobosa*	Globe sedge was last observed on the GMUG NFs in 2014 at 15 locations	Globe sedge is rare in the plan area, and its alpine habitat is highly vulnerable to climate change.
Plant	Canadian single-spike sedge *Carex scirpoidea*	Canadian single-spike sedge was last observed on the GMUG NFs in 2012 at 4 locations	Canadian single-spike sedge is rare on GMUG, and its long-term persistence on the GMUG is threatened due to impacts at several of its known fen sites from off-road vehicles, animal trails, and cattle grazing.
Plant	Green sedge *Carex viridula*	Green sedge was last observed on the GMUG NFs in 2002 at 3 locations	Green sedge is known from only three occurrences on the GMUG, and its habitat is impacted from a heavily used gravel road (dust and maintenance), illegal off-trail vehicle use, and improper grazing.
Plant	Osterhout's thistle *Cirsium osterhoutii*	Osterhout's thistle was last observed on the GMUG NFs in 2012 at 14 locations	Osterhout's thistle has a NatureServe ranking of T2. Species that have G/T1 or G/T2 NatureServe rankings are expected to be included as SCC unless it can be demonstrated and documented that the threats for those species are currently not present or relevant in the plan area (FSH 1909.12.12.52d). NatureServe notes that this species is impacted by bio-control for non-native thistles. At present we do not have evidence that threats to this species from bio-control do not operate on the GMUG, and as such it is included as SCC.
Plant	Reindeer lichen *Cladina arbuscula*	Reindeer lichen was last observed on the GMUG NFs in 2003 at 3 locations	Reindeer lichen is known from only three locations on the GMUG (all in fens), two of which are impacted by heavily-used county roads, which have bisected the fens and produce impacts from dust and road maintenance.
Plant	Willow hawthorn *Crataegus saligna*	Willow hawthorn was last observed on the GMUG NFs in 2001 at 22 locations	Willow hawthorn is known at two sites on the GMUG, and occurs in lower-elevation Cottonwood riparian habitats which are known to be highly impacted by anthropogenic stressors on the GMUG, and are considered highly vulnerable to climate change. Rarity, anthropogenic stressors, and threats from climate change indicate substantial concern for the long-term persistence of this species.
Plant	Dwarf alpine hawksbeard *Crepis nana*	Dwarf alpine hawksbeard was last observed on the GMUG NFs in 2012 at 10 locations	Dwarf alpine hawksbeard is an alpine plant, and its habitat is rated as highly vulnerable to negative impacts from climate change. Threats to this species and its habitat from climate change indicate substantial concern for the long-term persistence of this species.
Plant	Slender rock-break *Cryptogramma stelleri*	Slender rock-break was last observed on the GMUG NFs in 1999 at 7 locations	Slender rock-break has a low population on the GMUG and is rated by two different sources as extremely vulnerable to climate change. Rarity and threats from climate change indicate substantial concern for the long-term persistence of this species.

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Plant	Mountain bladder fern *Cystopteris montana*	Mountain bladder fern was last observed on the GMUG NFs in 2009 at 3 locations	Mountain bladder fern occurs on mossy, shaded, moist to wet rocks and cliffs within spruce-fir and spruce-fir aspen forest. On the GMUG, these forests on the GMUG are undergoing a major spruce beetle outbreak that has caused significant canopy loss across the plan area, altering this species' habitat and indicating substantial concern for the long-term persistence of this species.
Plant	Rockcress draba *Draba globosa*	Rockcress draba was last observed on the GMUG NFs in 2006 at a single location	Rockcress draba is rated as extremely vulnerable to climate change, and its alpine habitat is rated as highly vulnerable. This species is known from one site on the GMUG. Species with single occurrences have inherent viability concerns because a single event can remove the species entirely from the Forest, particularly those that are vulnerable to habitat alteration.
Plant	San Juan draba *Draba graminea*	San Juan draba was last observed on the GMUG NFs in 2013 at 15 locations	San Juan draba is a G2 species described as extremely vulnerable to climate change, similarly its alpine habitat is described as highly vulnerable to climate change. Species that have G/T1 or G/T2 NatureServe rankings are expected to be included as SCC unless it can be demonstrated and documented that the threats for those species are currently not present or relevant in the plan area (FSH 1909.12.12.52d). NatureServe notes that this species is vulnerable to off road vehicle damage and climate change. Several of the occurrences on the GMUG are in areas accessible to off road vehicles and climate change is a known threat to this species on the GMUG.
Plant	Yellowstone whitlow-grass *Draba incerta*	Yellowstone whitlow-grass was last observed on the GMUG NFs in 1998 at 2 locations	Yellowstone whitlow-grass occurs in alpine habitats rated highly vulnerable to climate change. This species is know from only two sites on the GMUG, one of which is at risk from illegal off-trail vehicles. Rarity and threats from climate change and off road vehicle use indicate substantial concern for the long-term persistence of this species.
Plant	Whitlow-grass *Draba malpighiacea*	Whitlow-grass was last observed on the GMUG NFs in 2012 at 2 locations	Whitlow-grass is a G1 species that is rated as extremely vulnerable to climate change. Its alpine habitat is also highly vulnerable to climate change. This species is known from only two occurrences on the GMUG. NatureServe identifies climate change as the primary threat to this species.
Plant	Woods draba *Draba oligosperma*	Woods draba was last observed on the GMUG NFs in 2014 at 15 locations	Woods draba occurs in alpine habitats that are rated as highly vulnerable to climate change. Several locations on the GMUG are also at-risk from illegal off-road vehicle use. Threats from climate change and risk of impact from off road vehicle use indicate substantial concern for the long-term persistence of this species.

Category	Species	Evidence of Occurrence	Substantial Concern About the Species Capability to Persist over the Long Term
Plant	Colorado Divide whitlow-grass *Draba streptobrachia*	Colorado Divide whitlow-grass was last observed on the GMUG NFs in 2014 at 15 locations	Colorado Divide whitlow-grass is rated as extremely vulnerable to climate change, and its alpine habitat is rated as highly vulnerable. Threats to this species and its habitat from climate change indicate substantial concern for the long-term persistence of this species.
Plant	Tundra draba *Draba ventosa*	Tundra draba was last observed on the GMUG NFs in 2006 at 3 locations	Tundra draba is known from only four locations on the GMUG. This species occurs in alpine habitats that are rated as highly vulnerable to climate change. Rarity and threats from climate change indicate substantial concern for the long-term persistence of this species.
Plant	Roundleaf sundew *Drosera rotundifolia*	Roundleaf sundew was last observed on the GMUG NFs in 201[redacted] a single location	Roundleaf sundew is a current Regional Forester's Sensitive Species known from a single site on the GMUG where it is found only in iron fens. The site where it occurs has been impacted in recent years by t[redacted]nauthorized ditches. Species with single occurrences have particular viability concerns because a single event can remove the species entirely from the Forest, particularly those known to already be impacted.
Plant	Low fleabane *Erigeron humilis*	Low fleabane was last observed on the GMUG NFs in 1995 at 4 locations. Analysis of aerial imagery indicates that the alpine habitat where this species is found is unaltered since 1995. As such it is unreasonable to assume that the species is not extant on the GMUG.	Low fleabane is rare on the GMUG, and rated as extremely vulnerable to climate change. Its alpine habitat is considered highly vulnerable to climate change. Rarity and threats from climate change indicate substantial concern for the long-term persistence of this species.
Plant	Wooly fleabane *Erigeron lanatus*	Wooly fleabane was last observed on the GMUG NFs in 2007 at 3 locations	Woolly fleabane is rare on the GMUG, and rated as extremely vulnerable to climate change. Its alpine habitat is considered highly vulnerable to climate change. This species is also at-risk from impacts of illegal off-road vehicle use at least one of its locations on the GMUG. Rarity and threats from climate change and off-road vehicles indicate substantial concern for the long-term persistence of this species.

Category	Species	Evidence of Occurrence	Substantial Concern About the Species Capability to Persist over the Long Term
Plant	Colorado wild buckwheat *Eriogonum coloradense*	Colorado wild buckwheat was last observed on the GMUG NFs in 2016 at 10 locations	Colorado wild buckwheat is a G2 species rated as highly vulnerable to climate change, and the alpine portion of its habitat is rated as highly vulnerable. NatureServe threats to this species include recreational damage, grazing, invasive species, small population sizes, and climate change. At present there is no evidence that these threats do not operate on the GMUG. Species that have G/T1 or G/T2 NatureServe rankings are expected to be included as SCC unless it can be demonstrated and documented that the threats for those species are currently not present or relevant in the plan area (FSH 1909.12.12.52d).
Plant	Altai cottongrass *Eriophorum altaicum var. neogaeum*	Altai cottongrass was last observed on the GMUG NFs in 2014 at 7 locations	Altai cottongrass is extremely vulnerable to climate change and is exposed to several risk factors on the GMUG, including snow compaction from winter ski grooming and effects from illegal off-trail vehicle use.
Plant	Chamisso's cottongrass *Eriophorum chamissonis*	Chamisso's cottongrass was last observed on the GMUG NFs in 2011 at 6 locations	Chamisso's cottongrass is a current Regional Forester's Sensitive Species which is uncommon within the plan area and subject to several threats at the regional level, at least one of which (illegal off-trail motorized vehicle use) is known to operate on the GMUG.
Plant	Slender cottongrass *Eriophorum gracile*	slender cottongrass was last observed on the GMUG NFs in 2011 at 6 locations	Slender cottongrass is a current Regional Forester's Sensitive Species known from six sites on the GMUG. Two of these sites occur in a permitted ski area and may be subject to habitat loss from snow compaction from winter grooming activities.
Plant	Variegated scouring rush *Hippochaete variegata*	Variegated scouring rush was last observed on the GMUG NFs in 2015 at 10 locations	Variegated scouring rush is impacted by competition from invasive species on the GMUG, and also at-risk due to impacts from herbicide spraying of invasive species, road construction, and ditch maintenance.
Plant	Large-flower globe-mallow *Iliamna grandiflora*	Large-flower globe-mallow was last observed on the GMUG NFs in 2012 at 6 locations	Large-flower globe-mallow is uncommon on the GMUG (six known occurrences), with evident population declines. These declines are likely caused by fire exclusion, as this species is thought to require disturbance with heat.
Plant	Simple kobresia *Kobresia simpliciuscula*	Simple kobresia was last observed on the GMUG NFs in 2012 at 2 locations	Simple kobresia is a current Regional Forester's Sensitive Species that is highly vulnerable to climate change and known from only two sites on the GMUG. One site is adjacent to a heavily travelled gravel road, and the second site shows noticeable effects of trampling by livestock and wild ungulates as well as tracks from illegal off-road vehicle use.

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Plant	Northern twayblade *Listera borealis*	Northern twayblade was last observed on the GMUG NFs in 2008 at 10 locations	Northern twayblade occurs in old-growth sprue-fir forests. Spruce-fir forests on the GMUG are undergoing a major spruce beetle outbreak that has caused significant canopy loss across the plan area, altering this species' habitat and greatly reducing the extent of this habitat on the GMUG.
Plant	Colorado desert-parsley *Lomatium concinnum*	Colorado desert-parsley was last observed on the GMUG NFs in 2004 at 2 locations	Colorado desert-parsley is a G2 species that is very rare on GMUG with only two known occurrences. This species is extremely vulnerable to climate change. NatureServe notes that this species is threatened by motorized recreation and trampling from domestic livestock. At present there is no evidence that these threats do not operate on the GMUG. Species that have G/T1 or G/T2 NatureServe rankings are expected to be included as SCC unless it can be demonstrated and documented that the threats for those species are currently not present or relevant in the plan area (FSH 1909.12.12.52d).
Plant	Colorado wood-rush *Luzula subcapitata*	Colorado wood-rush was last observed on the GMUG NFs in 2012 at 8 locations	Colorado wood-rush is rated as extremely vulnerable to climate change. It is known from eight sites on the GMUG, two of which are vulnerable to impacts from illegal off-road vehicle use. Vulnerability to climate change and risk from off-road vehicle use indicate substantial concern for the long-term persistence of this species.
Plant	Bog stitchwort *Minuartia stricta*	Bog stitchwort was last observed on the GMUG NFs in 2012 at 2 locations	Bog stitchwort occurs in alpine habitats which are highly vulnerable to climate change. This plant is known from only two occurrences on the GMUG. Rarity and threats from climate change indicate substantial concern for the long-term persistence of this species.
Plant	Tundra saxifrage *Muscaria monticola*	Tundra saxifrage was last observed on the GMUG NFs in 2010 at 11 locations	Tundra saxifrage occurs in rocky alpine peaks and ridges and snowmelt areas, which are considered highly vulnerable to climate change. Threats from climate change indicate substantial concern for the long-term persistence of this species.
Plant	Western mouse-tail *Myosurus cupulatus*	Western mouse-tail was last observed on the GMUG NFs in 1999 at a single location.	Western mouse-tail is known from only one site on the plan area and at risk of misidentification and unintentional destruction from invasive plant spraying. Species with single occurrences have inherent viability concerns because a single event can remove the species entirely from the Forest, particularly for those already at risk from the management of invasive species.

Category	Species	Evidence of Occurrence	Substantial Concern About the Species Capability to Persist over the Long Term
Plant	Grand Mesa penstemon *Penstemon mensarum*	Grand Mesa penstemon was last observed on the GMUG NFs in 2012 at 10 locations	Grand Mesa penstemon has a NatureServe rating of G2. NatureServe notes that this species is threatened by road maintenance, competition from invasive species, and the treatment of those species. At the present we do not have evidence that threats to this species from weed spraying along roadside habitats and/or increased undesirable disturbance along roadsides do not operate on the GMUG. Species that have G/T1 or G/T2 NatureServe rankings are expected to be included as SCC unless it can be demonstrated and documented that the threats for those species are currently not present or relevant in the plan area (FSH 1909.12.12.52d).
Plant	Adobe beardtongue *Penstemon retrorsus*	Adobe beardtongue was last observed on the GMUG NFs in 2010 at 2 locations	Adobe beardtongue is extremely rare on the GMUG, with only one known occurrence, and limited to undisturbed Mancos shale adobe hills and flats (a very rare habitat on the GMUG). These two factors constitute substantial concern for its long-term persistence in the plan area. Species with single occurrences have inherent viability concerns because a single event can remove the species entirely from the Forest, particularly those limited to a very rare habitat.
Plant	Avery Peak twinpod *Physaria alpina*	Avery Peak twinpod was last observed on the GMUG NFs in 2014 at 11 locations	Avery Peak twinpod is a G2 species rated as extremely vulnerable to climate change, and its alpine habitat is highly vulnerable to climate change. This species tolerates light disturbance, but several known locations on the GMUG are at risk from high levels of disturbance from illegal off-road vehicle use, which is identified as a threat in NatureServe.
Plant	Piceance bladderpod *Physaria parviflora*	Piceance bladderpod was last observed on the GMUG NFs in 2013 at a single location	Piceance bladderpod is a G2 species rated as extremely vulnerable to climate change, and very rare on the GMUG (one known occurrence). Species with single occurrences have particular viability concerns because a single event can remove the species entirely from the Forest. NatureServe identifies oil shale mining, oil and gas development, off road vehicles, and overgrazing as threats. At the present we do not have evidence that these threats do not operate on the GMUG. Species that have G/T1 or G/T2 NatureServe rankings are expected to be included as SCC unless it can be demonstrated and documented that the threats for those species are currently not present or relevant in the plan area (FSH 1909.12.12.52d).

Category	Species	Evidence of Occurrence	Substantial Concern About the Species Capability to Persist over the Long Term
Plant	Feathermoss *Pleurozium schreberi*	Feathermoss was last observed on the GMUG NFs in 2006 at 2 locatio	Feathermoss is very rare on the GMUG (2 occurrences with total known cover of ~5.3 sq. meters). One site where this species occurs is impacted by invasive species and an earthen dam and ditch that has led to the loss of mosses across the site.
Plant	Tundra buttercup *Ranunculus gelidus*	Tundra buttercup was last observed on the GMUG NFs in 2007 at 4 locations	Tundra buttercup is a current Regional Forester's Sensitive Species rated as extremely vulnerable to climate change, and its alpine habitat is rated as highly vulnerable to climate change. This species is rare on the GMUG (~80 plants across 4 occurrences). Rarity and threats from climate change indicate substantial concern for the long-term persistence of this species.
Plant	Lime-loving willow *Salix calcicola*	Lime-loving willow was last observed on the GMUG NFs in 2000 at a single location	Lime loving willow occurs in alpine habitats that are rated as highly vulnerable to climate change. This species is very rare on the GMUG, known from a single occurrence. Species with single occurrences have inherent viability concerns because a single event can remove the species entirely from the Forest, particularly those already threatened by habitat alteration from climate change.
Plant	Sphagnum *Sphagnum angustifolium*	Sphagnum was last observed on the GMUG NFs in 2017 at 2 locations	Sphagnum is a current Regional Forester's Sensitive Species known from 1-2 occurrences on the GMUG, and grows only in iron fens. One location on the GMUG may be affected by highway maintenance.
Plant	Girgensohn's sphagnum *Sphagnum girgensohnii*	Girgensohn's sphagnum was last observed on the GMUG NFs in 2003 at 2 locatio	Girgensohn's sphagnum is found only in iron fens and known from a single occurrence on the GMUG. This occurrence is ~50 meters below US 550 and at risk due to highway maintenance and winter chemical applications. Species with single occurrences have inherent viability concerns because a single event can remove the species entirely from the Forest, particularly those whose habitat is already altered by road maintenance and chemical application.
Plant	Water awlwort *Subularia aquatica*	Water awlwort was last observed on the GMUG NFs in 2006 at a single location	Water awlwort is extremely rare on the GMUG, known from a single site with two plants. This location is at risk due to potential snow compaction from snowmobiles and water table impacts from illegal off-road vehicle use. Species with single occurrences have inherent viability concerns because a single event can remove the species entirely from the Forest, particularly those that are already impacted by snow compaction and motorized recreation.
Plant	Hanging Garden sullivantia *Sullivantia hapemanii var. purpusii*	Hanging Garden sullivantia was last observed on the GMUG NFs in 2013 at 6 locations	While populations of hanging garden sullivantia are currently stable on the GMUG, this species is extremely vulnerable to climate change.

Category	Species	Evidence of Occurrence	Substantial Concern About the Species Capability to Persist over the Long Term
Plant	Sun-loving meadowrue *Thalictrum heliophilum*	Sun-loving meadowrue was last observed on the GMUG NFs in 2013 at a single location	Sun-loving meadowrue is a current Regional Forester's Sensitive Species, has a G2 ranking, and is rated as extremely vulnerable to climate change. This species is very rare on the GMUG, known from a single occurrence. Species with single occurrences have particular viability concerns because a single event can remove the species entirely from the Forest, particularly those that are already at risk from climate change.
Plant	Rothrock townsend-daisy *Townsendia rothrockii*	Rothrock townsend-daisy was last observed on the GMUG NFs in 2014 at 4 locations	Rothrock townsend-daisy is a G2 species. NatureServe notes that the threats to this species include off-road vehicle use and climate change. At the present we do not have evidence that threats to this species from illegal off-road vehicle use and climate change do not operate on the GMUG. Species with a NatureServe ranking G/T1 or G/T2 NatureServe rankings are expected to be included as SCC unless it can be demonstrated and documented that the threats for those species are currently not present or relevant in the plan area (FSH 1909.12.12.52d).
Plant	Little bulrush *Trichophorum pumilum*	Little bulrush was last observed on the GMUG NFs in 2008 at a single location	Little bulrush is known from a single fen site on the GMUG, which is subject to impacts (dust, road maintenance) from an adjacent, heavily-used gravel road. Species with single occurrences have inherent viability concerns because a single event can remove the species entirely from the Forest, particularly those whose habitat is already altered by roads and their maintenance.
Plant	Lesser bladderwort *Utricularia minor*	Lesser bladderwort was last observed on the GMUG NFs in 2015 at 22 locations	Lesser bladderwort is a current Regional Forester's Sensitive Species which is rare on the GMUG, and is highly vulnerable to illegal off-trail vehicles, ditching, improper livestock grazing, and water management practices, particularly drawing down and flooding of reservoirs.

Chapter 3. Sustainability

Environmental Sustainability of At-Risk Species

Environmental sustainability of At-Risk species on the GMUG is the ability of the At-Risk species to maintain or recover viable populations, as well as to function in ways that support interdependent species. This means that the At-Risk species survive, but also contribute to the survival of other species, by acting as food sources, or by manipulating their environment in ways that benefits other species (such as butterflies pollinating flowers).

At-Risk species are, almost by definition, of uncertain environmental sustainability.

Economic Sustainability of At-Risk Species

The economic value of At-Risk species has several aspects to it. The public sees value in the preservation of species perceived as rare or at-risk. This translates into support for programs aimed at protecting or recovering these species, which have economic impacts in the form of government/other employees who work with the species (both in the species' local environment, as well as off-site workers). Tourism to see these species and the environments that they depend upon also has economic impacts.

Protection of native species environments can translate into indirect economic value, such as decreased costs for cities to purify drinking water if water quality is better due to measure designed primarily to protect native fish.

There can be negative impacts as well, in the form of restrictions and regulations. Ranchers may need to spend more money on fences or move cattle more often, special use permits may be denied, and timber harvest volume can drop.

It can be possible for the economic aspects of the management of At-Risk species to be mixed. Some groups benefit and others see harm; the impacts to these groups can change or even swap as regulations increase or decrease over time due to changes in law and the policies of the government agencies that manage At-Risk species and their environments. Extractive users and tourism-related businesses often face such alternate impacts.

Overall, the economic sustainability of At-Risk species is strongly tied to the social perception of the value of these species as translated through policy, law, and consumer choice.

Social Sustainability of At-Risk Species

At-Risk species have social value. To some extent, the *social* sustainability of species can be the inverse of their perceived *environmental* sustainability. People may value species more because they are perceived as being rare or at-risk. Conversely, people may see the social value of species protection drop if they perceive that the costs of protecting the species are too high.

This makes for a mixed analysis of the social sustainability of At-Risk species. People will support the continued protection and management of such species, but may withdraw that

social support if the economic cost is perceived as being too high, or government regulation too restrictive.

Chapter 4. Current Forest Plan and its Context within the Broader Landscape

Existing Forest Plan Management Direction for At-Risk Species

An important part of the Forest planning process is to make determinations of the need to change management direction, referred as Need for Change. This is accomplished by assessing the current situation using existing information. The assessment process involves identifying planning area ecosystems, ecosystem drivers and stressors, trends, key ecosystem characteristics, risk factors, information gaps, and incorporates public review and input on issues and management concerns within the planning area. Collectively, this informs the Need for Change. This document details our initial review of existing information, and identifies our preliminary draft Need for Change.

Current Forest Plan Direction (The Amended Land and Resource Management Plan for the Grand Mesa, Uncompahgre and Gunnison National Forests, 1991)

- Wildlife and Fisheries Forest Plan direction is found at II-34 to II-42 (described current conditions as of 1991); and III-24 to III-33 (management direction). Management direction on forested structural diversity found on pages III-9a, III-9b and III-10 is an important in terms of wildlife habitat structural needs, and describes general direction and standards and guidelines on vertical and horizontal diversity. Refer to the Need for Change spreadsheet, which details out the specific forest plan direction identified above.

Forest direction goals for fish and wildlife were to:

- Increase National Forest System winter range carrying capacity for elk and deer
- Increase or improve wildlife habitat diversity
- Improve fisheries habitat
- Increase vertical and horizontal diversity

Forest Plan Consistency with External Plans for Wildlife and Other Species

Consideration of existing plans, and the potential need for consistency with them or with certain components, will inform the need for change. A partial list of existing pertinent plans include:

- Gunnison sage-grouse Rangewide Conservation Plan
- Candidate Conservation Agreement for the Gunnison sage-grouse Gunnison Basin population
- BLM's revised Resource Management Plans for Gunnison sage-grouse (ongoing)

- The USFWS has begun a recovery plan process for the Gunnison sage-grouse. Their timeline for that process and how that might fit with our Forest Plan Revision timeline is unclear, but both processes are likely on parallel timelines. As we engage USFWS and the public with our process, we will learn how these the Forest Plan Revision and the Gunnison sage-grouse recovery planning might inform each other.
- Uncompahgre fritillary butterfly recovery plan
- Southern Rockies Lynx Amendment
- Lynx Conservation Assessment and Strategy (2013 edition)
- Colorado Parks and Wildlife 2015 Strategic Plan, particularly Goal I – Conserve wildlife and habitat to ensure healthy sustainable populations and ecosystems. Other goals in the plan will likely inform several other Forest Plan components, especially outdoor recreation.

Issues in the Broader Landscape

Invasive and noxious nonnative plant species across the broader landscape across all land ownerships is increasing and an issue. Increasing recreation activity is a trend that should be included (tier to or integrate from the Recreation Assessment). Development and changes in private land uses adjacent to the planning area impacts At-Risk species.

Chapter 5. Need for Plan Changes to Respond to Assessing At-Risk Species Issues

The Need for Change Identified in the 2006 GMUG Comprehensive Evaluation Report

The Terrestrial Ecosystems section (3.4) of the 2006 GMUG Comprehensive Evaluation Report is largely still relevant today and will also drive the need for change in this revision effort, and relate to species of conservation concern in the following manner:

The Vegetation section in the 2006 GMUG Comprehensive Assessment contains identified needs for change that primarily relate to ecosystem diversity, and these are incorporated where appropriate in the ecosystems assessments. The following items are more specific to species diversity needs:

- Within the limits of agency authorities, the capability of the Plan area and overall multiple-use objectives, Plan components need to be adequate to provide appropriate ecological conditions to contribute to conserving federally listed threatened or endangered species. This applies to currently listed species and to species that may be listed in the future. The Plan needs to incorporate management direction from existing recovery plans and other conservation assessments/plans that currently exist for listed species into Forest Plan management direction (e.g., Canada lynx Conservation Assessment and Strategy, Uncompahgre fritillary Butterfly Recovery Plan). Plan language needs to recognize that conservation measures for additional species may be needed in the future and will be incorporated into future project and Plan-level decisions as necessary.

- The Forest Plan needs to incorporate management direction included in conservation plans for species-of-concern (Gunnison sage-grouse Rangewide Conservation Plan, Boreal Toad Conservation Plan and Agreement) to contribute to efforts to prevent listing of these species.
- The Forest Plan needs to direct the development and implementation of conservation strategies for species-of-concern that lack such strategies.
- Species-specific management considerations identified in the habitat/species evaluations need to be incorporated into Plan components for species-of-concern and species-of-interest.
- Desired conditions and management guidelines for wetlands and fens need to be developed.
- Desired conditions and management guidelines need to be developed for specialized habitats (i.e., alpine, Green Mountain formation, fens, acidic wetlands, dripping ledges, waterfalls, cliffs, caves, snags, coarse woody debris).
- Need to increase minimum guidelines for retention of large diameter snags, large diameter living trees to provide future snags, and coarse woody debris. Guidelines should vary by habitat type where necessary to reflect inherent differences between types. The selected silvicultural methods used in conifer forests need to insure retention of habitat features. There may need to be a shift from even-aged to uneven-aged harvest methods to maintain and develop these habitat features.
- The revised Plan should consider guidelines for maximum road and trail (both motorized and non-motorized) densities within a specified scale that should be allowed to minimize impacts of road/trail use on species-of-concern and species-of-interest that could potentially be affected.
- Old growth guidelines need to be adjusted to recognize differences in historic disturbance regimes and resulting landscape patterns of seral conditions, as well as species habitat requirements (see evaluations of plan components on species by habitat type discussions in the Species Diversity section of the CA).
- Need to develop monitoring for rare plants.
- Need to complete and maintain electronic Forest Service corporate databases for national, regional, and Forest use.
- Need to collaboratively manage for rare species information with Colorado Natural Heritage Program.

Needs for Change Identified for Current Revision Effort

- Integrate updated, current science on species to provide consistency with the most relevant, best available science and information. There should be a focus on incorporating wildlife conservation biology principles, and less prescriptive direction.
- Consider management direction for rare plants or insects (current Forest Plan does not have any).

- Consider whether specific habitat factors are declining on the Forest, and if so, should those declining habitat components drive monitoring targets?
- Identify plan components for species of conservation concern. Consider species groupings, or guilds, that capture commonalities. Develop Forest Plan components to protect or conserve the important common component/s to the group.
- Tie Forest Plan direction to the resource rather than to a piece of ground.
- Incorporate adaptive management: provide for flexibility with sideboards such that new science and information can be applied as it changes and evolves in the future. Incorporate desired conditions (or avoid undesirable conditions) and wildlife conservation biology principles to ensure that the Forest Plan stays relevant 10 – 20 years from now.

Consider addressing specifics issues with plan direction:

- Conflicts between livestock and big game; big game winter range concerns
  - There is a risk of contact and disease transmission between domestic and wild sheep in some areas of the planning area, particularly on the Ouray and Gunnison Ranger Districts. This is a risk factor on neighboring BLM lands, particularly in the Lake Fork of the Gunnison and Lake City area. Coordination and collaboration with BLM and Colorado Parks and Wildlife is essential. Existing risk assessments and efforts to reduce contact risk on adjacent BLM and Forests (Rio Grande NF) need review and thoughtful consideration because management decisions influence connected public land units. Where feasible, management consistency holistically across the landscape, regardless of land manager, is important to effectively address this issue. Review overlap of domestic sheep grazing allotments spatially and temporally with wild sheep ranges and current grazing management. A Forest-wide risk assessment is needed to inform management direction in the new forest plan on this issue.
  - Conflicts/competition between big game and livestock for forage was evaluated in the 1991 Amended LRMP. Forage availability on big game winter ranges, areas used in transition in spring and fall, and within Gunnison sage-grouse designated critical habitat (overlaps a large proportion of big game winter range), is a current concern. Management recommendations for vegetation treatments that maximize benefits for multiple uses and ecosystem services should be identified. Desired conditions include maintaining or increasing forage production, where capable (capability could be determined at site-specific treatment level but not in the Forest Plan) to maintain and enhance ecosystem resiliency and forage production for livestock and big game. Forest Plan direction should have clear direction for desired conditions within Gunnison sage-grouse critical habitat consistent with recovery objectives.
  - Consider identifying specific areas not suitable for winter travel (motorized over-the-snow travel) in order to address conflicts with big game winter range. Known areas of big game winter range conflict with winter travel are the Flat Top Mountain and Almont Triangle areas on the Gunnison Ranger District.

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Appendix 1. Threatened, Endangered, Proposed and Candidate species ecosystems and habitat characteristics

Uncompahgre Fritillary Butterfly (*Bolaria acrocnema*)

Uncompahgre fritillary butterfly (UFB) is narrow endemic, restricted to isolated alpine habitats in the San Juan Mountains of southwestern Colorado (NatureServe 2015). Uncompahgre Peak (Uncompahgre NF – Gunnison Ranger District) and Redcloud Peak were the only two colonies known at the time of listing and recovery planning. Shortly after completion of the Recovery Plan, an additional colony was discovered. Eight other colonies were discovered in subsequent years (USDI Fish and Wildlife Service 2009).

Currently, eleven known colonies exist - three are quantitatively monitored with line transects, two of those three are on the GMUG, and the remaining eight are monitored only for presence.

Four of the known 11 colonies occur within the planning area (including one which straddles the boundary between the GMUG and RGNF). Quantitative population data is not recorded for two of these sites; therefore, abundance and trend information for populations within the planning area as a whole has not been identified. In the two locations on the GMUG that are quantitatively sampled, the most recent estimated recruitment (from the 2016 field season) was 2,950. This was a significant increase from the 2015 recruitment estimate of 925.

For all three quantitatively sampled colonies combined, the 2016 population estimate is 6,037. Abundance during 2016 rebounded slightly from the historically low estimates recorded in 2015 which were the lowest since studies began in 2003 (Alexander and keck 2017). Alexander and Keck (2017) are still in the process of statistically analyzing the long term trends but do not have statistically valid data yet.

Based on the monitoring report for the 2016 field season (Alexander and Keck 2017) the ongoing qualitative monitoring of the 11 confirmed populations documented population persistence at only nine of the 11 known colonies. Persistence has not been documented at Rio Grande Pyramid colony for four years and likewise for nine years at the Machin Lake colony of the Canyon Diablo population. The lack of confirmation of the UFBs at the Rio Grande Pyramid colony for four years, Machin Lake colony for seven years and the Cinnamon Pass colony for over a decade may indicate that some populations may be extirpated.

In 2016, only four individuals total were observed at the Baldy Chato North colony, and none were observed at Baldy Chato South. Nine visits were conducted at this site during the 2016 field season, which has been consistently monitored for the last 13 years. The low number of individuals observed is concerning. This is a significant decline for this colony compared to all previous years of consistent monitoring.

All known UPB populations are associated with large patches of snow willow (Salix nivalis) above 12,000 feet, which provide food and cover. The species is found primarily on northeast-facing slopes, which are the coolest and wettest microhabitat available in the San Juan Mountains.

Females lay their eggs on snow willow, which is also the larval food plant, while adults take nectar from a wide range of flowering alpine plants (USDI Fish and Wildlife Service 2015). Adults fly about late July into August. Flight is possible only in warm sunny weather.

It is known that illegal collecting has taken place in the past at some well-known locations.

In recognition of this potential threat to UFB from livestock grazing, the U.S. Forest Service avoids sheep grazing within UFB colonies altogether, or allows only trailing through the colonies and suitable habitat, but not bedding or long-term grazing. The only colony on the GMUG with sheep trailing on a reoccurring (but inconsistent) basis is the Uncompahgre Peak colony on the Gunnison Ranger District (USDI Fish and Wildlife Service 2009). No domestic sheep trailing was observed at any of the colonies in 2016.

The lack of evidence for persistence at some subpopulations may indicate that these populations are not always stable or that population numbers are relatively low and that the emergence period is relatively short. (Alexander and Keck 2015).

Climate change remains a concern due to the relatively limited habitat size and high elevation of this species. Climate change may be affecting the developmental timing of UFBs which may account for some shifts in persistence. Events such as the early UFB emergence date in 2012 may be providing additional anecdotal evidence (Alexander and Keck 2015). Existing and predicted climate trends may also present implications for other alpine system pollinators. Future monitoring and assessment is needed to evaluate the threat of climate change on this federally endangered species (Alexander and Keck 2015).

Threats listed in the final listing rule and the Recovery Plan include trampling of the UFB and its habitat by humans and livestock, collecting, lack of regulatory mechanisms, adverse climatic changes, small population size, and low genetic variability (USDI Fish and Wildlife Service 2009). While most known UFB populations are in remote areas, potential threats to the species' persistence still exist. Increasing recreational traffic, including off-trail use, domestic livestock grazing or trailing, grazing by wild ungulates and the potential for global climate change all pose problems to habitat necessary to the species' recovery. Illegal collecting may also continue at some colonies although none has been documented recently (Alexander and Keck 2015).

This species is endemic to the central San Juan Mountains of Colorado. To put this into perspective, from one high point in the La Garita Wilderness on the Gunnison Ranger District, all known colonies that exist for this species in the entire world can be seen. As such, this species is highly susceptible because its entire geographic area is exposed to these threats and risk factors. Within its range, the few colonies that persist are small and dependent on very specific microhabitat characteristics that may be susceptible to climate change influences.

Gunnison Sage-Grouse (Centrocercus minimus)

Historically, the range of the Gunnison sage-grouse included parts of central and southwestern Colorado, southeastern Utah, northwestern New Mexico and northeastern Arizona. Gunnison sage-grouse currently occur in seven populations in southwestern Colorado and southeastern Utah (79 FR 69312-69363).

Gunnison sage-grouse populations associated with the planning area include the Gunnison Basin, Crawford, San Miguel Basin, and Pinon Mesa populations. Occupied designated critical habitat of these populations covers approximately 611,244 acres, of which approximately 97,494 acres from the Gunnison Basin, San Miguel Basin, and Pinon Mesa populations coincides with lands managed by the GMUG National Forests. The majority of occupied critical habitat within the planning area occurs on the Gunnison Ranger District within the Gunnison Basin population.

Status of these populations is described by the USFWS (79 FR 69312-69363). Population trends for Gunnison sage-grouse are estimated using Colorado Parks and Wildlife lek count data. Three-year moving averages of high male counts are used to assess the sustainability of Gunnison sage-grouse and consist of the average of actual high male counts for a three-year period. For example, the 3-year moving average of 2016 is calculated based on the total high male count for the years 2014, 2015, and 2016.

There are 15 known leks (breeding sites) in the planning area, 14 overlapping with the Gunnison Ranger District and one on the Grand Valley Ranger District. Of the 14 leks on the Gunnison Ranger District, 12 are active, one is inactive and one is historic. The one lek on the Grand Valley Ranger District has a status of historic.

For the year 2016, high male counts on leks coinciding with the GMUG National Forests, Gunnison Ranger District, were 33% of the total Gunnison Basin population. On average during the period from 2008 to 2016, high male counts on active GMUG National Forests leks were 31.6% of the total Gunnison Basin population.

Sage-grouse are considered obligate users of sagebrush and require large, contiguous areas of sagebrush across the landscape for long-term survival. Several species of sagebrush provide the specific food, cover, and reproduction habitats critical for sage-grouse survival (USDI Fish and Wildlife Service 2014c).

In Colorado, strutting occurs from mid-March through late May, depending on elevation (Rogers 1964 cited in GSRSC 2005). Territories on leks are established by males in early March, but the timing can vary annually by 1-2 weeks depending on weather condition, snow melt, and day-length.

Approximately 85% of nests occur within 4 miles of lek sites. Nests typically occur on the ground at the base of live sagebrush. Hatching begins around mid-May and usually ends by July. Most eggs hatch in June, with a peak between June 10 and June 20. (Patterson 1952 cited in GSRSC 2005).

Intermixing of broods and flocks of adult birds is common with the advent of fall, and birds move from riparian areas to sagebrush-dominated landscapes that continue to provide green forbs. Fringed sagebrush is often a transitional food as grouse shift from summer to winter diets (Schroeder et al. 1999 cited in GSRSC 2005).

GRSG winter range in Colorado varies according to snowfall, wind conditions, and suitable habitat (Rogers 1964 cited in GSRSC 2005). Sage-grouse may travel short distances or many miles between seasonal ranges. Movements in fall and early winter (September-December) can be extensive with some movements exceeding 20 miles. During severe winters sage-grouse depend on very tall sagebrush, which is exposed even above deep snow, providing a

consistently available food source. Sage-grouse forage exclusively on sagebrush leaves during winter months (GSRSC 2005).

Within the planning area, the majority of occupied critical habitat is sagebrush, but the area also includes cottonwood and herbaceous riparian, juniper, oak, aspen, and coniferous forest vegetative communities. Typical sagebrush types include mountain big sagebrush, Wyoming big sagebrush and black sage. Mountain big sagebrush occurs at higher elevations and at lower elevations containing moist sites. Wyoming big sagebrush is typically found at lower elevations and on drier sites. Black sage is also found on dry gravel soils in lower elevations.

Aspect is an important factor influencing soil moisture content and the distribution of big sagebrush, with mountain big sagebrush often occurring on more northerly slopes and Wyoming big sagebrush occurring on more southerly slopes. Conservation efforts to maintain and increase sizes and connectivity of intact sagebrush patches and riparian areas is important to provide connectivity within and between populations and to support life history requirements of the species.

There are many perennial, intermittent and ephemeral streams within the sagebrush-steppe habitat that provide important brood rearing habitat. Many of these streams have sagebrush encroachment as a result of down-cutting and entrenchment of the stream channel, leading to contraction of the riparian zone (GSRSC 2005).

The Gunnison sage-grouse Rangewide Steering Committee (CSRSC 2005) identified the following conservation objectives and strategies specific to USFS management of lands (page and section references below are applicable to Gunnison sage-grouse Rangewide Conservation Plan (CSRSC 2005)):

- Incorporate grazing management practices (such as those presented on page 212) for both cattle and sheep that are compatible with, or enhance, GUSG habitat (see Appendix H) on federal and state lands during the permit renewal process, or when monitoring indicates need.
- Protect habitat from permanent loss, and evaluate development potential and protection needs within vacant/unknown and potential habitats: “Obtain fee title to important habitats through land purchase, land exchanges, or mineral rights acquisition” (pg. 223).
- Implement recommendations from rangewide strategy on “Human Infrastructure: Powerlines, Other Utility Corridors, Wind Turbines, Communication Towers, Fences, and Roads” (pg. 225).
- Implement recommendations on “Information and Education” (pg. 230) and “Lek Viewing” (pg. 231).
- Implement recommendations on “Noxious and Invasive Weeds” (pg. 232).
- Implement recommendations on “Oil & Gas Development and Mining” (pg. 233).
- Implement recommendations on “Pesticides” (pg. 239).
- Implement recommendations on “Predation” (pg. 243).
- Implement recommendations on “Recreational Activity” (pg. 245).
- Implement recommendations on “Weather/Drought” (pg. 253).

- Implement timing restrictions provided in rangewide "Human Infrastructure: Powerlines, Other Utility Corridors, Wind Turbines, Communication Towers, Fences, and Roads" strategy (pg. 225), and "Oil & Gas and Mining" strategy (pg. 233).
- Implement recommendations from rangewide strategy on "Predation" (pg. 243).
- Conduct inventory of vacant/unknown habitat areas using inventory technique developed at a rangewide level ("Habitat Monitoring" strategy, pg. 220).
- Search for new or unknown existing leks utilizing survey methodology developed at rangewide level ("Habitat Monitoring" strategy, pg. 220).
- Map GUSG seasonal habitats in a GIS as defined per "Habitat Monitoring" rangewide strategy, Objective 1, Strategy #7 (see pg. 220).
- Evaluate suitability of vacant/unknown and potential habitat classification and determine if habitat improvement techniques may enhance suitability.
- Mapping and condition assessment of sage-grouse habitats is important, so that habitat below recommended guidelines can be identified and improved. Targeting brood-rearing habitat may be an effective approach in terms of increasing chick survival and population recruitment. Habitat improvement focusing on increasing the forb component of deficient early brood-rearing habitat or wet meadow/riparian habitats for late brood-rearing are likely to be very beneficial.

The FWS identified the following five Primary Constituent Elements as necessary for the conservation and recovery of the species (79 FR 69191-69310):

Landscape Specific Primary Constituent Element Primary Constituent Element 1

Extensive sagebrush landscapes capable of supporting a population of Gunnison sage-grouse. In general, this includes areas with vegetation composed primarily of sagebrush plant communities (at least 25 percent of the land is dominated by sagebrush cover within a 0.9-mi (1.5-km) radius of any given location), of sufficient size and configuration to encompass all seasonal habitats for a given population of Gunnison sage-grouse, and facilitate movements within and among populations. These areas also occur wholly within the potential historical range of Gunnison sage-grouse (GSRSC 2005, pp. 32–35, as adapted from Schroeder et al. 2004, entire).

Seasonally Specific Primary Constituent Elements Primary Constituent Element 2

Breeding habitat composed of sagebrush plant communities that, in general, have the structural characteristics within the ranges described in Table 5. Habitat structure values are average values over a project area. Breeding habitat includes lek, nesting, and early brood-rearing habitats used typically March 15 through July 15 (GSRSC 2005, p. H–3). Early brood-rearing habitat may include agricultural fields.

Table 5. Breeding habitat structural guidelines for Gunnison sage grouse

Vegetation variable	Amount in habitat
Sagebrush Canopy Cover	10–25 percent
Non-sagebrush Canopy Cover b	5–15 percent
Total Shrub Canopy Cover	15–40 percent
Sagebrush Height	9.8–19.7 in (25– 50 cm)
Grass Cover	10–40 percent
Forb Cover	5–40 percent
Grass Height	3.9–5.9 in (10– 15 cm)
Forb Height	2.0–5.9 in (5–15 cm)

[a] Derived from GSRSC 2005, p. H–6, which depicts structural values for both arid and mesic areas in Gunnison sage-grouse habitat. Here we provide the full range of these structural values to account for this variation.

[b] Includes shrubs such as horsebrush (*Tetradymia* spp.), rabbitbrush (*Chrysothamnus* spp.), bitterbrush (*Purshia* spp.), snakeweed (*Gutierrezia sarothrae*), greasewood (*Sarcobatus* spp.), winterfat (*Eurotia lanata*), Gambel's oak (*Quercus gambelii*), snowberry (*Symphoricarpos oreophilus*), serviceberry (*Amelanchier* spp.), and chokecherry (*Prunus virginiana*).

Primary Constituent Element 3

Summer-late fall habitat composed of sagebrush plant communities that, in general, have the structural characteristics within the ranges described in Table 6.

Habitat structure values are average values over a project area. Summer-fall habitat includes sagebrush communities having the referenced habitat structure values, as well as agricultural fields and wet meadow or riparian habitat types. Wet meadows and riparian habitats are also included qualitatively under PCE 5 below.

Table 6. Summer-late fall habitat structural guidelines for Gunnison sage grouse (a, b)

Vegetation variable	Amount in habitat
Sagebrush Canopy Cover	5–20 percent
Non-sagebrush Canopy Cover	5–15 percent
Total Shrub Canopy Cover	10–35 percent
Sagebrush Height	9.8–19.7 in (25– 50 cm)
Grass Cover	10–35 percent
Forb Cover	5–35 percent
Grass Height	3.9–5.9 in (10– 15 cm)
Forb Height	1.2–3.9 in (3–10 cm)

[a] Structural habitat values provided in this table do not include wet meadow or riparian habitats. Therefore, we address these habitat types under Primary Constituent Element 5 below.

[b] Derived from GSRSC 2005, p. H–7, which depicts structural values for both arid and mesic areas in Gunnison sage-grouse habitat. Here we provide the full range of these structural values to account for this variation.

[c] Includes shrubs such as horsebrush (*Tetradymia* spp.), rabbitbrush (*Chrysothamnus* spp.), bitterbrush (*Purshia* spp.), snakeweed (*Gutierrezia sarothrae*), greasewood (*Sarcobatus* spp.), winterfat (*Eurotia lanata*), Gambel's oak (*Quercus gambelii*), snowberry (*Symphoricarpos oreophilus*), serviceberry (*Amelanchier* spp.), and chokecherry (*Prunus virginiana*).

Primary Constituent Element 4

Winter habitat composed of sagebrush plant communities that, in general, have sagebrush canopy cover between 30 to 40 percent and sagebrush height of 15.8 to 21.7 in (40 to 55 cm).

These habitat structure values are average values over a project area. Winter habitat includes sagebrush areas within currently occupied habitat that are available (i.e., not covered by snow) to Gunnison sage-grouse during average winters (GSRSC 2005, p. H–3).

Primary Constituent Element 5

Alternative, mesic habitats used primarily in the summer-late fall season, such as riparian communities, springs, seeps, and mesic meadows (GSRSC 2005, pp. 30, H–7; Schroeder et al. 1999, p. 4; Connelly et al. 2000a, p. 980).

The most substantial current and future threats to the Gunnison sage grouse is habitat loss and decline due to human development and associated infrastructure (USDI Fish and Wildlife Service 2014c). Other threats impacting Gunnison sage-grouse to a lesser extent include overgrazing, mineral development, pinyon-juniper encroachment, fences, invasive plants, wildfire, large-scale water development, predation (primarily associated with human disturbance and habitat decline) and recreation. The fragmented nature of existing habitat amplifies the negative effects of these other threats (USDI Fish and Wildlife Service 2014c). Climate change influences are likely to exacerbate these threats. In the sagebrush ecosystem, climate change is anticipated to increase vulnerability to invasive species and pinion-juniper encroachment. Climate change may also increase vulnerability to fire and drought. The Gunnison sage-grouse is considered highly vulnerable to adverse effects of climate change, based on the Gunnison Basin Climate Change Vulnerability Assessment (Neely, et al. 2011).

Gunnison Basin population – The GSRSC (2005) identified primary issues for the Gunnison Basin population, including protection of habitat from permanent loss, grazing management, habitat enhancement and restoration, management of lek viewing, and the importance of the population for research and augmentation efforts. The U.S. Fish and Wildlife Service identified several threats to sage-grouse within the Gunnison Basin population. These include historic modification of habitat leading to habitat loss and fragmentation, roads and trails, domestic grazing and wild ungulate herbivory, invasive plants and climate change.

In 2015, a programmatic biological assessment was completed through an interagency collaboration between the GMUG National Forests, BLM Gunnison Field Office, and the National Park Service Curecanti National Recreation Area. The programmatic addressed riparian and wet meadow habitat restoration (erosion control) and non-native plant species treatment activities in sage-grouse habitat. This project addresses these threats throughout the Gunnison Basin by controlling noxious and invasive weeds and restoring proper hydrologic function.

The main threat described by the GSRSC (2005) is loss and fragmentation of habitat, especially due to residential development. Since the development of the Gunnison sage-Grouse Rangewide Conservation Plan (GSRSC 2005), certain actions have transpired that address this threat. Many private land owners have enrolled property in conservation easements, protecting large areas of private ranchland adjacent to public lands from development. Many landowners also enrolled in the Candidate Conservation Agreement with Assurances prior to the 2014 listing decision. Additionally, Gunnison County adopted land use resolutions that require biologist review, in consultation with Colorado Parks and Wildlife, of proposed developments on private land within Gunnison sage-grouse habitat.

Other factors that require attentive management are roads and trails, livestock grazing, exotic plant invasions, special use permit activities, and recreation. Recreation and special use permit activities, in particular, have the potential to serve as vectors for weed transmission and expansion, especially along roads, trails, and powerline corridors.

San Miguel Basin – Primary threats to this population are natural gas development, habitat loss from sagebrush removal, pinon-juniper encroachment in some areas, development and subdivision, poor habitat quality, and effects of drought (GSRSC 2005). There is a large amount of private land used by this population. Cooperating with private land owners in conservation efforts is key to maintaining this population.

Pinon Mesa – The primary issues for this population are habitat loss from development and subdivision, declines in habitat quality, genetic isolation and associated lack of genetic diversity, and the need to increase acreages of occupied habitat by establishing connectivity with other suitable or potentially suitable habitats, and with other populations (GSRSC 2005). Historically, connectivity to other populations probably occurred along the Uncompahgre Plateau south and west towards the San Miguel Basin (GSRSC 2005). The Grand Valley Ranger District has implemented treatments to reduce pinon-juniper in unoccupied sage-grouse habitat on the north portion of the Uncompahgre Plateau. Additional treatments to reduce pinon-juniper encroachment in unoccupied habitat and future planned riparian/wet meadow restoration treatments will increase habitat suitability for future sage-grouse occupancy and help establish connectivity.

Crawford – The primary issues for this population are habitat enhancement and restoration, expansion of occupied habitat, and protection of habitat from permanent loss, especially in potential areas of expansion (GSRSC 2005). Habitat conditions are affected by pinon-juniper invasion and expansion into sagebrush and grass areas that historically consisted of more open conditions. Past management activities are believed to have contributed to pinon-juniper encroachment and late-seral shrub growth, specifically serviceberry and oakbrush (GSRSC 2005). Over the last ten years habitat work on public and private lands has occurred, and continues to occur, including riparian and wet meadow habitat restoration. The United States Geological Service has implemented telemetry research using GPS collar technology within this population which informs conservation efforts. One threat that is becoming more apparent is the disturbance during the lek and nesting seasons from shed hunters; lek counters have observed people on foot and horseback going across leks (Garrison pers. comm. 2017). One factor influencing this is that the lek sites occur along a main road accessing the area (Garrison pers. comm. 2017).

Forest Service lands that coincide with this population are classified as unoccupied habitat. Currently there is no overlap of occupied habitat on the GMUG National Forests for this population. The GMUG National Forests may have a role in contributing to restoration and expansion of occupied habitat by evaluating opportunities for treatments within unoccupied habitat areas.

Yellow-billed Cuckoo (Western) (*Coccyzus americanus*)

In the United States the range of the western yellow-billed cuckoo includes the area west of the Continental Divide, south through Montana, Wyoming, Colorado, and along the watershed divide between the upper and middle Rio Grande and Pecos Rivers in New

Mexico and Texas, south to Big Bend in southwestern Texas, and extending to the States of the west coast (79 FR 59992-60038).

In Colorado, yellow-billed cuckoos were historically noted as rare summer visitors, primarily on the eastern plains, but also in Middle Park and on the western slope at Grand Junction (Sclater 1912, in Wiggins 2005). Bailey and Niedrach (1965 in Wiggins 2005) considered yellow-billed cuckoos an uncommon summer resident, mainly on the eastern plains and into the Front Range, with a few breeding records from Grand County and one bird collected in Montezuma County. Thus, the few historical records suggest that the species apparently has always been rare in western Colorado, an opinion shared by Andrews and Righter (1992, in Wiggins 2005). Recent breeding bird atlas work in Colorado (Carter 1998 in Wiggins 2005) revealed only a single likely nesting record west of the continental divide over the five years of fieldwork (summarized from Wiggins 2005).

There are no records of this species on the planning unit. The San Luis Valley where yellow-billed cuckoo occurrence has been documented is about 35 miles south from the GMUG boundary. Neither Natureserve nor the Rocky Mountain Bird observatory have any records of this species closer than the San Luis Valley record. Ebird shows multiple sightings of this species near the planning unit but not on NFS lands. Although it is possible that individuals of this species may enter the planning unit from time to time, the presence has not yet been documented. Very little suitable habitat occurs within the planning unit and there is no habitat that contains all of the primary constituent elements identified below.

The western yellow-billed cuckoo currently nests almost exclusively in low to moderate elevation riparian woodlands that cover 50 acres (20 hectares (ha) or more within arid to semiarid landscapes (Hughes 1999 cited in 78 FR 61622-61666). Cuckoo nests are typically placed in dense patches of broad-leaved deciduous trees, usually with a relatively thick understory (Hughes 1999). Western cuckoos (including those in the western Great Plains) prefer to nest in willow (Salix spp.), cottonwood (Populus spp.), and mesquite (Prosopis spp.), but they will also utilize orchards (Laymon 1980, Walters 1983, summarized in Wiggins 2005).

The western yellow-billed cuckoo generally arrives on its breeding grounds in mid-June. In late summer, the birds begin their southbound migration in mid-August, and most have left the breeding grounds by mid-September (78 FR 61622-61666).

Nesting peaks later (mid-June through August) than in most co-occurring bird species, and may be triggered by an abundance of cicadas (Cicadidae sp.), katydids (Tettigoniidae sp.), caterpillars (Lepidoptera sp.), or other large prey items that form the bulk of their diet (Hamilton and Hamilton 1965, Rosenberg et al. 1982, cited in 78 FR 61622-61666). Nesting in western North America continues through August, and up to three broods can be raised in a season if the prey base is sufficient (78 FR 61622-61666). Yellow-billed cuckoos build an open cup nest with a loose saucer-shaped stick construction. Clutch size varies from two to five eggs depending on the available food supply. The incubation and nestling periods are short, with the eggs hatching in 11–12 days and young fledging in 5–7 days (Hughes 1999 cited in USDI Fish and Wildlife Service 2013).

Western yellow-billed cuckoos rarely nest at sites less than 50 acres (ac) (20 hectares (ha)) in size, and sites less than 37 ac (15 ha) are considered unsuitable habitat. Habitat patches from 50 to 100 ac (20 to 40 ha) in size are considered marginal habitat. Habitat between 100 ac (40

ha) and 200 ac (81 ha), although considered suitable are not consistently used by the species. The optimal size of habitat patches for the species are generally greater than 200 ac (81 ha) in extent and have dense canopy closure and high foliage volume of willows (Salix sp.) and cottonwoods (Populus sp.) and thus provide adequate space for foraging and nesting. (Laymon and Halterman 1989 cited in 79 FR 48548-48562).

The USFWS consider the following Primary Constituent Elements as habitat features that provide for this species' life-history processes and are essential to the conservation of the species 79 FR 48548-48562:

Riparian woodlands. Riparian woodlands with mixed willow-cottonwood vegetation, mesquite-thorn-forest vegetation, or a combination of these that contain habitat for nesting and foraging in contiguous or nearly contiguous patches that are greater than 325 ft (100 m) in width and 200 ac (81 ha) or more in extent. These habitat patches contain one or more nesting groves, which are generally willow-dominated, have above average canopy closure (greater than 70 percent), and have a cooler, more humid environment than the surrounding riparian and upland habitats.

Adequate prey base. Presence of a prey base consisting of large insect fauna (for example, cicadas, caterpillars, katydids, grasshoppers, large beetles, dragonflies) and tree frogs for adults and young in breeding areas during the nesting season and in post-breeding dispersal areas.

Dynamic riverine processes. River systems that are dynamic and provide hydrologic processes that encourage sediment movement and deposits that allow seedling germination and promote plant growth, maintenance, health, and vigor (e.g. lower gradient streams and broad floodplains, elevated subsurface groundwater table, and perennial rivers and streams). This allows habitat to regenerate at regular intervals, leading to riparian vegetation with variously aged patches from young to old.

Wiggins (2005) outlines the following elements conducive to yellow-billed cuckoo habitat restoration: 1) restoring more natural flow regimes to rivers and creeks, 2) restricting or eliminating livestock grazing along riparian areas, and 3) restricting or eliminating the use of pesticides near cuckoo breeding areas. The latter point is especially important in areas where orchards are adjacent to riparian areas, as cuckoos often forage at such sites.

Yellow-billed cuckoo abundance has declined in most areas within USFS Region 2, especially in western Colorado and Wyoming. The threats to yellow-billed cuckoos likely vary according to region, with habitat loss and fragmentation being particularly important in the western (arid) portions of Region 2 (Wiggins 2005). There have been a number of studies in the western United States that have assessed habitat availability for yellow-billed cuckoos, and without exception, they have shown drastic declines in riparian habitat extent and/or quality. Alteration of hydrology, due to dam construction or irrigation schemes, may both positively and negatively affect yellow-billed cuckoos. Other risk factors include livestock grazing and pesticides (Wiggins 2005).

Southwestern Willow Flycatcher (*Empidonax traillii extimus*)

The breeding range of the southwestern willow flycatcher includes southern California, Arizona, New Mexico, southwestern Colorado, and extreme southern portions of Nevada and Utah: specific range boundaries are delineated in the subspecies' recovery plan (USDI Fish and Wildlife Service 2002).

Current information suggests that important flycatcher habitat occurs in certain locations in the San Luis Valley in association with willow-dominated riparian and wetland communities on the valley floor. Although it is recognized that the San Luis Valley occurs within a gradation zone between the *E. t. adastus* and *E. t. extimus* subspecies (Paxton et al. 2008), the USFWS at this time considers all willow flycatchers in the San Luis Valley to be the *E. t. extimus* subspecies.

Due to a general lack of observations and breeding occurrence, no trend in the planning area is reported.

Southwestern willow flycatchers are strongly territorial. Flycatcher territories are often clumped together, rather than spread evenly throughout a habitat patch. Territory size varies greatly, probably due to differences in population density, habitat quality, and nesting stage. Estimated breeding territory sizes generally range from approximately 0.25-5.7 ac, with most in the range of approximately 0.5-1.2 ac (USDI Fish and Wildlife Service 2002).

The flycatcher builds a small open cup nest. Typical nest placement is in the fork of small-diameter (e.g., 0.4 in), vertical or nearly vertical branches. Occasionally, nests are placed in down-curving branches. Nest height varies considerably, from 1.6 to 60 ft, and may be related to height of nest plant, overall canopy height, and/or the height of the vegetation strata that contain small twigs and live growth. Most typically, nests are relatively low, e.g., 6.5 to 23 ft above ground (USDI Fish and Wildlife Service 2002).

The San Luis Valley encompasses the northernmost recovery unit identified by the U.S. Fish and Wildlife Service for the southwestern willow flycatcher (USDI Fish and Wildlife Service 2002). In the Final Rule, critical habitat was designated on five separate portions of the Rio Grande and Conejos River in the south portion of the San Luis Valley on BLM and federal refuge lands (USDI Fish and Wildlife Service 2013). None of the designated critical habitat occurs on National Forest System land.

Primary Constituent Element 1

Riparian vegetation. Riparian habitat along a dynamic river or lakeside, in a natural or manmade successional environment (for nesting, foraging, migration, dispersal, and shelter) that is comprised of trees and shrubs (that can include Gooddings willow, coyote willow, Geyer's willow, arroyo willow, red willow, yewleaf willow, pacific willow, boxelder, tamarisk, Russian olive, buttonbush, cottonwood, stinging nettle, alder, velvet ash, poison hemlock, blackberry, seep willow, oak, rose, sycamore, false indigo, Pacific poison ivy, grape, Virginia creeper, Siberian elm, and walnut) and some combination of:

(a) Dense riparian vegetation with thickets of trees and shrubs that can range in height from about 6 to 98 ft. Lower-stature thickets (6 to 13 ft tall) are found at higher elevation riparian forests and tall-stature thickets are found at middle and lower-elevation riparian forests;

(b) Areas of dense riparian foliage at least from the ground level up to approximately 13 ft above ground or dense foliage only at the shrub or tree level as a low, dense canopy;

(c) Sites for nesting that contain a dense (about 50 percent to 100 percent) tree or shrub (or both) canopy (the amount of cover provided by tree and shrub branches measured from the ground);

(d) Dense patches of riparian forests that are interspersed with small openings of open water or marsh or areas with shorter and sparser vegetation that creates a variety of habitat that is not uniformly dense. Patch size may be as small as 0.25 ac or as large as 70 175 ac.

Primary Constituent Element 2

Insect prey populations. A variety of insect prey populations found within or adjacent to riparian floodplains or moist environments, which can include: flying ants, wasps, and bees (Hymenoptera); dragonflies (Odonata); flies (Diptera); true bugs (Hemiptera); beetles (Coleoptera); butterflies, moths, and caterpillars (Lepidoptera); and spittlebugs (Homoptera).

The greatest historical factor in the decline of the southwestern willow flycatcher is the extensive loss, fragmentation, and modification of riparian breeding habitat (U.S. Fish and Wildlife Service, 2002 summarized in Sogge et al. 2010). Large-scale losses of southwestern wetlands have occurred, particularly the cottonwood-willow riparian habitats historically occupied by this subspecies. Factors causing habitat loss and/or change include urban, recreational, and agricultural development, water diversion and impoundment, channelization, livestock grazing, and replacement of native habitats by introduced plant species (Marshall and Stoleson, 2000; USDI Fish and Wildlife Service 2002 summarized in Sogge et al. 2002).

While nest parasitism by brown-headed cowbirds has been documented to negatively impact some southwestern willow flycatcher populations, especially at small and isolated breeding sites, it is highly variable and no longer considered among the primary rangewide threats to flycatcher conservation (USDI Fish and Wildlife Service 2002).

Mexican Spotted Owl (*Strix occidentalis lucida*)

The species is not known to occur on the GMUG; therefore, no trends are identified for the planning area. There are no reasonably foreseeable plans to reintroduce the species to the plan area. Natural colonization or recolonization may be possible.

Mexican spotted owls throughout their range nest, roost, forage, and disperse most commonly in mixed-conifer forests may include Douglas-fir and/or white fir, with codominant species including southwestern white pine, limber pine, and ponderosa pine. The understory often contains the above coniferous species as well as broadleaved species such as Gambel oak, maples, box elder, and/or New Mexico locust. In the northern part of the range, including southern Utah, southern Colorado, and far northern Arizona and New Mexico, owls occur primarily in rocky canyons and utilize caves and cliff ledges for nesting (Kertell 1977,

Reynolds 1990, Rinkevich 1991, Willey 1993, cited in USDI Fish and Wildlife Service 2013b).

Mexican spotted owls (MSO) in the Southern Rocky Mountains Ecological Management Unit (EMU) are found primarily in canyons, but the owls also occupy forest habitat types. The canyon habitat often has mature Douglas-fir, white fir, and ponderosa pine in canyon bottoms and on the north- and east-facing slopes. Ponderosa pine grows on the more xeric south and west-facing slopes, with pinyon-juniper growing on the mesa tops (USDI Fish and Wildlife Service 2012).

Foraging occurs in a variety of habitats including managed and unmanaged forests, pinyon-juniper woodlands, mixed-conifer and ponderosa pine forests, cliff faces and terraces between cliffs, and riparian zones (Ganey and Balda 1994, Willey 1998a,b; Ganey et al. 2003, Willey and Van Riper 2007, all cited in USDI Fish and Wildlife Service 2012). Reported prey items include woodrats, mice, voles, rabbits, gophers, bats, birds, reptiles, and arthropods.

Key habitat variables required to fulfill Mexican spotted owl life history requirements include nesting, roosting, and foraging habitat patches with structural, compositional, and successional diversity, as well as connectivity among suitable patches. Management recommendations for three categories of MSO habitat (i.e. Protected Activity Centers, Recovery Habitat, and Other Forest and Woodland Types) are provided within the Recovery Plan (USDI Fish and Wildlife Service 2012).

Two primary reasons cited for the original federal listing of MSO in 1993 were 1) historical alteration of its habitat as the result of timber-management practices, and 2) the threat of these practices continuing as evidenced in existing national forest plans. The danger of stand-replacing wildland fire was also cited as a threat at that time. With recent forest management now emphasizing sustainable ecological function and a return toward pre-settlement fire regimes, the primary threats to the MSO population in the U.S. have since transitioned from timber harvest to an increased risk of stand-replacing wildland fire. Climate variability combined with current forest conditions may also synergistically result in increased loss of habitat from fire. More intense natural drought cycles and the ensuing stress placed upon forested habitats could result in even larger and more severe wildland fires in owl habitat (USDI Fish and Wildlife Service 2012).

North American Wolverine (*Gulo gulo*)

Not present in the plan area. There are no reasonably foreseeable plans for reintroduction of this species to the plan area, but it may be possible for the species to naturally recolonize the area.

Until recently, the last confirmed wolverine sighting in Colorado was in 1919. Twelve survey efforts conducted in Colorado from 1979-1996 yielded no confirmed sightings. Occasional reports of wolverine sightings were investigated, but wolverine were never officially documented. In spring 2009, researchers with the Greater Yellowstone Wolverine Program tracked a wolverine from Grand Teton National Park south into north central Colorado. This was the first wolverine confirmed in the state in 90 years (CPW 2015).

One wolverine observation is reported occurring within the adjacent Rio Grande NF in 1997. However, given the information provided above, this observation did not constitute a confirmed sighting.

In Colorado, nearly all historical and recent reports of wolverines are from higher elevation, alpine areas that occur in an island-like fashion. Wolverines require large areas of suitable, high-elevation habitat. They are solitary, territorial animals and have large home ranges. In the Yellowstone Region, female home ranges average over 150 square miles and males nearly 500 square miles. Wolverines can travel large distances over extremely rough terrain and deep snow. Individual wolverines may move over 18 miles in one night (CPW 2012).

Diets consist of small rodents, rabbits, porcupines, marmots, other small mammals and occasionally large game, but most ungulate remains in their diet are likely from carrion. Breeding occurs during the warmer months. Two to four young are born in late March or early April (CPW 2015). Persistent, stable snow greater than 5 feet deep appears to be a requirement for natal denning, because it provides security for offspring and buffers cold winter temperatures (79 FR 47522-47545). Den sites typically occur in debris piles at the base of an avalanche chute and buried under deep snow cover (CPW 2015).

Wolverine habitat is projected to decrease in area and become more fragmented within the foreseeable future as a result of climate changes. These impacts are expected to have direct and indirect effects to wolverine populations in the contiguous United States including reducing the number of wolverines that can be supported by available habitat and reducing the ability of wolverines to travel between patches of suitable habitat. This reduction in connectivity is likely to affect metapopulation dynamics making it more difficult for subpopulations to recolonize areas where wolverines have been extirpated and to bolster the genetics or demographics of adjacent subpopulations (USDI Fish and Wildlife Service 2011).

Effects to wolverines from land management actions such as grazing, timber harvest, and prescribed fire are largely unknown. Wolverine habitat tends to be located at high elevations and in rugged topography that is unsuitable for intensive timber management. Much of wolverine habitat is managed by the U.S. Forest Service or other Federal agencies and is protected from some practices or activities such as residential development. In addition, much of wolverine habitat within the contiguous United States is already in a management status such as wilderness or national park that provides some protection from management, industrial, and recreational activities. Wolverines are not thought to be dependent on specific vegetation or habitat features that might be manipulated by land management activities. The US Fish and Wildlife Service concluded that land management activities as discussed above do not constitute a threat to the wolverine DPS (USDI Fish and Wildlife Service 2011).

Canada Lynx (*Lynx canadensis*)

In 1999, the Colorado Parks and Wildlife (CPW) initiated a lynx recovery program intended to augment any existing populations in the Southern Rockies with transplants from Canada and Alaska to re-establish a self-sustaining breeding population. The augmentation program resulted in a total of 218 lynx being transplanted into the San Juan Mountains during 1999-2006.

CPW documented 10 lynx dens and 32 kittens produced on the GMUG National Forests from 2003 – 2010 (J. Ivan, pers. comm. 2017.

Resident lynx have been documented on the Ouray Ranger District and the southern portion of the Gunnison Ranger District near the RGNF. A smaller core population is documented in the Taylor Park area of the Gunnison Ranger District, and overlaps a portion of the White River National Forest. Numerous radio-collared lynx have been documented on the GMUG National Forests since 1999.

Lynx habitat within the planning area was most recently modeled following habitat mapping criteria from the Southern Rockies Lynx Amendment and mapped in 2011 (USDA Forest Service 2011). Vegetation characteristics provide the criteria for identification of both primary and secondary habitats. Approximately 1,109,674 acres are classified as lynx primary habitat, 276,157 acres are delineated as secondary habitat, and 13,119 acres are identified as unsuitable habitat (the 2011 model is run periodically to incorporate changes to lynx habitat resulting from vegetation management activities and natural disturbances).

A total of nine linkage areas have also been delineated. Lynx habitat on the GMUG National Forests extends across administrative boundaries within the greater San Juan Mountains, Elk Mountains, and Sawatch Mountain Range and includes the San Juan, Rio Grande, White River, and San Isabel National Forests. Individual lynx in the core reintroduction area on the Rio Grande National Forest are known to have used all or any one of these units in the greater San Juan Mountains area (Theobald and Schenk 2011). Habitat connectivity between these administrative units is essential for facilitating movement of Canada lynx across the landscape.

Aerial surveys to detect insect and disease influences indicate widespread mortality in spruce forest and to a lesser extent other forest types within the planning area. Data from 1997 to 2016 show that approximately 631,301 acres of lynx habitat were affected by insects, disease and fire.

Insects and disease have also impacted lynx habitat in linkage areas. As similarly seen across all lynx habitat on the GMUG, Spruce beetle is the most significant agent affecting habitat in linkage areas, followed by subalpine fir mortality complex/Western Balsam bark beetle, and sudden aspen decline.

In 2013, a study was initiated on the Rio Grande National Forest to investigate how lynx respond to forests heavily influenced by spruce bark beetles in the San Juan Mountains of southern Colorado. Preliminary results suggest that bark beetle mortality does not appear to be currently influencing lynx distribution or reproduction (R. Ghormley, pers. comm. 2015). Beginning January 2017, this study expanded onto the Gunnison Ranger District of the GMUG National Forests.

Canada lynx habitat in Colorado primarily occurs in the subalpine and upper montane forest zones. The majority of the habitat used occurs between 9,900 – 11,620 feet (Theobald and Shenk 2011). Forests in these zones typically contain deep winter snows and are dominated by subalpine fir, Engelmann spruce, aspen, and lodgepole pine. A preference for these forest types, particularly spruce-fir associations, has been documented by radio-telemetry and tracking techniques associated with lynx reintroduced to Colorado (Theobald and Shenk 2011). Other habitats used by reintroduced lynx include spruce-fir/aspen associations and various riparian and riparian-associated areas dominated by dense willow (Shenk 2009).

Throughout North America, the distribution of lynx is closely tied to habitats that support an abundant population of snowshoe hare (Koehler 1990, Aubry et al. 2000). These habitats are generally defined as regenerating stands that contain dense, small-diameter stems that provide both food and horizontal cover (Koehler 1990, Aubry et al. 2000). In Colorado, both small diameter lodgepole stands and mature spruce-fir stands support the highest density of snowshoe hares (Ivan 2011). Reintroduced lynx in Colorado are also utilizing red squirrels, cottontails, and other alternate prey items. Red squirrels are closely associated with mature forest conditions, and would occur sympatrically with snowshoe hare as an important alternate prey species (Buskirk et al. 2000). The increased use of riparian-willow systems by reintroduced lynx during late summer and fall is also considered to be associated with alternate prey sources (Shenk 2009).

Births by lynx in Colorado occurred in late May to mid-June (Shenk 2006). All den sites found in Colorado have occurred within the spruce-fir zone on steep, north-facing slopes and are most often associated with substantial amount of large diameter woody debris (Merrill 2005, Shenk 2009). The average elevation at Colorado den sites is 11,004 feet (Shenk 2009). Disturbances such as insects and disease and windthrow contribute to the downed log component and are therefore important for reproduction and protection for the kittens (Aubry et al. 2000). For denning habitat to be functional, however, it must be in or adjacent to quality foraging habitat. Because lynx may frequently move their kittens in the first few months, multiple nursery sites are needed that provide kittens with overhead cover and protection from predators and the elements (Ruediger et al. 2000). Downed logs and overhead cover must also be available throughout the home range to provide security when kittens are old enough to travel.

Lynx are known to move long distances, but open areas, whether man-made or natural, may not be used as extensively (Mowat et al. 2000). Lynx typically avoided openings greater than about 300 feet wide (Koehler and Brittell 1990), although this may differ in the Southern Rockies due to more heterogeneous forest (Ruggiero et al. 2000). Canopy closures of at least 40% are important at the site-scale, regardless of the type of cover involved (Shenk 2006). Habitat use was associated with distance from large patches of forest (upper montane) cover. There was little association of lynx habitat use areas with other land cover types (Theobald and Shenk 2011). This data indicates that most lynx use in Colorado is associated with larger contiguous blocks of forest that is primarily dominated by spruce-fir forest cover types.

Forested conditions between foraging and denning habitat has also been shown to facilitate movement within the home range, particularly along ridgelines where lynx commonly travel (Ruggiero et al. 1994). Linkage areas may be provided by forest stringers that connect large forested areas, or by low, forested passes that connect subalpine forests on opposite sides of a mountain range (Ruediger et. al. 2000).

Specific ecological conditions for recovery, conservation, and viability of Canada lynx on the Rio Grande National Forest are best described in the Southern Rockies Lynx Amendment (SRLA) (USDA Forest Service 2008a). All key criteria in the SRLA Management Direction (Objectives, Standards, and Guidelines) should be considered for local conservation and recovery efforts but are too numerous to mention here. However, some key ecological conditions considered important on the Forest include:

- A conservation focus on late-successional spruce-fir cover types in combination with aspen and cool-moist mixed conifer stand components represent the majority of the high-quality lynx habitat locally. High-elevation willow-riparian systems also represent high value for summer foraging use.

Connectivity attributes that facilitate movement should be further defined and mapped across the Unit and adjoining unit landscapes.

- Recognition of important movement and dispersal areas that may require a management focus even when outside of existing linkage areas, LAUs or known occupied reproductive habitat. Local examples include: the North Pass area that overlaps the Gunnison Ranger District and the Saguache Ranger District (Rio Grande NF) that may provide for dispersal and ingress of lynx in and out of the local core area; pure lodgepole pine forests in the Taylor Park area not mapped as lynx habitat and outside of LAUs but in close proximity to a core population area; and the Slumgullion Pass area with recently documented (winter 2017) lynx movements between Wager Gulch and Slumgullion Pass.
- Protection, maintenance, and restoration of dense understory conditions that support primary prey species (snowshoe hare), particularly when associated with late-successional spruce-fir cover types or post-bark beetle conditions in former late-successional green forests.
- Management of activities that contribute to snow compaction in lynx habitat.

The SRLA (USDA Forest Service 2008b) incorporated and addressed the following risk factors for lynx:

The LCAS [Ruediger et al. 2000] identified several specific management activities and practices termed “risk factors” for the Southern Rockies geographic area. Risk factors affecting lynx productivity included fire exclusion, grazing, and winter recreational uses that create compacted snow conditions.

- Fire exclusion has resulted in a lack of early successional stages of conifers, which provide important snowshoe hare habitat.
- Unmanaged grazing by domestic and wild ungulates in aspen and high elevation willow stands can degrade snowshoe hare habitat. Grazing influences on riparian willow is not considered a broad-scale factor influencing high-elevation riparian willow habitat on the GMUG National Forests; however, it can be a localized issue in certain areas particularly those with a meadow or grassland park interface. Concentrated use in these areas impacts stream geomorphology, water retention and water quality, leading to soil loss and associated loss of vegetation that contributes to snowshoe hare habitat.
- Road, trail and recreational activities that results in snow compaction may facilitate increased access into lynx habitat and competition for food resources by competitors (primarily coyotes). Over-the-snow vehicle use and additional modes of winter recreation are anticipated to increase on the GMUG National Forests.
- Risk factors affecting lynx mortality include trapping, predator control activities and predation by mountain lions, and being hit by vehicles on major highways and many of the major mountain passes in the Southern Rockies Management Geographic Area. Illegal trapping is not considered a widespread concern locally. Starvation has also been a

factor locally in Colorado, especially during the early years of the reintroduction effort (Shenk 2010).

- Risk factors affecting lynx movement include barriers to movements such as major highways and associated development within rights-of-way. Private land development, especially along road corridors in mountain valleys, may also fragment habitat and impede movement of lynx. Urban expansion and development on private land has further fragmented an already patchy distribution of lynx habitat, many times in response to development or expansion of a developed recreational facility on NFS lands within lynx habitatsBased on data from the Colorado Department of Transportation on average annual daily traffic and trends over time, traffic volume is anticipated to increase in the future.

The most recent update to the LCAS provided a full revision, incorporating all prior amendments and clarifications, substantial new scientific information that has emerged since 2000 including related parts of the Lynx Recovery Plan Outline, as well as drawing on experience gained in implementing the 2000 LCAS (Interagency Lynx Biology Team 2013). Conservation measures were also updated and are similar to, but at times rewritten, to help address the anthropogenic influences mentioned below.

The first tier (most significant) anthropogenic influences noted in the revised LCAS include:

- Climate Change. Potential threats associated with climate change include 1) shifts in species distribution 2) changes in periodicity of the snowshoe hare cycle 3) reduction in lynx habitat and population size 4) changes in demographic rates and 5) changes in predator-prey relationships.
- Vegetation Management including effects from timber harvest, precommercial thinning, and fuels treatments.
- Fragmentation of Habitat. Primary potential threats involve vegetation patterns (anthropogenic and natural), and highways and road fragmentation.

Second tier anthropogenic influences noted in the revised LCAS include:

- Incidental trapping
- Recreation. Recreation trend is increasing significantly and the mechanism of effects include 1) habitat loss 2) disturbance 3) changes in competition for snowshoe hare prey (i.e. snow compaction) 4) winter recreation activities 5) snowmobile warming huts and Nordic trail huts, and 6) developed campgrounds.
- Minerals and energy exploration and development.
- Illegal shooting.
- Forest/backcountry roads and trails.
- Grazing by domestic livestock.

Recent modeling suggests that climate change is likely to impact lynx in the contiguous Distinct Population Segment. Although the timing, magnitude, and consequences of climate-related impacts are difficult to predict, lynx habitats and populations in the contiguous U.S. are likely to be smaller and more isolated in the future and, therefore, more vulnerable to other threats (USDI Fish and Wildlife Service 2013).

Humpback Chub (*Gila cypha*)

These species are protected as Endangered, under provisions of the Endangered Species Act in 1973 and is also classified at Endangered by the state of Colorado. The species is not present in the plan area but may be subject to downstream impacts from the management of NFS lands that comprise the plan area.

There are five known populations in the Colorado River watershed upstream of Glen Canyon Dam. Extant populations of this species appear to be declining. The USFWS attributes declines in humpback Chub to an abundance of non-native species and recent droughts.

According to NatureServe's humpback Chub report: "The endangered status of this species has been attributed primarily to the following factors: loss, fragmentation, and modification of habitat through impoundment (e.g., stream inundation, reduced water temperatures, reduced spring flows, and increased daily fluctuation in flows, resulting from construction and operation of Hoover Dam, Glen Canyon Dam, and Flaming Gorge Dam); introduced competitors and predators; and hybridization with G. elegans and G. robusta. However, genetic analyses suggest that hybridization in Colorado River basin Gila species "can be considered natural and not detrimental to the long-term survival of the species" whereas habitat alteration and effects of non-native fishes should be of greater concern (Douglas and Douglas 2007). Flow reductions and low water temperatures (Clarkson and Childs 2000) may curtail successful spawning/recruitment and increase competition with other species. The range expansion of the introduced Asian tapeworm is a serious threat (Clarkson et al. 1997). Populations in the Little Colorado River, Black Rocks/Westwater Canyon, and Yampa Canyon are restricted to relatively short river reaches that could be decimated by a catastrophic event (USFWS 1990). Effects of climate change on chub habitat, dam operations, and water use by irrigators need to be assessed and addressed (USFWS 2011)."

Bonytail Chub (*Gila elegans*)

These species are protected as Endangered, under provisions of the Endangered Species Act in 1980 and is also classified at Endangered by the state of Colorado. The species is not present in the plan area but may be subject to downstream impacts from the management of NFS lands that comprise the plan area.

Until 2015 there were no known reproducing populations of bonytail chub in the wild and this species is the rarest of the four endangered Colorado River fishes. Stocking is being used to try to re-establish the species and reproduction was recorded in 2015 and 2016.

According to NatureServe's bonytail chub report: "Threats to the species include habitat modifications resulting from streamflow regulation, dams that function as movement barriers on main-stem rivers, competition with and predation by nonnative fish species, hybridization (possibly), and pesticides and pollutants (USFWS 2002). The significance of, and factors leading to, hybridization with other *Gila* species are unclear, and this factor is not regarded as an important threat at the present time (USFWS 2002). However, hybridization should be evaluated as bonytails are released into the wild and populations become established (USFWS 2002). Low population size and lack of recruitment are major obstacles to recovery."

Green Lineage Colorado River Cutthroat Trout (*Oncorhynchus clarkii pleuritcus*)

Thorough overviews of Colorado River Cutthroat Trout biology and ecology are available in Young (2008, 2009) and Hirsch et al. (2013).

There are two genetic "lineages" of Colorado River subspecies of Cutthroat trout (CRCT) on the GMUG: blue lineage (*Oncorhynchus clarki stomias)* and green lineage. Current BASI indicates that the Blue lineage is not native to the area, and is present only due to stocking. Blue lineage CRCT on the GMUG are not protected or listed under the Endangered Species Act and would not qualify as SCC. The green lineage on the GMUG is native and is protected as "Threatened" under ESA. This section of the Assessment only considers the green lineage CRCT.

Colorado River Cutthroat Trout (green lineage) are well-distributed on the GMUG. Habitat conditions in which CRCT persist tend to be good: relatively intact streamflow, stream channel, and streamside conditions. CRCT require water temperatures not exceed about 79 °F and do best when summer water temperature are between 50 and 65 °F (Roberts et al., 2013).

In 2012 the GMUG NF revised a status assessment for native Cutthroat Trout (Dare et al., 2011) that included an analysis of the distribution of Conservation Populations relative to the Forest's Watershed Integrity Class (WIC) ratings (USDA Forest Service, GMUG and San Juan National Forests, 2005) Thirty-two of 38 conservation populations reported in the 2012 assessment (two populations are no longer present) were located in watersheds with WIC ratings of 1 or 2, which translates to about 84 percent of occupied stream habitat (Table 7). WIC 1 and 2 watersheds are those least influenced by past and current land-management practices and therefore exhibit relatively natural watershed processes and biota. WIC 3 and 4 watersheds are those most influenced by past and on-going management activities and may contain areas where watershed processes and biota have been degraded. Six of the 38 conservation populations occupied WIC 3 and 4 watersheds. A CRCT status assessment completed in 2005 (James et al., 2005) reported that 86 percent occupied streams were in WIC 1 and 2 watersheds, suggesting CRCT continue to occupy the highest quality streams on the national forest.

In 2006 GMUG personnel completed a broad-scale assessment of stream and riparian habitat conditions using the PACFISH/INFISH Biological Opinion (PIBO) protocol (Adams 2006). Habitat data were collected in 19 reference watersheds (Table 7). Reference watersheds were those exhibiting the least human influence and represented the most "natural" conditions on the Forest. Within each watershed a variety of abiotic and biotic data were collected in a response reach. Six of the 19 reference watersheds contain conservation populations of cutthroat trout.

Table 7. Reach-scale stream habitat characteristics collected in response reaches of 19 reference watersheds on the GMUG NF

[Data were collected using the PACFISH/INFISH Biological Opinion (PIBO) protocol (Kershner et al., 2004). Table adapted from Adams 2006]

Attribute	Mean (SD)	Range
Residual pool depth (m)	0.28 (0.13)	0.12 – 0.69
Undercut depth (m)	0.68 (0.60)	0.19 – 3.02
Undercut banks (%)	30.30 (15.13)	4.76 – 60.00
Bank angle	107.45 (14.05)	76.00 – 132.31
Bank stability (%)	95.95 (5.04)	78.57 – 100.00
Width to depth ratio	22.03 (4.99)	8.02 – 36.34
Pool fines, < 2 mm (%)	14.20 (24.14)	0.00 – 99.33
Pool fines, < 6 mm (%)	16.20 (24.31)	0.00 – 99.43
D50 (mm)	61.29 (40.49)	2 – 134
D85 (mm)	143.66 (100.00)	6.84 – 350
Conductivity	97.90 (74.58)	30 – 270
Alkalinity	90.79 (45.54)	20 – 240

CRCT populations do best when the average water temperature in the summer is between 50 and 65 °F (Roberts et al., 2013).

Most streams on the GMUG have summer water temperatures below 50 °F and are too cold to support a robust CRCT population. Streams that have water temperature that are too cold for CRCT will become more hospitable to CRCT in the coming decades.

Model outputs suggest that many of the GMUG NF's high-elevation streams are too cold for native fishes (Cutthroat Trout and Bluehead Sucker) currently but could become suitable for Cutthroat Trout in the future if stream temperatures rose as much as 3 °C. The model's down-scaled AIB model predictions suggest that all but the highest elevation streams on the GMUG NF would become too warm for native Cutthroat Trout.

Human alterations to streams, including dams and water diversions, have fragmented and isolated most CRCT populations on the GMUG. While the loss of a migratory form within a CRCT population is not good, it remains to be seen if CRCT populations can persist for long time periods in relatively small sections of stream habitat.

In a study of fragmentation and isolation of streams that supported native Cutthroat Trout, GMUG fisheries biologists determined that while the 25 of 39 populations of native Cutthroat Trout populations were isolated by barriers, only eight of these were fragmented by barriers located within occupied reaches (Dare et al., 2012). These data suggest native Cutthroat Trout occupy stream reaches for which connectivity is relatively high. Instream barriers are likely contributing to persistence of native Cutthroat Trout in watersheds in which non-native, invasive species, such as Brook Trout are present.

In 2016 USFS personnel identified a previously unknown population of green-lineage CRCT in the North Fork of Escalante Creek. This population occupies over 15 contiguous stream miles and contains both resident and migratory life history forms. The North Fork Escalante

Creek population is unique because it is the only known population supporting multiple life histories. In 2017 the USFS began work on a barrier to protect this population from invasion by Rainbow Trout. The USFS is cooperating with Trout Unlimited, the Bureau of Land Management, and Colorado Parks and Wildlife to accomplish this conservation project.

Impoundment and water diversion are common across the GMUG but portions of streams in which CRCT are present have been relatively undisturbed by water development.

Non-native brook trout and rainbow trout, are the biggest threat to the long-term persistence of native cutthroat trout on the GMUG.

Cutthroat trout are susceptible to whirling disease which can be transmitted to them by hatchery-reared salmonids or anglers wearing waders and wading boots laden with infected sediment. Whirling disease is present in the Colorado River and Gunnison River basins. Whirling disease is present on the Grand Mesa and may have caused the extirpation of some cutthroat trout populations located there (L. Martin, CPW, personal communication).

Cutthroat trout populations are also threatened by land management activities that affect stream habitat, including livestock and grazing management, mineral extraction, road construction, timber harvest, and water development.

Climate change associated with warming air temperatures documented around the globe (Intergovernmental Panel on Climate Change 2007) may be a threat to the long-term persistence of native cutthroat trout populations throughout their range, including the GMUG. Young (2008) provides an excellent review of the potential for changing climate to affect cutthroat trout populations in the Rocky Mountains. Briefly, increasing air temperatures will trigger an upstream shift in the distribution of habitat suitable for native cutthroat trout (see Stream Temperature section above). If air temperatures continue to rise, the amount of suitable habitat for native cutthroat trout populations will eventually decrease. Coupled with reductions in suitable habitat is the increased likelihood that cutthroat trout populations will be exposed to severe thunderstorms and wildfires, and associated disturbances like debris flows and landslides. Populations could be lost as a result of these disturbances and habitat fragmentation will limit the demonstrated ability of salmonid fishes to colonize streams in the wake of disturbance (Rieman et al., 1997; Brown et al., 2001; Burton 2005).

The Forest recently completed a draft Watershed Vulnerability Assessment (WVA) intended to identify the potential for climate change and related disturbances to affect forest health. The analysis found that 39 percent of conservation populations were located in areas that have high erosion sensitivity and 16 percent of conservation populations were located in areas highly sensitive to uncharacteristic run-off events (Howe et al., unpublished data). Catastrophic erosion events, such as debris flows, can alter stream habitat and kill stream fish (Benda et al., 2003; Dunham et al., 2003; Rieman and Isaak 2010). For spring-spawning fish, including cutthroat trout, uncharacteristic seasonal run-off could reduce reproductive success and impact populations.

Colorado Pikeminnow (*Ptychochelus lucius*)

This species was listed as Endangered in 1973, and is listed as Threatened by the State of Colorado. This species is not present in the plan area, but may be impacted by the downstream impacts of the management of NFS lands within the plan area.

Adult populations of this species appear to be stable in the Colorado River but are declining in the Green River. Stocking is being used to augment wild populations. The USFWS and partners are attempting to re-establish Colorado pikeminnow in the San Juan River.

According to NatureServe's Colorado pikeminnow report: "Decline resulted probably from a combination of threats, including direct loss of habitat, changes in flow and temperature, and blockage of migration routes by the construction of large reservoirs. In addition, interactions with nonnative fishes may have had a decimating effect in waters not affected by dams" (USFWS 2011).

Razorback Sucker (*Xyrauchen texanus*)

This species was listed as Endangered by the FWS in 1991. The State of Colorado lists it as Threatened. This species does not occur in the plan area, but may be impacted by downstream impacts from the management of NFS lands in the plan area.

Populations of this species were assumed lost from the Colorado River and San Juan River and a population in the Green River was very small. Stocking is being used to re-establish populations in the Colorado River and San Juan River and there is evidence stocked fish are surviving and spawning.

According to NatureServe's razorback sucker report: "Threats to the species include streamflow regulation, habitat modification, competition with and predation by nonnative fish species, and pesticides and pollutants (USFWS 2002).

Recruitment is very low (or absent) despite spawning and hatched larvae (e.g., in upper Green River basin). For example, no recruitment to reservoir populations was detected between 1963 and 1990 in the lower Colorado River basin, despite collecting with appropriate equipment (Minckley et al. 1991). Low recruitment results primarily from predation on larvae and juveniles by introduced fishes (Marsh et al. 2003). Competition with and predation by exotic crayfish may also be a problem in some areas (Lenon et al. 2002).

Habitat changes resulting primarily from dam operations has greatly restricted the amount of suitable habitat; these detrimental changes include high winter flows, reduced high spring flows, altered river temperatures (Clarkson and Childs 2000), and reduced flooding (USFWS 1990).

Natural recovery is limited by a paucity of spawning adults. Hybridization with other suckers is a potential problem in some locations (Tyus and Karp 1990, Minckley et al. 1991)."

DeBeque Phacelia (*Phacelia submutica*)

This species was listed as Threatened under ESA in 2011. It is found at roughly 25 to 30 sites on the GMUG. Rangewide, the U. S. Fish and Wildlife Service in 2010 showed 24 sites with almost 43,000 plants[10]; the Forest Service added 26 sites with another 5,000 plants.[11] 182 records at CNHP.

This species is found on sparsely-vegetated shale slopes and badlands, where the soil is effectively thin because of hard clay layers, and is derived from two members of the Wasatch Formation (Atwell Gulch and Shire[12]). The presence of apparently suitable habitat without the plants of this species leads to the conjecture that there must be other limiting factors.

These are small annual plants, therefore dependent on seed bank.

"The leading current disturbance to the plants and habitats of Phacelia submutica on the Grand Mesa National Forest is trampling by large herbivores, primarily mule deer and cattle. Livestock are not permitted on this portion of the National Forest, nonetheless there is some trampling damage at two populations from trespass cattle from adjacent BLM public land. One of the sites on the Grand Mesa National Forest has been impacted by off-road vehicles, mostly dirt bikes. Most of the habitats on the Grand Mesa National Forest are well protected from access by cattle or off-road vehicles, by surrounding steep badlands and canyons. … Phacelia submutica seems relatively secure on National Forest System Lands, based on what we know about its populations and habitats on this National Forest."

Stable shale slopes of the Wasatch Formation (where this species is typically found) are found on the lower slopes of Horsethief Mountain.

Colorado Hookless Cactus (*Sclerocactus glaucus*)

This species is listed as "Threatened" under ESA, it received that determination in 1979. Colorado hookless cactus is endemic to Colorado and is nnown from several hundred locations in Garfield, Mesa, Delta, and Montrose Counties. On the GMUG, the species is known from three or four populations on the lower slopes of Battlement Mesa, Grand Mesa National Forest.

Field investigations in recent years have turned up several large populations, and the total number of plants known probably is in the hundreds of thousands. Population numbers seem to be relatively stable, with a few plants being lost from time to time from road building, development, and collection.

This species is mostly found in rocky openings in sagebrush and saltbush communities. The GMUG occurrences are all on colluvial benches near wash bottoms.

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[10] Federal Register 75(120):35721-35746. June 23, 2010.

[11] Forest Supervisor's letter to Regional Forester, 2670 of July 28, 2010.

[12] Atwell and Shire Gulches have headwaters on the Grand Mesa National Forest, near the habitats of *Phacelia submutica* there.

A recent thesis using genetic modeling demonstrated that there are significant genetic differences between the north and south portions of this distribution (Schwabe 2012, Schwabe and others 2014).

It is apparent that the GMUG populations are remnants of larger populations, since currently *Sclerocactus glaucus* only occurs where cattle could not reach because of landscape barriers. The area where these populations occur has not been grazed by livestock for at least 40 years. Currently, the biggest impact on these plants and their habitats is the large population of mule deer in the area. These deer herds have been driven upward to these slopes of Horsethief Mountain by development in their former winter ranges at lower elevations to the west. Most *Sclerocactus glaucus* plants on the Forest are partially underneath or within a shrub or next to a cobble or boulder, protecting them from the extensive, continual soil churning from the deer hooves. The GMUG plants of *Sclerocactus glaucus* are sparsely distributed, corresponding closely to the small patches of remaining habitat.

The larger, healthier populations of *Sclerocactus glaucus* on the BLM land below the Forest are subject to overcollection by humans, gathering cactus for gardens (or perhaps for illegal sale). This threat is not expected to be significant on the National Forest, as all *Sclerocactus glaucus* sites are inaccessible (they are remnants from the more intense cattle grazing of past decades).

Sagebrush and saltbush stands on colluvial benches undisturbed by mule deer and other large herbivores are required for the recovery, conservation and viability of this species. It is unlikely that the few, dispersed plants on the GMUG would constitute a viable population.

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Appendix 2. Species Initially Considered, but Removed from Consideration based on "Known to Occur" Criteria

Due to documented proximity to the plan area, the USFS staff re-checked occurrence records to determine if the following species were present in the plan area. For the 76 species in Table 8, no records in the plan area were found. Therefore, absent further confirmed documentation of presence, those species cannot be included as SCC.

Table 8. Species initially considered for potential SCC status, but removed from consideration based on "known to occur" criteria

Taxon Group	Species	Reason for Consideration
Insect	Mojave sootywing *Hesperopsis libya*	"Should consider" due to S2 Rank. This species has been sighted near the forest (between Hotchkiss and Paonia) but nothing within the forest. Not known to occur in the plan area.
Insect	Yuma skipper *Ochlodes yuma*	"Should Consider" due to S2 rank, and species occurrence near the plan area. Not known to occur in the plan area.
Insect	Alberta arctic *Oeneis alberta*	"Should Consider" due to S3 rank, and species occurrence near the plan area. Not known to occur in the plan area.
Bird	Burrowing owl *Athene cunicularia*	"Should consider" due to R2 Sensitive, State Threatened and BCC status. Not known to occur in the plan area.
Bird	American bittern *Botarus lentiginosus*	"Should consider" due to R2 Sensitive. Not known to occur in the plan area.
Bird	Columbian sharp-tailed grouse *Tympanuchus phasianellus columbianus*	"Should consider due to S2 rank and R2 Sensitive. Species was petitioned for ESA listing but was declared "Not Warranted". Not known to occur in the plan area.
Mammal	White-tailed prairie dog *Cynomys leucurus*	"Should consider due to R2 Sensitive and S3 rating, located near planning area (25 miles). Not known to occur in the plan area.
Mammal	Spotted bat *Euderma maculatum*	"Should Consider" due to S2 rank and being R2 Sensitive, found near the plan area but not documented within. Not known to occur in the plan area.
Mammal	Fringed myotis *Myotis thysanodes*	"Should Consider" due to R2 Sensitive and SGCN Tier one, found near the plan area. Not known to occur in the plan area.
Mammal	Dwarf shrew *Sorex nanus*	"Should Consider" due to S2 rank. Found near the plan area. Not known to occur in the plan area.
Mammal	Kit fox *Vulpes macrotis*	"Should Consider" due to S1 rank. This species present in nearby areas. Not known to occur in the plan area.
Fish	Flannelmouth sucker *Catostomus latipinnis*	"Should Consider" due to being present on R2 Sensitive Species list. Species is present in the Colorado River system downstream from the planning area. It is subject to the downstream impacts from management of the plan area, but is not found in the area. Not known to occur in the plan area

Taxon Group	Species	Reason for Consideration
Fish	Mountain sucker *Catostomus platyrhynchus*	"Should Consider" due to R2 Sensitive and SGCN Tier 1. Species is present in the Colorado River system downstream from the planning area. It is subject to the downstream impacts from management of the plan area, but is not found in the area. Not known to occur in the plan area
Fish	Round-tailed Chub *Gila robusta*	"Should consider" due to S2, R2 Sensitive and SGCN Tier 1 ranks. Species is present in the Colorado River system downstream from the planning area. It is subject to the downstream impacts from management of the plan area, but is not found in the area. Not known to occur in the plan area.
Reptile	Smith's black-headed snake *Tantilla hobartsmithii*	"Should consider" due to S2 Rank, species occurs near the plan area. Not known to occur in the plan area.
Plant	Aleutian maidenhair fern *Adiantum aleuticum*	“Should consider” due to S1 rank. One record for the species may be on the forest, but the location given in the record is not precise enough to determine presence or absence on the unit due to the number of privately held mining claims in that location.
Plant	Southern maidenhair fern *Adiantum capillus-veneris*	“Should consider” due to S2 rank. Previously thought to occur on the GMUG, but closer examination of the occurrence record showed the specimen to have been collected within the town or Ouray, not on NFS lands. Not known to occur in the plan area
Plant	Rocky Mountain columbine *Aquilegia saximontana*	"Should Consider" due to S3 rank. Not known to occur in the plan area.
Plant	Alpine arnica *Arnica alpina* var. *tomentosa*	“Should consider” due to S1 Rank. May occur in the planning area, but the closest occurrence record appears to be on the White River NF. Not known to occur in the plan area.
Plant	Alpine aster *Aster alpinus* var. *vierhapperi*	"Should consider" species found within one mile of GMUG boundary. Not known to occur in the plan area.
Plant	meadow milkvetch *Astragalus argophyllus* var. *martinii*	"Should consider" due to NatureServe ranking, found within 5 miles of planning unit boundary. Not known to occur in the plan area.
Plant	Brandegee’s milkvetch *Astragalus brandegeei*	"Should consider" due to S1/S2 ranking, found within 1 mile of plan area. Not known to occur in the plan area.
Plant	Browse milkvetch *Astragalus cibarius*	"Should consider" due to S1 ranking and found within five miles of the plan area. Not present on the plan area. Coordinates within Intermountain herbarium records show the species as present, but the text description of the location is clear and is several hundred miles from the plan area
Plant	DeBeque milkvetch *Astragalus debequaeus*	"Should Consider" due to S2 rank. Not known to occur in the plan area
Plant	Eastwood milk-vetch *Astragalus eastwoodiae*	"Should Consider" due to S2 ranking found within 5 miles of the forest boundary. Not known to occur in the plan area.
Plant	Horseshoe milkvetch *Astragalus equisolensis*	"Must Consider" due to T1 S1 ranking. Not known to occur in the plan area.
Plant	Violet milkvetch *Astragalus iodopetalus*	"Must Consider" due to G2 ranking. Not known to occur in the plan area.

Taxon Group	Species	Reason for Consideration
Plant	Fisher Towers milkvetch *Astragalus piscator*	"Must Consider" due to G2 Rank, or "Should Consider" if G ranks are averages and S ranks are considered, found within 5 miles of the plan area boundary. Not known to occur in the plan area.
Plant	San Rafael milkvetch *Astragalus rafaelensis*	"Must consider due to G2 rank, "Should Consider" if G ranks are averaged and S ranks considered. Not present in the plan area.
Plant	sandstone milkvetch *Astragalus sesquiflorus*	"Should consider"due to G3 and S1 rankings, found within 5 miles of the plan area
Plant	leathery grape fern *Botrychium multifidum*	"Should Consider" due to S1S2 rank. Occurrence on GMUG is considered to be a mis-identification. Not known to occur in the plan area.
Plant	weak-stemmed mariposa lily *Calochortus flexuosus*	"Should Consider" due to S2 rank, found within 5 miles of the plan area. Not known to occur in the plan area.
Plant	Eastwood evening-primrose *Camissonia eastwoodiae*	"Must consider" due to G2 rank. Not known to occur in the plan area
Plant	low northern sedge *Carex concinna*	"Should Consider" due to S1 rank, found within 5 miles of plan area. Not known to occur in the plan area.
Plant	Sartwell's sedge *Carex sartwellii*	"Should consider" due to S1 rank. Originally thought to occur in the plan area, but the location described is imprecise and may be on private land outside the forest boundary. Not known to occur in the plan area.
Plant	Great Basin centaury *Centaurium exaltatum*	"Should consider" due to S1 rank. Found within 5 miles of plan area
Plant	American yellow lady's-slipper *Cypripedium calceolus* ssp. *parviflorum*	"Should consider" due to S2 rank, found within 5 miles of plan area. Not known to occur in the plan area.
Plant	Colorado larkspur *Delphinium ramosum* var. *alpestre*	"Should consider" due to S2 rank, found within 5 miles of plan area. Not known to occur in the plan area
Plant	Heil's tansy mustard *Descuriania kenhelii*	"Must consider" due to G1 rank. Not known to occur in the plan area.
Plant	northern rockcress *Draba borealis*	"Should consider" due to S2 rank, found within one mile of the plan area boundary. Not known to occur in the plan area.
Plant	clawless draba *Draba exunguiculata*	"Must consider" due to G2 ran, found within 1 mile of plan area. Not known to occur in the plan area.
Plant	Gray's Peak whitlow-grass *Draba grayana*	"Must consider" due to G2 rank. Found within 5 miles of plan area. Not known to occur in the plan area.
Plant	spike pappusgrass *Enneapogon desvauxii*	"Should consider" due to S1 rank, found within 5 miles of plan area. Not known to occur in the plan area.
Plant	giant helleborine *Epipactis gigantea*	"Should consider" due to S1 rank, found within 5 miles of plan area. Not known to occur in the plan area.
Plant	San Juan gilia *Gilia haydenii*	"Should consider" due to G3S2 rank, found within 5 miles of plan area. Not known to occur in the plan area.
Plant	hamatocaulis moss *Hamatocaulis vernicosus*	"Should consider" due to S1S3 rank, found within 1 mile of plan area boundary. Not known to occur in the plan area.

Taxon Group	Species	Reason for Consideration
Plant	Red alum-root *Heuchera reubescens*	“Should consider” due to S1 rank. Known to occur just outside the plan area boundary; the occurrence record at first appeared to be within the plan area but further review concluded that the location was on nearby Bureau of Land Management land.
Plant	Alkaline pepperwort *Lepidium crenatum*	"Must consider" due to S2 rank. Not known to occur in the plan area
Plant	Uncompahgre bladderpod *Lesquerella/Physaria viciana*	"Must consider" due to S2 rank. Not known to occur in the plan area
Plant	Wasatch biscuitroot *Lomatium bicolor* var. *bicolor*	“Should consider” due to S1 rank. This species may occur on the GMUG, but the single record placing it here may be a misidentification of *L. bicolor* var. *leptocarpum*.
Plant	Payson lupine *Lupinus crassus*	"Must consider" due to G2 rank. Not known to occur in the plan area
Plant	Dolores River skeletonplant *Lygodesmia doloresensis*	"Must consider" due to G1G2 rank. Not known to occur in the plan area
Plant	Eastwood monkeyflower *Mimulus eastwoodiae*	“Should Consider” due to G3 and S1 rank. Not present in the plan area. Initially thought to be in plan area, but the location described in the occurrence record is outside of the plan area.
Plant	Grand Junction cat's-eye *Oreocarya aperta*	"Should" be considered due to GH and SH rankings, found within 5 miles of the plan area. Not known to occur in the plan area.
Plant	cliff dweller's candlestick catseye *Oreocarya elata*	"Should consider" due to G3 and S2 ranks. Found within 5 miles of plan area. Not known to occur in the plan area.
Plant	Long-flower cat's-eye *Oreocarya longiflora*	"Should" consider due to G3 rank, found within 5 miles of plan area boundary. Not known to occur in the plan area.
Plant	Gypsum Valley cateye *Oreocarya revealii*	"Must consider" due to G2 rank, found within 5 miles of plan area. Not known to occur in the plan area.
Plant	Kotzebue’s grass of Parnassus *Parnassia kotzebuei*	“Should consider” due to S2 rank and presence on the USFS Region 2 Sensitive species list. The single herbarium record placing this species in the plan area may be in error. Therefore, this species does not meet the criteria for “known to occur.”
Plant	Paradox breadroot *Pediomelum aromaticum*	"Should consider" due to G3 and S2 rank. Found within 5 miles of plan area. Not known to occur in the plan area.
Plant	Smooth cliff-brake *Pellaea glabella* spp. *simplex*	“Should consider” due to S2 rank. Present very near the plan area, but records lack enough precision to determine presence/absence with any certainty. Therefore, this species does not meet the criteria for “Known to occur”. Not known to occur in the plan area.
Plant	little penstemon *Penstemon breviculus*	"Should consider" due to G3 and S2 rank, found within 1 mile of plan area boundary. Not known to occur in the plan area.
Plant	Harrington beardtongue *Penstemon harringtonii*	"Should consider" due to G3 rank, found within 5 miles of plan area. Not known to occur in the plan area.
Plant	Utah penstemon *Penstemon utahensis*	"Should consider" due to S2 rank, found within 5 miles of plan area boundary. Not known to occur in the plan area.
Plant	Cushion bladderpod *Physaria pulvinata*	"Must consider" due to G1 rank, found within one mile of plan area. Not known to occur in the plan area.

Taxon Group	Species	Reason for Consideration
Plant	Rollins' twinpod *Physaria rollinsii*	"Must consider" due to G1 rank. Not known to occur in the plan are
Plant	Intermountain rubberweed *Picradenia helenioides*	“Should Consider” due to G3 rank. Invalid taxonomy.
Plant	Parish's alkali grass *Puccinellia parishii*	"Should consider" due to S1 rank. Not known to occur in plan area
Plant	dwarf raspberry *Rubus arcticus* ssp. *acaulis*	"Should consider" due to S1 rank. Not known to occur in the plan area
Plant	sageleaf willow *Salix candida*	"Should Consider" due to S2 rank. Not known to occur in plan area.
Plant	Pygmy Sagebrush *Seriphidium pygmaeum*	"Should consider" due to S1 rank, found within 5 miles of plan area boundary. Not known to occur in the plan area.
Plant	Balitic sphagnum *Sphagnum balticum*	"Should consider" due to S1 rank, also on Regional Forester's Sensitive Species List. Not known to occur in the plan area
Plant	Sphagnum *Sphagnum platyphyllum*	“Should Consider” due to S1S2 rank. Not known to occur in the plan area
Plant	Arizona prince-plume *Stanleya albescens*	"Should consider" due to S2 rank, found within five miles of plan area boundary. Not known to occur in the plan area.
Plant	juniper tumble mustard *Thelypodiopsis juniperorum*	"Must consider" due to S2 rank. Not known to occur in the plan area
Plant	Strigose easter-daisy *Townsendia strigosa*	"Should consider" due to S1 rank, found within 5 miles of plan area. Not known to occur in the plan area.
Plant	flatleaf bladderwort *Utricularia intermedia*	"Should consider" due to s1 rank, found within one mile of plan area. Not known to occur in the plan area

United States Department of Agriculture
Forest Service

Grand Mesa, Uncompahgre, and Gunnison
National Forests
2250 South Main Street
Delta, CO 81416
www.fs.usda.gov/gmug/