United States Department of Agriculture

Coconino National Forest Land and Resource Management Plan

Final Environmental Impact Statement

Volume IIa. Chapter 3: Wildlife, Fish, and Plants

Forest Service | Coconino National Forest | Southwestern Region | MB-R3-04-32 March 2018

Final Environmental Impact Statement for the Coconino National Forest Land and Resource Management Plan

Volume IIa. Chapter 3 (continued): Wildlife, Fish, and Plants

Coconino, Gila, and Yavapai Counties, Arizona

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Abstract: To comply with the National Forest Management Act and address changes that have occurred over the past 30 years, the Coconino National Forest proposes to revise the current land management plan (1987 plan). This programmatic final environmental impact statement (FEIS) documents analysis of the impacts of four alternatives developed for programmatic management of the 1.8 million acres administered by the Coconino National Forest. The analysis displays the anticipated progress toward the desired conditions as well as the potential environmental and social consequences of implementing each alternative. Alternative A is the no-action alternative, which is the1987 forest plan, as amended. Alternative B (modified) is the preferred alternative and is reflected in the accompanying Final Land and Resource Management Plan for the Coconino National Forest. This alternative addresses new information and concerns received since the 1987 forest plan was published, and it meets objectives of Federal laws, regulations, and policies. Alternative C considers increases in the amount of wilderness and special areas, as well as increased opportunities for semi-primitive recreation. Alternative D considers fewer restrictions on human access, use, and infrastructure.

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Wildlife, Fish, and Plants

For more information on species resources, see the respective sections in other parts of the FEIS in chapter 3.

Species Viability

The vegetative and species diversity found on the forest is largely unique in comparison to the surrounding landscape as it has 13 vegetation types, a wide elevation range (2,500 feet to 12,000 feet), and different types of riparian areas in a largely arid southwestern landscape.

This section evaluates and discloses the potential environmental consequences to species that may result from the adoption of a revised land management plan for the Coconino NF. It provides a summary of species viability assessments and examines in detail consequences to federally listed and proposed species and critical habitat, Forest Service regionally sensitive species, migratory birds, eagles, and management indicator species.

The National Forest Management Act regulations require that habitat is managed to support viable populations of all species within the planning area (1982 Planning Rule provisions at 36 CFR 219). The focus of this evaluation is on the condition of the habitat provided on Coconino NF. Condition was represented by departure values or distribution of vegetative states as described in the sections on “Vegetation and Fire,” “Soil,” “Watersheds and Water,” and “Riparian Resources.” For planning purposes, a viable population is regarded as one that has the estimated numbers and distribution of reproductive individuals to ensure its continued existence is well distributed in the planning area.

Species List

A comprehensive list of species (‘forest planning species’) with potential viability concerns was collaboratively developed and compiled by the Coconino National Forest (USDA Forest Service 2009c). The forest planning species list was subsequently modified based on more recent information (see Appendix C). NatureServe conservation status ranks and the Arizona Game and Fish Department’s State Wildlife Action Plan list were re-checked to see if any updates since 2009 would result in changes to the list (AZGFD 2012). A summary of the State Wildlife Action Plan list review is located in the project record. Under an agreement with the forest, the Museum of Northern Arizona summarized new and hard-to-find invertebrate information from literature and experts in the field (Stevens and Ledbetter 2014). Changes in the Southwestern Region Sensitive Species list were also incorporated (USDA Forest Service 2013). After the DEIS was released in 2013, Coconino NF biologists provided additional site-specific information regarding species habitat relationships that resulted in changes in primary ERUs for individual species and adding ephemeral and intermittent riparian drainages as an important habitat element for certain amphibians and reptiles.

The forest planning species in this report are comprised of federally listed species, species proposed for Federal listing, Regional Forester sensitive species, and other species. Other species hold no special regulatory status except as addressed for viability under the National Forest Management Act. Table 1 lists the acronyms associated with habitats. Forest Ranks (or F-Ranks) were developed for the forest planning species. The ranking process generally followed the conventions used by NatureServe and others in defining State and Global Ranks. The F-Ranks were used in the viability risk assessment as a categorical variable representing a species’ current

abundance and distribution (table 2). This represents the existing condition of each species' abundance and distribution on the Coconino NF. Rare species are often associated with rare habitats which would not become common with management. Table 3, table 4, and table 5 list the habitat associations, threats, and forest ranking for federally listed, Southwestern Region Sensitive Species, and other forest planning for which there are viability concerns.

Table 1. Key information for primary habitat associations

Abbreviation	ERU name	Abbreviation	ERU Name
DC	Desert Communities	PJG	Pinyon Juniper with Grass
IC	Interior Chaparral	PJES	Pinyon Juniper Evergreen Shrub
CWRF	Cottonwood Willow Riparian Forest	PJW	Pinyon Juniper Woodland
MBDRF	Mixed Broadleaf Deciduous Riparian Forest	PP	Ponderosa Pine
MWRF	Montane Willow Riparian Forest	MCFF	Mixed Conifer with Frequent Fire
WC	Wetland	MCIF	Mixed Conifer with Infrequent Fire
SDG	Semi-desert Grassland	SF	Spruce-Fir
GBG	Great Basin Grassland	AT	Alpine Tundra
MSG	Montane/Subalpine Grassland		

Table 2. Description of F-Ranks

F-Rank	Description
F1	Very rare on the forest within its habitat – occupies a very small portion of its habitat.
F2	Rare on the forest within its habitat - occupies a small portion of its habitat
F3	Uncommon on the forest within its habitat
F4	Common on the forest within its habitat
F5	Widespread and abundant on the forest within its habitat
F?	Present on the forest but abundance information is insufficient to develop risk
FP	Possibly could occur on the forest, but documented occurrences not known
FN	Occurs on the forest, but no breeding population is documented on the forest
FO	Occurs off the forest
FH	Occurred on forest historically, but no known extant populations

Federally Listed Species

Federally listed threatened and endangered species are those plant and animal species formally listed by the U.S. Fish and Wildlife Service under authority of the Endangered Species Act of 1973 (P.L. 93-205), as amended. Pursuant to Section 7 (2) (a) of the Endangered Species Act, a biological assessment would be prepared to assess the effects of implementing the Coconino NF plan selected alternative on endangered or threatened species and ensure that proposed actions in the selected alternative would not jeopardize the continued existence of listed species.

The Coconino NF has 20 federally listed species or species proposed for listing under the Endangered Species Act on its threatened and endangered species list. The majority of threatened and endangered species on the forest are associated with perennial streams and riparian habitat. Designated proposed and critical habitats are also listed in table 3. These do not change by alternative. Table 3 lists the species, listing status, known endemism, primary habitats, current estimated habitat (amount of occupied habitat or number of records where known), and fine filter threats. Species with fine filter threats are further analyzed through the fine filter process. Species with no fine filter threats are evaluated at the coarse filter (habitat) level.

Table 3. Threatened and endangered species with their habitats and threats

Name/Status	Critical Habitat	Recovery Plan	F Ranking	Primary Habitat	Current Estimated Habitat	Fine Filter Threats Under Forest Service Control
Amphibians						
Chiricahua leopard frog *Lithobates chiricahuensis* **Threatened** **Endemic**	232 acres	Yes	F1	MBRDF, MWRF, Wetlands, Streams, Springs. Ephemeral drainages within Recovery Unit 5	14 occupied sites in and around constructed and natural waters. Suitable habitat: 101,329 acres.	Disease, predation, mining activities, managed grazing, barriers to connectivity, pollutants, rarity.
Birds						
California condor *Gymnogyps californianus* **Experimental nonessential; Endangered**	None	Yes	FN	Cliffs. Could use many ERUs	No occupied habitat. Two sitings on forest. Suitable habitat: 116,378 acres.	Energy development (transmission lines).
Mexican spotted owl *Strix occidentalis lucida* **Threatened** **Endemic**	575,100 acres	Yes	F2	PP Gambel oak, MCFF, MCIF Cliffs and canyons	118,341 acres of protected activity centers (PACs) representing 190 occupied or formerly occupied sites that occur wholly or partly on the forest. Suitable habitat: 403,461 acres.	Disturbance at occupied nest sites and roosts from activities such as dispersed recreation, fire suppression activities. Managed grazing.
Southwestern willow flycatcher *Empidonax traillii extimus* **Endangered**	472 acres	Yes	F1	CWRF, MBDRF, Springs	No occupied nesting habitat. Only single migratory and floater birds have been observed. 7,250 acres of potentially suitable habitat not including springs.	Disturbance at occupied nest sites, rarity, managed grazing. Nest parasitism, invasive plant species, and water diversions.
Western yellow-billed cuckoo *Coccyzus americanus occidentalis* **Threatened** **Endemic**	Proposed	No	F2	CWRF, MBDRF, mesquite bosques	Occupied sites: 18 representing 16.28 stream miles (1,790 acres habitat along the Verde River and its tributaries). Suitable habitat: 7,520 acres.	Disturbance during the breeding season from dispersed recreation activities such as hiking and camping, camping in developed campgrounds, and motorized travel.

Name/Status	Critical Habitat	Recovery Plan	F Ranking	Primary Habitat	Current Estimated Habitat	Fine Filter Threats Under Forest Service Control
Yuma Ridgway's rail *Rallus obsoletus yumanensis* **Endangered**	None	Yes	None		No longer considered to occur or have potential habitat on the forest.	None
Fish						
Colorado pikeminnow *Ptychocheilus lucius* **Experimental nonessential** **Restricted Distribution**	None	Yes	F2	Perennial streams, CWRF, MBDRF	Occupied and potentially suitable: 35.2 miles.	Physiological stress due to habitat loss or degradation and loss of habitat connectivity, disease, Competition and larval predation from introduced or invasive species.
Gila chub *Gila intermedia robusta* **Endangered** **Endemic**	11.8 stream miles	No	F1	Perennial streams, CWRF, MBDRF	Occupied and potentially suitable: 16.4 miles	Predation from and competition with non-natives. Physiological stress due to habitat loss or degradation, disease,
Gila topminnow *Poeciliopsis occidentalis occidentalis* **Endangered** **Endemic**	None	Yes	F1	Perennial springs Perennial streams, CWRF, MBDRF	Occupied: 9.1 miles[4], potentially suitable: 13.7 miles.	Physiological stress due to habitat loss or degradation, disease, predation (bullfrogs, crayfish) and competition from non-natives (Western mosquitofish)
Gila trout *Oncorhynchus gilae gilae* **Threatened** **Endemic**	None	Yes	F1	Perennial streams, MBDRF, MWRF	Potentially suitable and occupied: 23.3 miles. Introduced to the West Fork of Oak Creek in 2015.	Physiological stress due to habitat loss or degradation, disease, competition and hybridization with non-native trout, restricted range (small, isolated populations).

Name/Status	Critical Habitat	Recovery Plan	F Ranking	Primary Habitat	Current Estimated Habitat	Fine Filter Threats Under Forest Service Control
Little Colorado spinedace *Lepidomeda vittata* **Threatened** **Endemic**	About 31 stream miles	Yes	F1	Perennial streams, MWRF	Occupied and suitable: 31 miles	Physiological stress due to habitat loss or degradation (roads, fire, sedimentation, decreased flow due to impoundments), disease, predation and competition from introduced or invasive species (predation by rainbow trout and crayfish)
Loach minnow *Tiaroga cobitis* **Endangered** **Endemic**	79.8 miles	Yes	F1	Perennial streams, Riparian forest types	Occupied: 9.1 miles in Fossil Creek. Potentially suitable: 143.8 miles	Physiological stress due to habitat loss or degradation (dewatering of stream reaches), disease, predation by non-native fishes (catfish and red shiner)
Razorback sucker *Xyrauchen texanus* **Endangered**	42.7 miles	Yes	F2	Perennial streams, CWRF, MBDRF	Occupied and potentially suitable: 22.6 miles.	Physiological stress due to habitat loss, loss of connectivity, or degradation from water development, disease, predation by non-native catfish, pesticides and pollutants that degrade water quality.
Spikedace *Meda fulgida* **Endangered**	117.7 miles	Yes	F1	Perennial streams, CWRF, MBDRF	Occupied: 9.1 miles in Fossil Creek and Spring Creek. Critical Habitat: Verde River: 73.2 miles.	Physiological stress due to habitat loss or degradation, disease, predation and competition with non-native species.
Mammals						
Black-footed ferret *Mustela nigripes* **Endangered**	None	Yes	FH	GBG, MSG, PJG	No occupied habitat. 377,775 acres of potentially suitable habitat (last confirmed sighting 40 years ago).	None

Name/Status	Critical Habitat	Recovery Plan	F Ranking	Primary Habitat	Current Estimated Habitat	Fine Filter Threats Under Forest Service Control
Mexican Gray Wolf *Canis lupus baileyi* **Experimental non-essential; Endangered** **Endemic**	None	Yes	FN	No primary. Could use many	No occupied habitat. Potentially suitable habitat: 1,264,270 acres. Two sitings on forest.	None
Plants						
Arizona Cliffrose *Purshia subintegra* **Endangered** **Narrowly Endemic**	None	Yes	F1	DC, SDG, Verde Formation	Occupied habitat: 1,000 acres. Potentially suitable habitat: 57,571 acres.	Managed grazing, dispersed recreation, mining.
San Francisco Peaks Ragwort *Packera franciscana* **Threatened** **Narrowly Endemic**	720 acres	Yes	F1	SF, AT, talus slopes	Occupied habitat: 213 acres. Potentially suitable habitat: 939 acres.	Individual plants could be impacted by trampling, crushing, or soil erosion from off-trail hiking and localized avalanche abatement.
Reptiles						
Narrow-headed gartersnake *Thamnophis rufipunctatus* **Threatened** **Endemic**	Proposed	No	F1	CWRF, MBDRF, MWRF, perennial streams	Potentially occupied: 151.6 miles, potentially suitable 176.5 miles,	Physiological stress due to habitat loss or degradation, loss of native fish prey due to habitat loss and invasive species, predation from invasive species.
Northern Mexican gartersnake *Thamnophis eques* **Threatened** **Endemic**	Proposed	No	F1	CWRF, MBDRF, Wetlands perennial streams, ephemeral and intermittent drainages	Occupied habitat: lower Oak, Page Springs and Bubbling ponds fish hatcheries, Spring Creek, Sycamore Creek, and along the Verde River to Camp Verde. Suitable proposed critical habitat: 95.8 stream miles	Physiological stress due to habitat loss or degradation, loss of fish and amphibian prey due to habitat loss and invasive species, predation and competition for prey.

[4] Occupied habitat is considered the perennial portion of Fossil Creek, upstream of the permanent barrier in the Mazatzal Wilderness.

Sensitive Species

The Coconino NF has occupied or potential habitat for 53 Southwestern Region Sensitive Species. There are 2 amphibians, 4 birds, 4 fish, 7 invertebrates, 5 mammals, 31 plants, and no reptiles that are on the sensitive species list present or possibly present on the forest. Table 4 lists the species, known endemism, primary habitat (including any association with special features), current estimated habitat (amount of occupied habitat or number of records where known), and fine filter threats. Species with fine filter threats are further analyzed through the fine filter process. Species with no fine filter threats are evaluated at the coarse filter (habitat) level.

Table 4. Southwestern Region sensitive species with their habitats and threats

Name	F Ranking	Primary Habitat	Current Estimated Habitat	Fine Filter Threats Under Forest Service Control
Amphibians				
Lowland leopard frog *Lithobates yavapaiensis* *Endemic*	F1	CWRF, MBDRF, streams, wetlands, springs, ephemeral and intermittent drainages	One occupied site at Fossil Creek. Potential suitable habitat: 5,573 acres not including springs and drainages.	Disease, Invasive or non-native exotic species, Rarity
Northern leopard frog *Lithobates pipiens*	F2	Wetlands, springs, ephemeral and intermittent drainages, constructed waters.	147 estimated occupied sites in constructed and natural waters between Mormon Lake and the Mogollon Rim. Potential suitable habitat: 9,879 acres not including springs, drainages, or constructed waters.	Disease, Invasive or non-native exotic species
Birds				
American peregrine falcon *Falco peregrinus anatum*	F4	Cliffs	Occupied habitat: 32 known nesting pairs. Suitable habitat: 109,048 acres.	Disturbance
Bald eagle *Haliaeetus leucocephalus*	F3	CWRF, MBDRF, MWRF, PP, large trees and snags in these vegetation types, cliffs	Occupied habitat: 6 breeding areas and 11 confirmed winter roosts. Suitable habitat: 56,670 acres (excluding cliffs). 27 potential winter roosts.	Disturbance. Electrocution from transmission lines. Collisions with communication and other structures.
Northern goshawk *Accipiter gentilis*	F3	PP, MCFF, MCIF,	Occupied habitat: 83 post fledgling areas (including 3 shared with other forests) that total 54,686 acres. Suitable habitat: 878,599 acres.	Disturbance, rarity
Western burrowing owl *Athene cunicularia hypugaea*	FP	GBG, MSG, PJG	No occupied sites. Suitable habitat: 374,544 acres.	None

Name	F Ranking	Primary Habitat	Current Estimated Habitat	Fine Filter Threats Under Forest Service Control
Fish				
Desert sucker *Catostomus clarki* *Endemic*	F3	Perennial streams, all riparian forest types	Occupied and Suitable: 193.5 miles. Upper Verde River watershed including lower Oak and Sycamore Creeks	Physiological stress due to habitat loss or degradation, disease, predation, competition (invasives), rarity
Little Colorado sucker *Catostomus sp.* *Endemic*	F3	Perennial streams, all riparian forest types	Occupied and suitable: Lower and upper Clear Creek (124.1 potential perennial stream miles)	Physiological stress due to habitat loss or degradation, disease, predation, competition (invasives), rarity
Roundtail chub *Gila robusta now including the former Headwater chub (G. nigra)** Endemic *Change as of April 7, 2017 Federal Register Vol. 82, No. 66 pp. 16981-16988	F2	Perennial streams, All riparian forest types	Potentially occupied and suitable: 360 miles	Physiological stress due to habitat loss or degradation from water development, predation and competition with non-natives, disease, rarity
Sonora sucker *Catostomus insignis* *Endemic*	F3	Perennial streams, all riparian forest types	Occupied and Suitable: 193.5 miles. Upper Verde River Watershed including Oak and Sycamore Creeks	Physiological stress due to habitat loss or degradation and alteration of hydrologic regime, disease, predation (catfishes), rarity
Invertebrates				
A Caddisfly *Lepidostoma knulli* *Endemic*	F2	Perennial streams, springs, MBDRF, CWRF	Occupied and Suitable: Oak Creek from Sedona upstream to Pumphouse Wash, 14.5 miles	Rarity
A caddisfly *Wormaldia planae* *Restricted distribution*	F?	Perennial streams, MBDRF, CWRF	Occupied and suitable: Fossil Creek, 11.7 miles	Rarity.

Name	F Ranking	Primary Habitat	Current Estimated Habitat	Fine Filter Threats Under Forest Service Control
A mayfly *Moribaetis mimbresaurus* *Restricted distribution*	F2	Perennial and ephemeral streams, springs, CWRF, MBDRF	Occupied habitat: 1 site in Pumphouse Wash, 1 site in Oak Creek. Suitable habitat likely similar to *L. knulli*, 14.5 miles	Rarity
Balmorhea Saddle-Case Caddisfly *Protoptila balmorhea* *Narrowly endemic*	FO	Perennial springs, CWRF, MBDRF	Occupied and Suitable habitat: Page and Lolo Mai springs	Rarity
California floater *Anodonta californiensis* *Endemic*	FH	Perennial springs, perennial streams, all riparian forest types	No occupied sites. Suitable habitat: 287.8 miles not including springs	Invasive or non-native species
Fossil springsnail *Pyrgulopsis simplex* *Narrowly endemic*	F2	Perennial springs, perennial streams, CWRF, MBDRF	Occupied: multiple springs in the Fossil Creek watershed. Suitable: 13.7 miles not including springs	Rarity
Page springsnail *Pyrgulopsis morrisoni* Listing not warranted 10/8/2015 Narrowly endemic	FO	Perennial springs, perennial streams, CWRF	No occupied sites on the forest. Suitable: Springs in the Page Springs area of Oak Creek	Rarity
Mammals				
Allen's lappet-browed bat *Idionycteris phyllotis* *Restricted distribution*	F3	Large trees and snags in PP, MCFF, and MCIF; cliffs, caves	Thirteen occupied roosts. Suitable habitat not including caves: 61,798 acres.	Disturbance. Rarity
Navajo Mogollon vole *Microtus mogollonensis Navajo*	F2	PP, MCFF, MCIF, openings in PJW	Six known occupied areas. Suitable habitat: 959,348 acres	None
Pale Townsend's big-eared bat *Corynorhinus townsendii pallescens*	F3	Cliffs, caves, archaeological sites	Occupied habitat: 9 known roosts. Suitable habitat: 110,335 acres not including caves and archaeological sites.	Disease. Disturbance
Spotted bat *Euderma maculatum*	FN	Cliffs and caves	No occupied habitat. Suitable habitat 110,335 acres.	Disturbance

Name	F Ranking	Primary Habitat	Current Estimated Habitat	Fine Filter Threats Under Forest Service Control
Western red bat *Lasiurus blossevillii*	F3	Deciduous trees in CWRF, MBDRF, MWRF, PP	Two occupied areas: West Clear Creek Wilderness, Kachina Village area. Suitable habitat: 324,754 acres.	Pesticides
Plants				
Alcove bog orchid *Platanthera zothecina* *Restricted distribution*	F1	MBDRF and springs (hanging gardens)	5 occupied sites totaling about one acre. Suitable habitat: 9,135 acres	Rarity and high levels of dispersed recreation in West Fork of Oak Creek
Arizona bugbane *Actaea arizonica* *Endemic*	F2	Canyons in MBDRF, MWRF	20 occupied sites totaling about 185 acres. Suitable habitat: 7,641 acres.	Rarity and high levels of dispersed recreation in West Fork of Oak Creek
Arizona phlox *Phlox amabilis* *Endemic*	F3	DC, SDG, PJW, PP	Occupied habitat: < 1 acre (16 records). Suitable habitat: 1,206,560 acres.	Rarity
Arizona sneezeweed *Helenium arizonicum* *Endemic*	F2	MSG, PP, Wetlands, Springs,	Occupied habitat: about 500 acres (264 records). Suitable habitat: 45,000 acres.	Rarity, Non-native invasive species, disturbance
Arizona sunflower *Helianthus arizonensis* *Restricted distribution*	F1	PJW	Occupied habitat: 1 acre (1 record). Suitable habitat: 92,913 acres.	Rarity
Bebb's willow *Salix bebbiana*	F1	MWRF, springs	Occupied habitat: < 50 acres (10 records). Suitable habitat: 3,829 acres not including springs.	Rarity, herbivory, water diversion
Blumer's dock *Rumex orthoneurus* *Restricted distribution*	F1	MWRF, springs	Occupied habitat: < 1 acre (1 record). Suitable habitat: 3,829 acres not including springs	Rarity, herbivory, water diversion
Cochise sedge *Carex ultra* *Endemic*	F1	MBDRF, MWR, springs.	Occupied habitat: <1 acre (2 records). Suitable habitat: 7,441acres not including springs.	Rarity
Crenulate moonwort *Botrychium crenulatum*	F2	AT	Occupied habitat: < 1 acre (5 records). Suitable habitat: 939 acres.	Rarity. Off trail hiking. Localized avalanche abatement.

Name	F Ranking	Primary Habitat	Current Estimated Habitat	Fine Filter Threats Under Forest Service Control
Disturbed (Tusayan) rabbitbrush *Chrysothamnus molestus* *Endemic*	F1	Calcareous soils in PJG	Occupied habitat: 340 acres. Suitable habitat: 8,040 acres.	Rarity, excessive disturbance to plants
Ertter's rose *Rosa woodsii* var. *ertterae* *Endemic*	F1	MBDRF, MWRF	Occupied habitat: < 1 acre representing 7 records. Suitable habitat: 2,751 acres	Rarity and high levels of dispersed recreation in West Fork of Oak Creek
Flagstaff beardtongue *Penstemon nudiflorus* *Endemic*	F3	PJES, PP	Occupied habitat: 500 acres (330 records). Suitable habitat: 895,117 acres.	Rarity, Ground disturbance
Flagstaff pennyroyal *Hedeoma diffusa* *Endemic*	F1	Rocky dolomitic limestone cliffs and ledges in PP, IC	Occupied habitat: >700 acres representing 258 occurrences. Suitable habitat: 111,918 acres.	Ground disturbance from vegetative treatments, Rarity
Phillip's (Grand Canyon) agave *Agave phillipsiana* *Endemic*	F1	Archaeological sites on limestone soils in SDG, PJES, DC.	Occupied habitat: <10 acres. Suitable habitat: 234,453 acres.	Rarity, Ground disturbance
Hairy clematis (Arizona leatherflower) *Clematis hirsutissima* var. *hirsutissima*	F1	PP	Occupied habitat: 15 acres. Suitable habitat: 569,400 acres.	Disturbance, rarity
Heathleaf wild buckwheat *Eriogonum ericifolium* var. *ericifolium* *Narrowly Endemic*	F1	Verde Formation in DC	Occupied habitat: 25 acres. Suitable habitat: 57,571 acres.	Rarity
Lyngholm's cliffbrake *Pellaea lyngholmii* *Endemic*	F1	Cliffs	Occupied habitat: < 1 acre (4 records). Suitable habitat: 53,381 acres.	Rarity, Ground Disturbance
Metcalfe's tick trefoil *Desmodium metcalfei* *Restricted distribution*	F1	MBDRF, PJES	Occupied habitat: < 1 acre (4 records). Suitable habitat: 267,447 acres.	Rarity, disturbance

Name	F Ranking	Primary Habitat	Current Estimated Habitat	Fine Filter Threats Under Forest Service Control
Mogollon thistle *Cirsium parryi* ssp. *Mogollonicum* *Narrowly endemic*	F1	Springs	Occupied habitat: < 1 acre (3 records). Suitable habitat: 5 acres	Rarity. Invasive plants.
Mt. Dellenbaugh sandwort *Arenaria aberrans* *Endemic*	F1	SDG, IC, PJES, PJG, PP	Occupied habitat: < 1 acre (15 records). Suitable habitat: 1,065,886 acres.	Rarity, Disturbance
Page Springs agave *Agave yavapaiensis* *Endemic*	F1	Archaeological sites in SDG, PJES	Occupied habitat: <1 acre (45 records). Suitable habitat: 193,205 acres	Rarity, Ground disturbance
Ripley's wild buckwheat *Eriogonum ripleyi* *Narrowly Endemic*	F1	Verde Formation in DC	Occupied habitat: 25 acres. Suitable habitat: 57,571 acres.	Rarity
Rock fleabane *Erigeron saxatilis* *Endemic*	F1	Cliffs and ledges in canyons	Occupied habitat: < 1 acre (8 records). Suitable habitat: 29,453 acres.	Rarity, Ground Disturbance
Rusby's milkwort (Hualapai milkwort) *Polygala rusbyi* *Narrowly endemic*	F2	Verde Formation in DC, SDG, PJES	Occupied habitat: 100 acres. Suitable habitat: 84,636 acres.	Rarity
Rusby's milkvetch *Astragalus rusbyi* *Endemic*	F3	Basalt soils in PP, MSG, MCFF, MCIF, Aspen	Occupied habitat: < 1,200 acres. Suitable habitat: 531,523 acres.	Rarity, disturbance
Sacred Mountain agave *Agave verdensis* *Endemic*	F1	Archaeological sites in SDG and DC.	Occupied habitat: < 50 acres representing 11 records. Suitable habitat: 89,401 acres	Rarity, Ground disturbance
Senator Mine alumroot *Heuchera eastwoodiae* *Endemic*	FP	Cliffs	Occupied habitat: none. Suitable habitat: 55,505 potential acres of cliffs in canyons.	Rarity
Sunset Crater beardtongue *Penstemon clutei* *Narrowly endemic*	F2	PP, PJG, PJW, cinder soils in Sunset Crater volcanic field	Occupied habitat: 50 acres. Suitable habitat: 15,314 acres.	Rarity, Dispersed recreation

Name	F Ranking	Primary Habitat	Current Estimated Habitat	Fine Filter Threats Under Forest Service Control
Tonto Basin agave *Agave delamateri* *Endemic*	F1	Archaeological sites in SDG, PJES, DC	Occupied habitat: <50 acres. Suitable habitat: 234,453 acres.	Rarity, Ground disturbance
Verde breadroot *Pediomelum verdiensis* *Narrowly endemic*	F1	Verde Formation in DC, SDG	Occupied habitat <5 acres (11 records). Suitable habitat: 23,990 acres	Rarity
Verde Valley (Mearn's) sage *Salvia dorrii* var. *mearnsii* *Narrowly endemic*	F2	Verde Formation in DC, SDG, PJES	Occupied habitat: <50 acres. Suitable habitat: 57,571 acres.	Rarity

Other Species

There are 56 other species whose viability may be at risk (1 amphibian, 9 birds, 2 fish, 4 invertebrates, 5 mammals, and 35 plants) that are present or possibly present on the Coconino NF. Table 5 lists the species, NatureServe conservation status, known endemism, primary habitat (including any association with special features), current estimated habitat (amount of occupied habitat or number of records where known), and fine filter threats. Species with fine filter threats are further analyzed through the fine filter process. Species with no fine filter threats are evaluated at the coarse filter (habitat) level.

Table 5. Other forest planning species with their habitats and threats

Name and NatureServe Conservation Status	F Ranking	Primary Habitat and Special Feature Association	Current Estimated Occupied and Potentially Suitable Habitat	Fine Filter Threats Under Forest Service Control
Amphibian				
Arizona toad *Anaxyrus microscaphus* Endemic	F2	CWRF, MBDRF, MWRF, Wetlands, Springs. Ephemeral and intermittent drainages used for movements.	Occupied and potentially suitable: 20,939 acres not including springs	Disease, invasive exotic animal species, rarity, hybridization with Woodhouse's toad.
Birds				
Common black hawk *Buteogallus anthracinus* Endemic	F4	CWRF, MBDRF, MWRF	Occupied: 32 nesting areas. Potentially suitable: 10,818 acres.	Disturbance

Name and NatureServe Conservation Status	F Ranking	Primary Habitat and Special Feature Association	Current Estimated Occupied and Potentially Suitable Habitat	Fine Filter Threats Under Forest Service Control
Evening grosbeak *Coccothraustes verspertinus*	F3	MCFF, MCIF, SF, Aspen	Occupied and potentially suitable: 2,881 acres.	None
Ferruginous hawk *Buteo regalis*	F3	SDG, GBG, MSG	No occupied nesting habitat. Potentially suitable: 115,570 acres	None
Golden eagle *Aquila chrysaetos*	F3	Cliffs. Occasionally snags and large trees in PP.	Occupied habitat: 9 nesting areas. Potentially suitable: 10 potential nesting areas and 110,335 acres of potential cliff sites.	Disturbance. Electrocution from transmission lines. Collisions, injury, or death associated with communication towers or energy development structures. Large-scale wind/solar energy development
Golden-crowned kinglet *Regulus satrapa*	F3	MCFF, MCIF, SF	Occupied and potentially suitable: 100,684 acres.	None
MacGillivray's warbler *Geothlypis tolmiei*	F4	MBDRF, MWRF, MCFF, MCIF, SF	Occupied and potentially suitable: 94,143 acres.	None
Pinyon jay *Gymnorhinus cyanocephalus*	F4	PJES, PJG, PJW	Estimated occupied and potentially suitable: 204,552 acres	None
Swainson's thrush *Catharus ustulatus*	F1	MCIF, SF	Estimated occupied and potentially suitable: 41,186 acres.	None
Three-toed woodpecker *Picoides dorsalis*	F3	MCFF, MCIF, SF	Estimated occupied and potentially suitable: 100,648 acres.	None
Fish				
Bluehead sucker *Catostomus discobolus*	F3	Perennial streams, riparian forest types	Occupied and potentially suitable: 123.5 miles.	Physiological stress due to habitat loss or degradation –particularly larger perennial rivers and streams, disease, predation, competition (invasive species)

Name and NatureServe Conservation Status	F Ranking	Primary Habitat and Special Feature Association	Current Estimated Occupied and Potentially Suitable Habitat	Fine Filter Threats Under Forest Service Control
Longfin dace *Agosia chrysogaster* *Endemic*	F3	Perennial streams, CWRF, MBDRF	Occupied and potentially suitable: 163.5 miles	Physiological stress due to habitat loss or degradation from flow alterations, predation (crayfish and Red Shiner)
Invertebrates				
Alberta arctic *Oeneis alberta daura*	F2/F3	MSG, MCIF, Aspen, Springs	Occupied and potentially suitable: 29,174 acres, not including springs.	None
Arizona snaketail *Ophiogomphus arizonicus* *Endemic*	F2?	Perennial springs, perennial streams, CWRF, MBDRF	Occupied: Multiple sites in Oak Creek. Potentially suitable: 287.8 miles	Rarity
Persephone's darner *Aeshna persephone* *Endemic*	F2?	Perennial springs, perennial streams, CWRF, MBDRF	Occupied: <1 stream mile. Potentially suitable: 287.8 miles.	Rarity
Redrock stonefly *Anacroneuria wipukupa* *Restricted distribution*	F2?	Perennial springs, perennial streams, CWRF, MBDRF	Occupied: Collected at five sites within or near forest boundaries. Potentially suitable: 287.8 not including springs	Rarity
Mammals				
Beaver *Castor canadensis*	F3	Streams, CWRF, MBDRF, MWRF	Occupied habitat: 719 acres. Potentially suitable habitat: 1,438 acres.	None
Greater Western mastiff bat *Eumops perotis californicus*	F1	Cliffs	Two records from the forest including one breeding site. No known roosts. Suitable habitat: 110,335 acres	None
Gunnison's prairie dog *Cynomys gunnisoni*	F3	GBG, MSG, PJG	Occupied habitat: 7,294 acres. Potentially suitable: 377,775 acres.	Disease
Pronghorn antelope *Antilocapra americana*	F3	GBG, Montane Grasslands, SDG	Occupied and potentially suitable habitat: 206,025 acres.	Disturbance. Connectivity, Rarity
Southwestern myotis *Myotis auriculus*	F3	Medium to large Gambel oak in PP-Gambel oak subtype, snags. Caves.	Occupied habitat: 15 known roosts. Potentially suitable habitat: 303,450 acres not including caves.	Disease, disturbance to active maternity or winter roosts in caves.

Name and NatureServe Conservation Status	F Ranking	Primary Habitat and Special Feature Association	Current Estimated Occupied and Potentially Suitable Habitat	Fine Filter Threats Under Forest Service Control
Plants				
Basin bladderpod *Lesquerella cinerea* *Restricted distribution*	F3	DC, SDG, PJES	Occupied habitat: <5 acres (40 records). Potentially suitable: 417,066 acres.	Rarity
Bearded gentian *Gentianopsis barbellata*	F2	AT	Occupied habitat: 200 acres. Potentially suitable: 939 acres.	Rarity, off-trail hiking, localized avalanche abatement
Bigelow's onion *Allium bigelovii* *Restricted distribution*	F2	DC, SDG, IC	Occupied habitat: <1 acre (5 records). Potentially suitable: 203,049 acres	Rarity
Black dropseed *Sporobolus interruptus* *Endemic*	F3	PP, GBG, MSG, PJES, PJG	Occupied habitat: >6,000 acres (48 records). Potentially suitable: 1,433,990 acres.	Rarity
Black spleenwort *Asplenium adiantum-nigrum*	F1	Cliffs	Occupied habitat: <1 acre (1 record). Potentially suitable: 2,787 acres.	Rarity
Blackroot sedge *Carex elynoides*	F1	AT	Occupied habitat: <1 acre. Potentially suitable: 939 acres	Rarity, off-trail hiking, localized avalanche abatement
Bollander's quillwort *Isoetes bolanderi*	F1	Wetlands	Occupied habitat: <1 acre (1 record). Potentially suitable: 2,545 acres.	Rarity
Bristlecone pine *Pinus aristata*	F3	SF	Occupied and suitable habitat: 13,946 acres.	Non-native organisms - White pine blister rust
Colorado blue columbine *Aquilegia caerulea var. pinetorum* *Restricted distribution*	F1	MCIF, SF	Occupied habitat: 1 acre (6 records). Suitable habitat: 51,028 acres.	None
Common moonwort *Botrychium lunaria*	F1	SF, AT, MSG (subalpine portion)	Occupied habitat: < 1 acre (23 records). Potentially suitable: 17,121 acres.	Rarity

Name and NatureServe Conservation Status	F Ranking	Primary Habitat and Special Feature Association	Current Estimated Occupied and Potentially Suitable Habitat	Fine Filter Threats Under Forest Service Control
Corkbark (subalpine) fir *Abies lasiocarpa var. arizonica* *Restricted distribution*	F3	SF	Occupied and potentially suitable: 13,946 acres.	None
Creeping milkvetch *Astragalus troglodytus* *Endemic*	F3	PP	Occupied habitat: <5 acres (47 records). Potentially suitable: 1,111,196 acres	Rarity, disturbance
Dane's dwarf gentian *Gentianella tenella*	F1	AT	Occupied habitat: <5 acres 9 records. Potentially suitable: 939 acres.	Rarity, off-trail hiking, localized avalanche abatement
Diamond Valley suncup *Camissonia gouldii* *Restricted distribution*	F1	PP Cinder soils in the Sunset Crater volcanic field	Occupied habitat: <1 acre (12 records). Potentially suitable: 15,314 acres.	Rarity
Different-nerve sedge *Carex heteroneura*	F1	AT	Occupied habitat: <5 acres (4 records). Potentially suitable: 939 acres.	Rarity, off-trail hiking, localized avalanche abatement
Ebony spleenwort *Asplenium playtneuron*	F1	Rocky outcrops and cliffs (dacite rock formations)	Occupied habitat: <1 acre (4 records). Potentially suitable: 2,787 acres.	Rarity
Flagstaff cinquefoil *Potentilla sanguinea* (syn. *Potentilla thurberi* var. *sanguinea*) Endemic	F1	PP	Occupied habitat: 10 acres (17 records). Potentially suitable: 791,897 acres.	Rarity, disturbance
Fossil Creek bedstraw *Galium collomiae* *Endemic*	F1	Cliffs	Occupied habitat: <5 acres (20 records). Potentially suitable: 34,058 acres.	Rarity
Graceful buttercup *Ranunculus inamoenus var. subaffinis* *Narrowly endemic*	F1	SF, AT	Occupied habitat: <5 acres (30 records). Potentially suitable: 14,884 acres.	Rarity
Hall's milkweed *Asclepias hallii* *Restricted distribution*	F1	MCIF, MSG	Occupied habitat: <1 acre (2 records). Potentially suitable: 37,083 acres.	None

Name and NatureServe Conservation Status	F Ranking	Primary Habitat and Special Feature Association	Current Estimated Occupied and Potentially Suitable Habitat	Fine Filter Threats Under Forest Service Control
James rubberweed *Hymenoxys jamesii* *Endemic*	F2	PP	Occupied habitat: <1 acre (1 record). Potentially suitable: 1,055,732 acres.	Rarity, disturbance
Jones' wild buckwheat *Eriogonum jonesii*	F2	PJG, PP	Occupied habitat: <5 acres (8 records). Potentially suitable: 1,053,329 acres.	Rarity, disturbance
MacDougal's aletes *Aletes macdougalii* *Restricted distribution*	F1	PJES, PP, MBDRF	Occupied habitat: <1 acre (8 records). Potentially suitable: 49,619 acres.	Rarity, disturbance
Mearn's lotus *Lotus mearnsii var. mearnsii* *Endemic*	F3	Limestone soils in DC, SDG, PJES	Occupied habitat: 20 acres (15 records). Potentially suitable: 97,817 acres.	Rarity
Oak Creek triteleia *Triteleia lemmoniae* *Endemic*	F2	PP, Wetlands, Springs	Occupied habitat: <1 acre (20 records). Potentially suitable: 801,776 acres.	Rarity
Pond lily *Nuphar lutea*	F1	Wetlands	Occupied habitat: <5 acres. Potentially suitable: 9,879 acres.	Rarity, disturbance to plants
Reflected moonwort *Botrychium echo*	F1	SF	Occupied habitat: <1 acre (1 record). Potentially suitable: 13,946 acres.	Rarity
Serrate phacelia *Phacelia serrata* *Restricted distribution*	F3	PP, cinder soils	Occupied habitat: 50 acres (26 records). Potentially suitable: 15,314 acres.	Rarity, Dispersed recreation
Skunk-top scurfpea *Pediomelum mephiticum* *Restricted distribution*	F1	SDG, PJES	Occupied habitat: <1 acre (5 records). Potentially suitable: 353,518 acres.	Rarity
Spider saxifrage *Saxifraga flagellaris*	F1	AT	Occupied habitat: <1 acre (1 record). Potentially suitable: 939 acres.	Rarity, off-trail hiking, localized avalanche abatement
Utah bladder fern *Cystopteris utahensis* *Restricted distribution*	F2	Cliffs	Occupied habitat: 5 acres (20 records). Potentially suitable: 56,669 acres.	Rarity

Name and NatureServe Conservation Status	F Ranking	Primary Habitat and Special Feature Association	Current Estimated Occupied and Potentially Suitable Habitat	Fine Filter Threats Under Forest Service Control
Verde four-nerve daisy *Tetraneuris verdiensis* Narrowly endemic	F1	Desert Communities, Verde Formation	Occupied: 2.6 acres, 1 population. Potentially suitable: 1,920 acres	Rarity
Western mousetail *Myosurus nitidus* *Restricted distribution*	F2	PJES, PP	Occupied habitat: <1 acre (4 records). Potentially suitable: 1,055,733 acres.	Rarity, Disturbance
Yavapai wild buckwheat *Eriogonum pulchrum* *Endemic*	F2	PJG	Occupied habitat: <1 acre (2 records). Potentially suitable: 261,432 acres.	Rarity, Disturbance

Analysis

Following the identification of the forest planning species, a two-stage process, coarse filter[1] and fine filter[2], was used to evaluate primary threats to species and their habitats and whether plan direction adequately provided for species viability. This process considered habitat (coarse filter) and species specific needs (fine filter). Species-specific plan direction was developed as needed to address those threats that the Forest Service could impact through management and for which it has jurisdictional control.

Species addressed in the coarse filter analysis are those who lack species-specific threats within Forest Service authority to their population viability. For some species, the likelihood of habitat limiting their resilience or increasing their vulnerability to stochastic events was low to moderate, which means that plan components that support desired conditions for the habitat, in general, are likely sufficient to provide for the species. However, for other species, this risk was moderate to high usually because the species is believed to have a limited range on the forest or it only occurs where certain habitat features are present, so it could be more vulnerable to altered disturbance regimes or stochastic events compared to species with a larger range. As plan components were developed, the habitat conditions that are required for these species were considered so that species without species-specific or fine filter threats had their habitat needs addressed by the plan components.

Analysis of coarse filter plan components and their ability to address threats to habitat is based on the ability of alternatives to address concerns of habitat abundance, quality, and threats to ERUs and other habitats. For coarse filter species, if plan components for an alternative address the threats to these habitats, then the threats to the species would also be addressed. As a result, the viability of these species' population is met by the plan components for the habitats and the species are not further analyzed in the fine filter analysis. Species for which the coarse filter is inadequate to address their threats are discussed further in the fine-filter analysis section.

This coarse filter/fine filter process was used to help develop and refine desired conditions, standards, and guidelines for the revised plan. Species specific plan direction was developed where needed for threats which the Forest Service could impact through management and for which the Forest Service has jurisdictional control.

Coding used in this analysis refers the reader to specific plan components that would apply by alternative. For alternative A, when specific plan language is being referenced, the analysis will include information in parentheses indicating on which page(s) the referenced plan component(s) can be found (e.g., 1987 Plan, page 1). For alternatives B (modified), C, and D, codes have been

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[1] Example of coarse filter process: Fire exclusion (a threat) in ponderosa pine (a habitat) has resulted in increased stand density, increased competition, and increased canopy. Consequently, less sunlight reaches the ground in some areas compared to reference conditions, and the understory (grasses, forbs, and shrubs) has become less abundant, diverse, and vigorous. Plan components that address fire exclusion by promoting natural fire return intervals and fire severity and describe desirable understory conditions address the primary threats to the habitat and associated species. Consequently, in this example, plan components that address the threat of fire exclusion to ponderosa pine also address the primary habitat threat to associated species.

2 Example of fine filter process: Chiricahua leopard frogs have threats in addition to threats to their habitats. They are threatened by chytrid fungus, a disease that is fatal to amphibians. Desired conditions for habitats used by frogs describe the composition, structure and natural processes of their environment but do not address species specific threats. A fine filter guideline was added to the plan specifically to address the threat of disease.

assigned to each plan component to reference and visually distinguish plan decisions more easily. Abbreviations are used in each code to identify: (1) if a plan decision applies forestwide (FW) or within a particular management (MA) or special (SA) area; (2) the applicable resource area (e.g., Air, Soil, etc.); and (3) type of plan decision (i.e., a desired condition (DC), objective (O), standard (S), or guideline (G)). The last part of each code is a number. For example, FW-WFP-DC-1 and 2 point to forestwide direction (FW) in the “Wildlife, Fish and Plants” section (WFP) and specifically to desired conditions (DC) numbers 1 and 2. The code SA-Wild-S-1, 2, and 3 refers to the plan section on “Special Areas” (SA) which includes wilderness (Wild) as one type of special area, and standards (S) 1, 2 and 3 in that section.

Assumptions for Wildlife, Fish, and Plants

- Fifteen years was the timeframe used for the species analysis because it is the life of the plan, and there is more certainty with the models within this timeframe.
- If a species is associated with a particular habitat, then the quality and quantity of habitat elements available to the species helps to predict its distribution and abundance within that habitat.
- Habitat abundance and distribution similar to that which supported associated species during conditions as a consequence of evolutionary time, will likely contribute to their maintenance in the future (Haufler et al. 1999). Therefore, habitat abundance and distribution similar to reference conditions will likely contribute to associated species maintenance in the future and the farther a habitat departs from those conditions, the lower the likelihood that it is sustainable and the greater the risk to viability of associated species.
- Risks to some species are the same as the risks to the habitats in which they occur. It was assumed that actions to address the risks or departures in these habitats would benefit the species as well.
- Little change to the amount of habitat, or habitat abundance, has occurred between reference conditions and the present. In other words, the Cottonwood Willow Riparian Forest on the forest now was Cottonwood Willow Riparian Forest in reference conditions. Little change to the amount of cliffs on the forest has occurred since reference conditions, and because little management occurs on cliffs, little change to the quality of cliff habitat has occurred.
- In general, the farther a habitat is departed from desired conditions (i.e., from reference or reference adjusted conditions), the greater the risk to viability of associated species and the less the alternative’s viability effectiveness. Conversely, the closer a habitat is to desired conditions, the lower the risk to viability of associated species and the greater the alternative’s viability effectiveness.
- It was assumed that the states in the Ponderosa Pine Gambel Oak subtype were proportional to the states in the Ponderosa Pine ERU as a whole.

Abundance, distribution, and quality of habitat

Abundant and well-distributed habitat provides for the continued persistence of a species. Abundance is the amount of habitat on National Forest System lands. Unless otherwise indicated, we assumed that little change to the amount of habitat would occur over time. In some cases, the amount of suitable habitat (quality) acres can change such as when grassland becomes wooded or

when a large fire removes the entire forest overstory. Note that some habitats are naturally rare like riparian forests, or alpine tundra.

Abundance values (consisting of rare, occasional, and common) were used to categorize the projected abundance of each habitat after 15 years of implementing each plan alternative. Fifteen years is considered the life of the plan during which a trajectory for habitat improvement or protection would be set. Fifteen years was also considered the point in time for which vegetative modeling would most accurately reflect progress toward achieving desired conditions and the consequences of plan direction between alternatives could be reasonably compared. Habitat distribution is expressed in terms of the mix of vegetation states or seral stages within an ERU. Habitat distribution can change with management, which is often the purpose of treatments. Habitat distribution considered the condition of intermixed ownerships and conditions, which may affect the interactions of species among suitable habitat areas on National Forest System lands. Lands in other ownership within or surrounding the Coconino may contribute to, or hinder, maintenance of species viability on National Forest System land.

Future habitat abundance and future habitat distribution based on management and activities are qualitatively classified (table 6). Future distribution is classified in terms of desired conditions; hence, while a habitat element may be common on the Coconino NF in the future, if it is still mostly departed from these conditions, it would be considered poorly distributed.

Table 6. Values used to categorize projected abundance of each habitat element

Habitat Abundance Value	Description
Rare	The habitat (ERU or habitat element) is rare, with generally less than 100 occurrences, or patches of the element generally covering less than 1 percent of the national forest planning area.
Occasional	The habitat (ERU or habitat element) is encountered occasionally, and generally is found in 1 to 10 percent of the national forest planning area.
Common	The habitat (ERU or habitat element) is abundant and frequently encountered, and generally is found on more than 10 percent of the national forest planning area.

Values for habitat abundance and distribution are estimated for existing condition and the 15-year plan period with consideration of trend to 50 years for each habitat by alternative. The values are primarily based on treatment objectives (table 7). For more information, see the sections on Vegetation and Fire, Soil, Watersheds and Water, Riparian Areas, and Biophysical Features, in volume I of the FEIS. Habitat quality may affect the movements and interactions of individuals among the suitable habitat areas found on National Forest System lands. This approach relies on the assumption that conditions similar to those that supported associated species during recent evolutionary history would likely contribute to their maintenance in the future, and the further a habitat departs from reference distribution and reference conditions, the greater the risk to viability of associated species.

Table 7. Values used to categorize distribution and quality of habitat and habitat elements

Value	Description of Habitat Distribution and Quality Values
Poor	High departure. The structure, composition, and or functioning of habitat is in poor condition relative to reference conditions. Number and size of habitat areas and /or their evenness in distribution across the landscape is greatly reduced.
Fair	Moderate departure. The structure, composition, and or functioning of habitat is in fair condition relative to reference conditions. Number and size of habitat areas and/or their evenness in distribution across the landscape is somewhat reduced.
Good	Low departure. The structure, composition, and/or functioning is similar to reference conditions. Number and size of habitat areas and /or their evenness in distribution across the landscape is similar to or only slightly reduced relative to reference conditions.

Likelihood of habitat limitation variable

Habitat abundance and quality values are combined to create one variable to indicate the general likelihood that the habitat would be limiting to populations of associated species, considering LRMP management and activities. This was done for each ERU and habitat element by alternative. The values are based on treatment objectives and mainly reflect the findings in the Vegetation/Fire, Riparian, Water, and Soil and other resources sections in Volume I of the FEIS (table 8). This "likelihood of limitation" was described as low, low-moderate, moderate, or high. In general, poor quality rare habitat would be more likely to increase the likelihood of risk to viability of associated species; good quality common habitat would be less likely to increase the risk to viability of associated species. In this general context, habitat could be limiting due to the abundance, distribution, or quality of habitat.

Table 8. Likelihood that habitat abundance and habitat quality will be a limiting factor to associated species

Habitat	Habitat Quality		
Abundance	Poor	Fair	Good
Rare	High likelihood that habitat would be a limiting factor for species viability	High likelihood that habitat would be a limiting factor for species viability	Moderate likelihood that habitat would be a limiting factor for species viability
Occasional	High likelihood that habitat would be a limiting factor for species viability	Moderate likelihood that habitat would be a limiting factor for species viability	Low likelihood that habitat would be a limiting factor species viability
Common	Moderate likelihood that habitat would be a limiting factor for species viability	Low-Moderate likelihood that habitat would be a limiting factor for species viability	Low likelihood that habitat would be a limiting factor for species viability

Species likelihood of limitation variable

Providing for species viability requires providing habitat (within the capacity of the forest) in a condition that allow existing populations to persist. The ability of existing populations to respond to available habitat depends in part on the populations' current robustness, which is generally a function of size or the number of populations. To reflect this, the likelihood of habitat limitation variable was combined with a species' F-Rank for each species/habitat element interaction to generate this rating. An F Rank is a categorical variable that describes the species current abundance and distribution on the forest (table 9). In general, for a given habitat condition, few small populations would be at greater risk than many widespread and abundant populations.

Table 9. Likelihood that an individual species would be limited by its habitat

F Rank	Likelihood of Limitation			
	High	**Moderate**	**Low-Moderate**	**Low**
F1 Very rare on the forest within its habitat – occupies a very small portion of its habitat.	Very High	High	Moderate-High	Moderate
F2 Rare on the forest within its habitat - occupies a small portion of its habitat	High	Moderate-High	Moderate-High	Moderate
F3 Uncommon on the forest within its habitat	Moderate-High	Moderate	Low-Moderate	Low
F4 Common on the forest within its habitat	Moderate	Low-Moderate	Low-Moderate	Low
F5 Widespread and abundant on the forest within its habitat	Low-Moderate	Low	Low	Low
F? ,FP, FN F? – present on the forest, but abundance information is insufficient to develop risk FP- possibly could occur on the forest, but documented occurrences not known FN – occurs on the forest, but no breeding population is documented on the forest	High	Moderate	Low-Moderate	Low
FH Occurred on the forest historically, but no known extant populations	High	Moderate	Low-Moderate	Low
FO Occurs off of the forest	Not Applicable	Not Applicable	Not Applicable	Not Applicable

As described above, associations of very rare species with habitat elements that are likely to be most limiting were identified as those most at risk; associations of more common species with habitats less likely to be limiting received lower risk ratings.

Management effect variable

This variable categorizes the relative expected outcome of plan language in each alternative in terms of minimizing species viability risk and are the result of plan decisions, including plan objectives. Management effect category values are 1, 2, 3, and 4. The lower the tally or number of management effects ratings for a species' associated habitat, the more effective the alternative is for that species viability. For example, a management effect of '4' under alternative A means that plan components may not exist or may be few and a decline in habitat quality as a result of management or lack management that result from plan components could be expected. In contrast, a management effect of '2' under alternative B (modified) means that plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat elements and is more effective for species viability than alternative A.

Table 10. Description of relative management effect rating

Management Effect Value	Description
1	Plan components provide optimal protection and management for **all** habitat and habitat element occurrences in the plan area. Quality of habitat or habitat elements is maintained or improved by providing protection, maintenance, and restoration to all or most occurrences (with limited exceptions). Where applicable, plan components address all identified fine filter species threats and needs in the plan area.
2	Plan components maintain or improve habitat quality by maintaining or improving protection and management for **most** habitat and habitat element occurrences in the plan area. Where applicable, plan components address the majority of identified fine filter species threats and needs.
3	Plan components maintain or improve protection and management for **some** habitat occurrences in the plan area. Quality of habitat or habitat elements is maintained or improved by providing protection, maintenance, and restoration to some occurrences. Where applicable, plan components address **some** identified fine filter species threats and needs.
4	Decline in habitat quality as a result of management or lack of management that result from plan components. Plan components may not exist or may be few. Where applicable, plan components address **few** identified fine filter species threats and needs.

Viability Effectiveness and Fine Filter Analysis

The fine filter analysis discusses finer scale species needs or concerns that are in addition to the coarse filter. Viability needs of species associated with the coarse filter habitat are generally met by improving, maintaining, or moving toward ERU or riparian area desired conditions. Standards and guidelines help meet the viability needs of species associated with fine filter habitat elements. However, the coarse-fine filter approach is not entirely discrete in that standards and guideline can contribute to viability for some coarse filter species, while the needs of fine filter species can also be provided for, in part, by the coarse filter desired conditions.

Coarse filter comparison of alternatives was done using a combination of using likelihood of habitat limitation values, management effect, and habitat trends. Likelihood of habitat limitation represent the intersection of abundance and quality and mainly reflect the findings in the Vegetation/Fire, Riparian, Water, and Soil and other resources sections in Volume I of the FEIS. Management effect is the overall expected outcome of alternative implementation in terms of species viability and are the result of plan decisions, including plan objectives.

Habitat trends (away, static, slowly toward, toward) were also used to compare the estimated rate of change, or improvement, relative to desired conditions for each alternative. Vegetation trend was used because vegetation responds more rapidly to natural or human-caused disturbances than soil and changes in vegetation would be more likely to occur within the planning period due to treatments.

The likelihood that a particular species would be limited by its habitat is also called the species likelihood of limitation and is a viability risk rating. The species likelihood of limitation outcomes for each species/habitat relationship were based on combining the species F Rank with the associated habitats likelihood of limitation (table 9). Viability risk categories are very high (VH), high (H), moderate-high (MH), moderate (M), low-moderate (LM), and low (L). Risk ratings of low to moderate are assumed to pose little risk to viability because they would fall within the natural range of variation in the environment.

A fine filter analysis was conducted for species with threats in addition to those associated with habitat. A section called Wildlife and Plant Issues and Topics compared the effects of plan language in each alternative on issues and topics relevant to a number of species. This section included topics and issues such as: mechanized use on trails in botanical and geological areas, connectivity, motor vehicle and disturbance in general, disturbance to plants, climate change, non-native or invasive species, and at-risk species. The analysis for each fine filter species included not only the coarse filter analysis for its habitats, but further evaluation of the specific topics and issues relevant to that species.

Wildlife and Plant Issues and Topics

Species-related issues were identified in the Analysis of the Management Situation (USDA Forest Service 2010a) and through comments received during the 90-day comment period. Some of those issues are shared by many of the species analyzed in the environmental impact statement. This section looks at some of the primary issues that species on the forest share: connectivity, motor vehicle disturbance, disturbance (to plants), non-native or invasive species, and at-risk species. Rather than repeat this analysis for every species to which it applies, these topics are being addressed once here. In the subsequent discussions on specific species, these wildlife and plant issues and topics will be incorporated by reference as applicable. For example, the analysis for Chiricahua leopard frog points to the Non-native or Invasive Species topic in the Wildlife and Plant Issues and Topics section for additional analysis regarding the impacts of invasive species.

Connectivity

Habitat connectivity was identified as an issue in the Analysis of the Management Situation in 2010 and through public comment. The concern was that the revised plan may not adequately promote habitat connectivity, address fragmentation, nor promote the identification or removal of potential barriers to wildlife movement or pollinators.

Contiguous or mostly contiguous blocks of habitat provide movement corridors for breeding, foraging, dispersal, and migration for terrestrial and aquatic species, including pollinators. Connectivity between habitat patches promotes movements of species between foraging and wintering grounds, up and down streams, and are needed for immigration, emigration, dispersal, as well as genetic flow between populations. Connectivity can occur at different spatial scales and among similar and different habitat patches. Species such as mountain lions or mule deer may move over thousands of acres, whereas Abert’s squirrels or northern leopard frogs move over a much smaller scale. These movements assure survival of individuals, family groups, help prevent local populations from extinction (Laurance 1991, Beier and Loe 1992), enable gene flow and reduce inbreeding depression (Beier and Loe 1992, Bennett 2003), and facilitate essential ecological processes like pollination and seed dispersal (Townsend and Levey 2005). Connectivity within and between stream networks is critical for persistence of many aquatic species by providing habitats for completion of all stages of species life histories and providing refugia in times of flood or drought, food resources and nutrients in the ecosystem (Fausch et al. 2002).

Habitat fragmentation can alter connectivity. Habitat fragmentation can be caused by natural processes (e.g., wildfire or flooding) or by unnatural processes (e.g., human development, energy production, roads). Connectivity can also be affected when linkages, or movement areas, are fragmented by unsuitable environmental conditions such as invasive or non-native species or

unsuitable temperatures. Fragmentation is when previously large or intact areas are broken into smaller disconnected areas by human activities. Barriers to animal movement can threaten the long-term persistence of wildlife populations and the long-term stability of ecosystems (Noss 1983, Wilcox and Murphy 1985, Noss 1987, Bennett 2003, Henle et al. 2004). Habitat fragmentation can cause problems such as roadway mortality and genetic isolation, and can increase the risk of wildlife-vehicle collisions and unwanted close encounters with wildlife.

Habitat fragmentation can be somewhat mitigated by protecting linkages, travelways, or corridors. Natural linkages include ridgelines, canyons, riparian areas, cliffs, and intact swaths of forest or grasslands. Linkages are most effective when they connect relative large and unfragmented areas of protected habitat that are large enough to sustain healthy wildlife populations and associated ecosystems. Wildlife linkages and their associated habitat may help wildlife adapt to changing climate by allowing populations to shift their range with latitude or elevation as the distribution of vegetation communities (Arizona Game and Fish Department (AZGFD) 2013). Linkages benefit plants by providing avenues for pollinator movement, allowing pollen transfer between populations (Townsend and Levey 2005).

Prior to 1876, we assume there were few to no barriers to animal movement or plant dispersal in northern Arizona. Since that time, population growth has resulted in urbanization, lands in different ownerships, more roads and traffic, and increased year-round recreation on national forest lands and wilderness areas. The development and use of structures has affected movement corridors and dispersal potential for many species, particularly wide-ranging animals. Structures can include roads, railroads, dams, fences, water diversions, and structures associated with energy, communication, management, and permitted activities. Traffic volume can contribute to fragmentation by reducing the frequency with which wildlife cross busy highways (Gagnon et al. 2007). Connectivity has also been affected by changes in vegetation; this includes encroachment of trees in and between grassland areas, invasive species, drought, or entire loss of movement corridors as a result of uncharacteristic wildfire. Lands in other ownership also affect connectivity via urban and rural development and increased activities and infrastructure. Not all habitats are, or should be connected. For example, endemic species often develop in isolated springs.

Several collaborative efforts have evaluated connectivity on the forest including the Arizona Wildlife Linkages Assessment (AZGFD 2006b), the Coconino County Wildlife Connectivity Assessment (AZGFD 2013a), and the San Francisco Peaks to Mogollon Rim Linkage Design (AZGFD 2013b). The 2013b report identified two wildland blocks that include the Coconino NF: the San Francisco Peaks and Mogollon Rim blocks. Located on the west side of Interstate 17, these two blocks were considered biologically important to 11 focal species and are expected to remain in relatively natural condition for at least 50 years. Three ‘strands’ or linkages were identified and suggested to maintain the connection between these two wildland blocks. The focal species were: Abert’s squirrel, badger, black bear, bobcat, elk, Gunnison’s prairie dog, mule deer, porcupine, pronghorn, Arizona black rattlesnake and northern leopard frog. Roads, rail lines, and developed lands were identified as significant obstacles.

The 2013b report also included possible mitigation measures for barriers and recommendations for maintaining or improving the permeability of wildland blocks for wildlife. These included removing or redesigning fences and addressing impacts from irresponsible recreation, noise, lighting, invasive species, unrestrained domestic pets, and other sources. Roadway mitigation structures could include overpasses, bridges, and culverts and so on to facilitate movement above or beneath roadways. Mitigation would be site-specific and dependent on the target species, scale

of the road, topography, traffic volume, and other considerations. Possible strategies for reducing the impacts of urban and rural development that are applicable to public lands are mentioned: combine habitat conservation with compatible goals such as recreation and protection of water quality; plan trails to minimize resource damage and disturbance of wildlife; encourage users to stay on trails and keep dogs leashed, and minimize human-wildlife conflict; encourage wildlife-friendly fencing; and discourage the killing of threat species such as rattlesnakes. This report also recommends prioritizing parcels that overlap wildlife corridors for future acquisition as open space.

All Alternatives

All alternatives identify known corridors such as the ones near Fort Valley, A-1 Mountain, Woody Ridge, and along busy highways (1987 Plan, pages 206-113 and 114). These corridors are mentioned in Background and Description for Wildlife, Fish and Plants in the proposed revised plan, because they are part of the existing condition.

All alternatives have areas that are closed seasonally to provide recreation opportunities in areas undisturbed by vehicles and/or to provide quiet areas for wildlife. These areas total about 45,962 acres and have existing closure orders: Pine Grove, Rattlesnake, Woods, and Woody Ridge (1987 Plan, page 59, 206-114, the Off-Road Driving Management Plan for Land and Resource Management Planning (Revised May 1991); MA-PineBelt-DC-5, 6, 7, 8, MA-LkMary-DC-4, MA-PineBelt-S-1, 2, 3, 4, and MA-LkMary-S-1).

All alternatives would provide large tracts of unroaded landscapes in Deadman Wash, which would benefit disturbance-sensitive pronghorn and golden eagles (1987 Plan, page 206-87; MA-PntdDsrt-DC-2, MA-VolcanWd-DC-4).

All alternatives promote fence designs that minimize obstructions to most animal movements (page 69, FW-WFP-G-- 6). Depending on where the fences are, this would maintain or improve the permeability of wildland blocks and corridors where ever they occur.

Roads fragment habitat by breaking large areas into small isolated patches supporting fewer individuals, and these small populations can lose genetic diversity and can become at risk of local extinction (Dodd et al. 2011). Barriers to movement or mortality hazards like roads would be reduced through expected work associated with the Four-Forest Restoration project that would decommission 200 to 800 miles of unauthorized roads and system roads (FW-RdsFac-O-1). These are not new roads but are identified on the motor vehicle use map. Although there is no plan objective, this work is also expected to occur in alternative A. Assuming each road is about 15 feet wide, including drainage ditches, then 1 mile of road equals about 1.8 acres of habitat (15 feet x 5,280 feet per mile=79,200 feet squared/43,560 square feet per acre=1.8 acres). Assuming that each naturalized or decommissioned road eventually becomes re-vegetated, then 200 decommissioned miles would represent approximately 360 acres of habitat and 800 miles would be the equivalent of 1,440 acres of habitat.

Alternative A

In alternative A, connectivity of habitats is primarily addressed through area-specific or habitat-specific plan language (i.e., FLEA, Sedona-Oak Creek Area, Highway Corridor 180, Mogollon Rim, Ponderosa Pine Mixed Conifer Less Than 40 Percent Slope, Pinyon Juniper Woodland Less Than 40 Percent Slope, Grassland and Sparse Pinyon Juniper Above the Rim, Riparian and Open Water). See 1987 Plan, pages 124, 125, 126, 133, 204; 148; 151;152; 153; 164; 201; 206-4; 206-

11; 206-50-51, 206-73, 206-75, 76, 206-103, 206-105, 206-107, 206-111, 206-113,114, 116. This language would protect some of the known travelways or corridors, provide cover in travelways, and reduce fragmentation. In addition, forestwide range standards and guidelines state that antelope passes, let-down fences, electric fences, or elk jumps should be installed wherever necessary to improve wildlife travelways (1987 Plan, page 69). This language would maintain or improve the permeability of wildland blocks where they exist and reduce the impacts to wildlife from human activities or management. Steeper slope habitats, designated wilderness, and rugged or hard to access terrain have maintained connectivity due to lack of management.

The approximately 151,333 acres of designated wilderness is managed to maintain wilderness resource values while emphasizing wilderness recreation and watershed condition (1987 Plan, page 105). Mechanized use and motorized use are not permitted in wilderness. Although naturally ignited fires are encouraged, few to none have been allowed to burn because of concerns for values-at-risk, human safety, and plan language that makes burning logistically more challenging to accomplish (see Vegetation and Fire Report for more detail). Designated wildernesses are not fragmented by roads or lands in other ownership, are widely distributed on the forest, generally overlap rugged terrain such as canyons, mountains, or cliffs, and vary in size. They are generally undisturbed by people or management activities except at trail heads, parking areas, and along main trails. For the most part, they maintain ecological function and biodiversity except for areas where fire in fire-adapted systems has been excluded. Depending on their size and the condition of the surrounding area, they may function as an essential part of a wildland block or linkage, especially when they are contiguous with other natural landscapes. For example, Strawberry Crater Wilderness is isolated, but is located near land managed by the National Park Service and is near Deadman Wash, which is managed for large tracts of unroaded landscape and remote recreational experiences (1987 Plan, page 206-87). This combination of land ownership and compatible objectives increases the effectiveness of a wildland block, improves connectivity, and is beneficial for wide-ranging or interactive species (Soulé et al. 2005).

Alternative A lacks plan components that address connectivity between riparian areas and uplands, between riparian and aquatic habitats and ground water, and along streams. These connections are essential for properly functioning ecosystems.

Alternative B (modified)

In contrast to alternative A, plan language in alternative B (modified) addresses connectivity of habitats forestwide. This alternative addresses interconnected terrestrial, riparian, and aquatic habitats through desired conditions that would promote access to new habitats, perpetuation of genetic diversity, species movements, dispersal, and migration (FW-Water-DC-4, 6; FW-Rip-All-DC- 1, 2, 3 and G-2; FW-Rip-RipType-G-2;FW-TerrERU-All-DC-3; FW-TerrERU-Grass-DC-3; FW-WFP-DC-6, FW-WFP-G-6; and MA-AMesa-DC-3). This language would maintain or improve habitat permeability and mitigate effects to linkages.

A desired condition in Roads and Facilities promotes protection of wildlife habitat and movement in the design of the transportation system (FW-RdsFac-DC-1) and a guideline requires managers to design bridges, culverts, stream crossings on permanent roads, and diversion structures to allow safe passage for aquatic organisms (FW-RdsFac-G-9). These plan components would also mitigate impacts to linkages and maintain or improve permeability of habitat blocks. This alternative makes an allowance for impermeable structures, e.g., to allow movement barriers where it is necessary to protect native aquatic species from non-native aquatic species (FW-WFP-DC-9, FW-RdsFac-G-9). Although this could negatively impact movements of aquatic species, at

the same time it would enhance survival and reproduction and contribute to the viability of the native species.

Implementation of the plan components under alternative B (modified) would include wetland, spring, and upland soil and watershed improvement projects that promote and restore proper function and connectivity (FW-Rip-All-DC-3, FW-Rip-Spr-O-1, FW-Rip-Wtlnds-O-1, FW-Rip-RipType-O-1, FW-Rip-All-G-1, 2).

Additional language in alternative B (modified) would reduce the impacts from increased uses or certain types of uses on the forest. These plan components would help sustain the permeability of wildland blocks and reduce impacts to linkages. This language includes: balancing recreational opportunities with the capacity of forest resources to support them and having minimal resource conflicts (FW-Rec-All-DC-6); managing recreation to prevent wildlife access to food, trash, and human waste (FW-Rec-All-G-2); and not issuing lands and recreation special use permits for activities proposed to occur within 200 feet of perennial streams, springs, or waters that contribute to or support sensitive resources such as federally listed or Southwestern Region sensitive species (FW-SpecUse-G-3). FW-Rec-Trls-G-1,3 would result in trail use remaining on the established trail surface, especially in high traffic or sensitive areas and few unplanned user-created trails.

Other plan components would mitigate the impacts from urban and rural development by locating and designing new and reconstructed overhead utility lines, support towers and other utility infrastructure to minimize adverse ecological and wildlife impacts (FW-SpecUse-G-5); retaining vegetation in rights-of-way to allow for habitat for species and wildlife movement corridors if vegetation does not interfere with meeting vegetation clearance requirements (FW-SpecUse- G-6), and designing alternative energy developments, such as wind energy, to minimize or avoid impact to other uses and resources, in particular wildlife (FW-SpecUse-G-11).

A desired condition in Land Adjustments describes a mostly contiguous land base that provides for biological diversity, retains its wildland character, and retains open space values (FW-LndAdj-DC-1). Guidelines in the same section identify qualities that the forest should consider when evaluating lands for acquisition (lands that contribute to the continuity of wildlife and plant habitat; that contain or influence wetlands, riparian areas, or other water related features, or that contain habitat for listed or sensitive species) (FW-LndAdj-G-1). Collaboration and coordination with other stakeholders is critical to managing connectivity and addressing barrier issues because habitat, linkages, and barriers are often multi-jurisdictional and at scales larger than a single entity. Several management approaches are beneficial in this regard. Collaboration with partners and stakeholders on grassland restoration, grassland connectivity, and education is encouraged through a management approach for Grassland ERUs. Management approaches under Wildlife, Fish, and Plants and Roads and Facilities encourage working with the Arizona Game and Fish Department, Arizona Department of Transportation, Arizona Wildlife Linkages Working Group, and others to identify linkages and barriers to wildlife movements, mitigation during project design, the establishment and removal of fish barriers, and improvement of wildlife movements across interstate highways. This could lead to utilizing products developed from other similar collaborations.

Alternative B (modified) recommends three wildernesses totaling 8,732 acres: Abineau (adjoins Kachina Peaks Wilderness), Strawberry (an addition to the Strawberry Crater Wilderness), and Davey’s (an addition to the Fossil Creek Wilderness). Recommended wilderness would be

managed to maintain or enhance primitive and undeveloped characteristics, to preserve native species, and to have ecological systems substantially free from effects or evidence of human control or manipulation (SA-RWild-DC-1, 2, and 3). These areas are not entirely protected from disturbance; however, because mechanized recreation is permitted, providing it does not detract from wilderness values, and motor vehicle use should only occur for limited administrative and permitted activities consistent with the area's wilderness character (SA-RWild-DC-6, SA-RWild-G-3). Motorized big game retrieval is permitted, providing it is consistent with Travel Management Rule decisions. Nonetheless, recommended wilderness would still remain in natural condition, be less disturbed than surrounding areas, and be additions to designated wilderness and expand wildland block or corridor areas, benefitting the associated species.

Alternative C

Alternative C has similar effects for recommended wilderness as alternative B (modified) except instead of 8,732 acres of recommended wilderness, there are 90,853 acres of recommended wilderness. The majority of acres in recommended wilderness are in Pinyon Juniper Evergreen Shrub, Pinyon Juniper Woodland, Cottonwood Willow Riparian Forest, Mixed Broadleaf Deciduous Riparian Forest, Montane Willow Riparian Forest, and Semi-desert Grassland.

The spatial arrangement of nine of these recommended wildernesses would result in mostly contiguous designated or recommended wilderness from the Wet Beaver Creek Wilderness south to the Matazal Wilderness. Generally, these wildernesses areas are rugged and have comparatively few roads and human disturbances. This continuity would be particularly beneficial for species with large home ranges like mountain lions, one of the top predators on the forest. Mountain lions tend to select for rough terrain, forest, woodland or chaparral cover, lower road densities, and avoidance of human disturbance (USGS 2007, Nicholson et al. 2014, Van Dyke et al. 1986 a and b). Mountain lions have large home ranges that range from about 13,000 to 207,000 acres for resident males, and about 7,000 to nearly 54,000 acres for resident females (Nicholson et al. 2014) so that large areas with the above characteristics would be most suitable for lions. In addition, the majority of the designated and recommended wilderness areas contain vegetation types favored by lions and their prey. A study by Van Dyke in 1986 suggested that lions most frequently crossed unimproved dirt roads, the type most likely to be found in recommended wilderness areas.

Unlike alternatives A and B (modified), alternative C would have plan components in eight management areas that more explicitly emphasize corridors and connectivity. These management areas are: Anderson Mesa, Blue Ridge, Hospital Ridge, Jack's Canyon, Knoll Lake, Limestone Pasture, Pine Grove, and Second Chance. The following desired condition would apply to each of the above management areas: "*Old growth stands and riparian corridors found within this MA provide biologically significant cores and corridors for wildlife and fish through the landscape.*" New guidelines would limit impacts to wildlife and associated habitats by limiting public motor vehicle access, limiting large group activities and large commercial tours (except for research), and maintaining the current area of motorized dispersed camping corridors. In addition, existing seasonal closures would remain largely unfragmented. These plan components would maintain or improve the permeability of the associated wildland blocks and linkages by reducing disturbance (see also the section on Motorized Vehicle Use and Disturbance).

The recreation and transportation suitability determinations for alternative C would also maintain permeability of wildland blocks or core areas and reduce the impacts of barriers more than the other alternatives because new motorized areas and new motorized trails would be not suitable in

these specific management areas. Note that suitability determinations are recommendations, not decisions, and are subject to site-specific NEPA.

Alternative D

Alternative D has the same effects as alternative B (modified), except there is no recommended wilderness.

Summary: Generally, alternative C has the most comprehensive plan language related to connectivity and fragmentation of all the alternatives, followed by alternatives B (modified) and D, than A.

Motor Vehicle Disturbance and Disturbance in General

Stakeholders were concerned that proposed revised plan language may not fully address disturbance of wildlife species from motor vehicle traffic. Alternative C was developed in part to address this topic. Conversely, some stakeholders thought that motor vehicle use did not present a threat to wildlife species, except for major highways, and thought this topic was inadequately addressed in the DEIS.

Human disturbance can negatively affect species in a variety of ways.

Motorized use, people presence, and indirectly, relatively high road densities, may cause raptors to abandon their territories or nests (Reynolds and Reiser 1992, Squires and Reynolds 1997, Morrison et al. 2009, Morrison et al. 2011, Kruger 2002) or lower productivity. This has been noted in golden eagles, ferruginous hawks, ospreys, black hawks, and Swainson's hawks. (Zuberogoitia et al. 2014, Richardson et al. 1999, White and Thurow 1985, Kahl 1972, Berry 1980, Schnell 1994, and 1998 in Sadoti 2012). Increased human activity may also result in home-range changes in raptors (Andersen et al. 1990). Individuals of certain species may tolerate certain types and intensities of disturbance. For example, in a study on the Kaibab Plateau, Grubb et al. (2013) found no evidence, based on their level of testing, that logging truck noise negatively affected nesting northern goshawks nor did they detect a response to general aviation aircraft. The authors made a point that less obvious physiological responses could have occurred and that different patterns in log hauling activity, changes in the proximity of goshawk nests to existing roads, or even different forest and terrain structure could result in different levels of response. A New Mexico study found no evidence that black hawks preferred nest sites farther from human activity than non-nests (Sadoti 2012).

Disturbance can also negatively affect bat maternity colonies and hibernating bats. Disturbance can negatively impact reproductive output and/or increase energy expenditure at a time in their life cycle where energy and conditions for minimizing energy expenditure is at a premium. Disturbance can also cause them to re-locate to less suitable hibernating sites (Tuttle and Stevenson 1977). For example, activity levels in a bat maternity colony increased in response to light intensity, noise, day of season, and distance between maternity roost locations and cave tours (Mann et al. 2002). (Gillette and Kimbrough 1970 and McCracken 1989 in BCI 2011). Each arousal of hibernating bats can rob them of 10 to 30 days of stored fat reserves (Thomas et al. 1990 and Tuttle 1991 in BCI 2011. Although bats may return to torpor after disturbance, they may lack sufficient energy reserves to make it through the rest of the winter.

Motor vehicles

Motor vehicle traffic in general can be lethal or non-lethal. Non-lethal disturbance could be a human related presence (wildlife watching, motorized vehicle) or sound (Frid and Dill 2002). In general, the magnitude of effects is influenced by the amount, type, frequency, duration, magnitude, location, speed, and timing of motor vehicle traffic (Steidl and Powell 2006, Loss et al. 2014) and associated uses could vary based on road condition, road width, road density, access to different destinations (such as camping areas, water and riparian areas), daily and seasonal timing, holiday/weekend, and values such as scenery or desirable recreation opportunities. The effects of motorized use and associated uses are typically of short duration however they affect wildlife populations adversely in both the short- and long-term (Steidl and Powell 2006).

Potential impacts to wildlife or wildlife populations could be physiological responses (heart rate, stress hormones), behavior and activity budgets, or space or habitat use. Species can vary widely in their responses to human activities as do different populations of the same species, which can depend on their previous exposure to the human activity (Steidl and Powell 2006). Deer, elk, and pronghorn may also have physiological effects from motorized wheeled vehicle disturbance particularly during critical periods such as winter or breeding season. Disturbance from recreation result in additional energy expenditure from ungulates by increasing metabolism and heart rate (Canfield et al. 1999, Geist 1978). This has been confirmed for white-tailed deer (Moen et al. 1982, Moen 1978), elk (Canfield et al. 1999) and mule deer (Freddy 1977, Weisenberger et al. 1996) and could result in increased vulnerability to predation, disease or death (Geist 1971, Berwick 1968, and Legg 1999). Additional disturbance-induced energy expenditure during the summer could occur when males are developing antlers or horns, females are lactating, and animals are accumulating fat reserves to over winter.

Fahrig and Rytwinski (2009) did a review of the effects of roads and traffic on animal abundance. Seventy-nine studies were reviewed and they found results for 131 species and 30 species groups. These studies showed that amphibians and reptiles tended to be negatively affected. Birds mostly had negative effects or no effects although there were a few positive effects for some small birds and for vultures. Loss et al. (2014) found that mortality can be higher with juvenile birds, in areas where bird populations are abundant, and in areas with favorable bird habitat in close proximity to the road.

The review showed that small mammals generally showed either positive effects or no effect; mid-sized mammals showed either negative effects or no effect, and large mammals showed predominantly negative effects. Using this information and information on species characteristics, Fahrig and Rytwinski developed predictions of the conditions that would lead to negative or positive or no effects of roads on animal abundance. Species types predicted to respond negatively to roads were those attracted to roads and unable to avoid individual cars; species with large movement ranges, low reproductive rates and low natural densities; small animals whose populations are not limited by road-affected predators and either avoid habitat near roads due to traffic disturbance or either avoid habitat near roads due to traffic disturbance or do not show avoidance of roads or traffic disturbance and are unable to avoid oncoming cars. Species types predicted to respond positively to roads were those species that are attracted to roads for an important resource such as food and are able to avoid oncoming cars and species that do not avoid traffic disturbance but do avoid roads and whose main predators show negative population-level responses to roads.

Table 11 shows the possible effects by species group for roads along with the rationale for the effect (Fahrig and Rytwinski 2009).

Table 11. Potential effect of roads or traffic disturbance on different species groups

Possible effect	Species groups	Rationale	
Vulnerability to road mortality. May reduce recruitment (Bury et al. 1977)	Amphibians, reptiles, some mid-sized and large mammals	Attracted to roads or do not avoid roads (i.e., use roads for thermal regulation; roads resemble some other habitat to which they are attracted)	Vulnerability is increased for slow moving species and/or those whose behavioral response to traffic is to stop.
		Roads overlap seasonal migration routes	
Higher overall probability of being killed	Animals with large movement ranges	Those that do not avoid roads may have a higher frequency of road crossing	May have territories with lower road densities even if they don't avoid roads
Positive road effects	Animals with sufficient cognitive ability and movement speed to avoid vehicles	Food availability may be higher	
	Animals that are not affected by (or avoid) roads or traffic and their predators are negatively affected by roads	Predation pressure could be less for these species in roaded areas. Animals may avoid some roads due to lack of protective cover.	
No road effects	Several small birds and small mammals	Road avoidance but not disturbed by traffic	Small movement ranges, small territory size, high reproductive rates. Road mortality can be low.

Motorized use on roads may kill individuals crossing or basking on roads and over time this reduces recruitment, particularly with species that have long maturation times (Bury et al. 1977). Severe impacts have been documented for wide-ranging predators such as the cougar in southern California, Florida panther, ocelot, wolf, and Iberian lynx (Forman et al. 2003 in AZGFD 2013b). In a 4-year study of 15,000 km of road observations in Organ Pipe Cactus National Monument, Rosen and Lowe (1994) in AZGFD 2013b found an average of at least 22.5 snakes per km killed annually due to vehicle collisions. The proportion of dead frogs and toads can increase with increasing traffic (Fahrig et al. 1995, Bouchard et al. 2009).

Some wildlife species respond to motorized use by altering their use of the roadside habitat through avoidance or displacement. Wildlife may use roadside habitats more frequently on low use roads than roads with high traffic volume (Edge and Marcum 1991). Elk, deer, and bear have been documented to avoid roads. Habitats near the roads are less available for elk use (Rost 1975, Edge 1982, Lyon 1979, 1983; Edge and Marcum 1985 a and b, 1991). Mountain lions have been reported to avoid heavily trafficked paved highways and areas with high densities of secondary roads (Alexander and Waters 2000, Dickson et al. 2005, Van Dyke et al. 1986b) although they may favor lightly traveled unpaved roads (Dickson et al. 2005). Results from USGS's 2007 study in the Flagstaff Uplands showed that paved highways were a barrier to lions. Numbers of

observed highway crossings were an order of magnitude less than expected if highways did not exist. This applied to Interstate 40, the Burlington Northern Santa Fe railroad line, Highway 180 and Lake Mary Road. USGS also reported that female lions avoided a 0.5- to 2-km area near paved highways whereas male lions did not.

Habitat Loss and Fragmentation due to roads

Roads and road use could potentially affect species occupancy in fragmented habitats and could cause a decline in habitat effectiveness. Some roads are barriers to the movement of some animals and this could affect population persistence for some but not all species. The literature indicates that relatively small, unpaved roads are not likely to affect populations of small mammals (Jaeger et al. 2005, McGregor et al. 2008, Bissonette and Rosa 2009, Fahrig and Rytwinski 2009). While individual animals may be killed by vehicles while they are crossing the road, overall effects to small mammals are not likely to occur at a scale that would affect predators.

In summary, motor vehicle traffic and/or disturbance can affect wildlife species in a variety of ways including death and injury, physiological responses, behavior and activity budgets, or space or habitat use. It can result in a decline in habitat effectiveness, failed or diminished reproduction, or even isolation of populations (AZGFD 2013b). The magnitude of effects is influenced by many factors including the amount, type, frequency, duration, magnitude, location, speed, and timing of motor vehicle traffic (Steidl and Powell 2006, Loss et al. 2014) and associated uses could vary based on road condition, road width, road density, access to different destinations (such as camping areas, water and riparian areas), daily and seasonal timing, holiday/weekend, and values such as scenery or desirable recreation opportunities. It is also influenced by the species (gender, age, time of year) and habitat requirements.

Environmental Consequences

Common to All Alternatives

Beneficial plan language in all alternatives includes seasonal closures, and implementation of timing restrictions to reduce disturbance to federally listed species, Southwestern Region sensitive species, golden eagles, pronghorn and a variety of other species. This language would have the indirect positive effects of promoting population recruitment and survival.

All alternatives have areas that are closed seasonally to provide recreation opportunities in areas undisturbed by vehicles and/or to provide quiet areas for wildlife. These areas total about 45,962 acres and have existing closure orders: Pine Grove, Rattlesnake, Woods, and Woody Ridge (1987 Plan, page 59, 206-114, the Off-Road Driving Management Plan for Land and Resource Management Planning (Revised May 1991); MA-PineBelt-DC-5, 6, 7, 8, MA-LkMary-DC-4, MA-PineBelt-S-1, 2, 3, 4, and MA-LkMary-S-1). In addition, the Cottonwood Basin Seasonal Closure area provides seasonally undisturbed habitat to protect bald eagles (1987 Plan, page 167, MA-VerdeV-DC-7, and S-1).

All alternatives require that timing restrictions be applied to projects that potentially negatively affect federally listed species, bald eagles, golden eagles (FW-WFP-S-2), and Southwestern Region sensitive species and pronghorn (1987 Plan, pages 64-1, 65-11, 206-11,206-12, 206-13, 206-67, 206-73, FW-WFP-G-8). Caves and abandoned mines used by bats would be managed to reduce disturbance to the species (1987 Plan page 51-1, FW-BioPhys-Geo-G-6).

Plan components in alternative A specifically provide for timing restrictions around active osprey nests. This would reduce disturbance and promote successful reproduction (1987 Plan, page 124). Although the other alternatives do not specifically mention osprey, other plan language would have similar effects. For example, the other alternatives have a guideline to that project related activities with the potential to disturb active raptor nests should be restricted within a minimum of 300 yards of these nest sites (FW-WFP-G-11). In addition, projects and management activities should be designed or managed to maintain or improve habitat for native species (FW-WFP-G-3). The 1987 Plan promotes successful reproduction and reduced disturbance by providing for uncut areas around active raptor nests and bald eagle roosts. The size of the uncut area varies by species (pages 123, 124). Plan language for the West MA (Management Area 38), would minimize recreation impacts to disturbance sensitive species outside the Urban/Rural Influence Zone and avoid or limit human disturbance to rare species such as peregrine falcons and Arizona bugbane (1987 Plan, pages 206-114 and 116).

There is miscellaneous plan language in all alternatives that relate to specific places on the forest or specific activities that would also reduce disturbance to species. This plan language follows.

All alternatives have guidelines that would protect the habitat for a variety of species in the vicinity of Walnut Canyon. These guidelines would be beneficial for survival and reproduction and would benefit the habitat for their prey species. Alternative A includes a guideline to protect the natural and cultural resources in the urban/wildland interface and the lands surrounding the (Walnut Canyon) national monument (1987 Plan, page 206-109). Alternatives B (modified), C, and D includes a guideline for activities and uses on the forest to be managed to protect cultural sites and to preserve habitat for disturbance-sensitive species both on the forest and within Walnut Canyon National Monument (MA-Walnut-G-1).

All alternatives list criteria that should be considered when closing a road including activities that cause stress or could negatively impact reproduction. When implemented, the closures could enhance survival, movements, and wildlife reproduction. This is a management approach in the Roads and Facilities section of the revised plan. See also 1987 Plan, pages 59, 206-71.

All alternatives would restrict aircraft activities related to commercial filming to protect threatened, endangered, and sensitive species, and would remind managers to work with the Federal Aviation Administration and air operators and administrations to minimize disturbances caused by aircraft over key wildlife areas. These plan components would eliminate or reduce aircraft-related disturbances to disturbance-sensitive species. See1987 Plan, page 206-11, and FW-SpecUse-G-13. A management approach in the revised plan promotes collaboration with the Federal Aviation Administration, airport administrations, air tour operators, military and government agencies, and other aircraft operators to minimize disturbances caused by aircraft over designated wilderness areas of the Coconino NF. Aircraft disturbances include, but are not limited to, diminishing solitude and primitive recreation opportunities and disruption to key wildlife areas during important times of their life cycle. Examples of key wildlife areas could include peregrine falcon nesting sites and big game wintering habitat. Encourage aircraft operators to adhere to the Federal Aviation Administration's Notice to Airmen regarding minimum altitudes over wilderness.

Other plan components would limit smoke from campfires in Oak Creek to protect habitat for bats, birds, and wildlife (1987 Plan, page 187-1; MA-OakCrk-G-10).

All alternatives would provide large tracts of unroaded landscapes in Deadman Wash that would benefit disturbance-sensitive pronghorn and golden eagles (1987 Plan, page 206-87; MA-PntdDsrt-DC-2, MA-VolcanWd-DC-4).

A guideline for all special uses would reduce disturbance by restricting land and recreation special use permits for activities within 200 feet of perennial streams, springs or waters that contribute to or support sensitive resources include federally listed or sensitive species (FW-SpecUse-G-3.

All alternatives have approximately 151,333 acres of designated wilderness which is managed to maintain wilderness resource values (1987 Plan, page 105, SA-Wild-DC-1, 2). Mechanized use and motorized use are not permitted in wilderness. Designated wildernesses are not fragmented, are widely distributed on the forest, generally overlap rugged terrain such as canyons, mountains, or cliffs, and vary in size. They are generally undisturbed by people or management activities except at trail heads, parking areas, and along main trails. For the most part, they would maintain ecological function and biodiversity except for areas where fire in fire adapted systems have been excluded. Depending on their size and the condition of the surrounding area, they may function as an essential part of a wildland block or linkage especially when they are contiguous with natural landscapes. Strawberry Crater Wilderness for example is isolated but is located near land managed by the National Park Service and near Deadman Wash (managed by Forest Service and National Park Service). Deadman Wash is managed for large tracts of unroaded landscape and remote recreational experiences (1987 Plan, page 206-87, MA-PntdDsrt-DC-2, MA-VolcanWd-DC-4)). This combination of land ownership and compatible objectives increases the area of relatively low disturbance and is beneficial for wide-ranging or interactive species (Soulé et al. 2005) as well as the other disturbance sensitive species.

Alternative A

Like alternative B (modified), alternative A promotes raptor survival by addressing the threat of collisions and electrocution of raptors by towers and powerlines, which should be constructed, or re-constructed, according to raptor specifications (1987 Plan page 80 and FW-SpecUse-G-5). However, alternative A does not address alternative energy such as wind and solar, and the impact of that infrastructure to raptors, or other species such as bats.

Unlike alternative B (modified), alternative A lacks timing restrictions for golden eagles, therefore, golden eagle reproduction could be negatively impacted by disturbances. Negative impacts could include a reduced number of young or lack of reproduction in a given year.

Alternative A would enhance or maintain survival and reproduction of wetland-nesting birds, deer, elk, pronghorn, turkeys, and bears through timing restrictions during the breeding season; however, the plan language is mostly specific to particular activities or particular areas (1987 Plan, pages 173, 176,124-1, 126, 204, 206-51). The timing restrictions for turkey nesting and in bear maternity areas is for logging, timber harvesting, and slash treatments. The timing restrictions for wetland bird nesting habitat are for noisy activities or activities that would damage nests or nesting habitat. A timing restriction for sensitive big game winter range is for firewood cutting in pinyon juniper on less than 40 percent slope (1987 Plan, page 153). Turkey roosts would be protected from recreational activities, especially dispersed camping and motor vehicle traffic in the Schnebly Rim MA (management area 28). Disturbance-sensitive species, such as turkey and bear, would have reduced disturbance as a result of maintaining large tracts of unfragmented habitat within Semi-primitive Non-motorized ROS settings in the Schultz MA

(management area 36) (1987 Plan, page 206-105). Human disturbance to wildlife in the Lake Mary Watershed (management area 35) would be minimized where needed, during the critical times (1987 Plan, page 206-98).

Alternative B (modified)

In contrast to alternative A, alternative B (modified) addresses alternative energy such as wind and solar, and the impact of that infrastructure to raptors, or other species such as bats. (FW-SpecUse-G-11). Cryan and others (2014) reported an unprecedented numbers of wind turbine-caused bat fatalities with peak fatalities in low-wind conditions during late summer and autumn. Migratory tree bats were most affected in this study (silver-haired bats *Lasionycteris noctivagans*, Eastern red bats *Lasiurus borealis*, and hoary bats *Lasionycteris cinereus*). Silver-haired bats and hoary bats occur on the forest. Golden eagles have also been killed at wind energy sites and are of particular concern because it is a Federal offense under the Bald and Golden Eagle Protection Act to take an eagle without a permit (USGS 2017).

Unlike alternative A, alternative B (modified) has desired conditions for cliff, caves, and talus slopes as generally undisturbed by human activities. This provides guidance for and better protects the associated species (FW-BioPhys-Geo-DC-1).

In addition, alternative B (modified) requires that projects and management activities be designed and implemented to maintain refugia and primary life cycle needs of Southwest region sensitive species and to protect and provide for narrowly endemic species and species with restricted distributions where they are likely to occur (FW-WFP-G-10). This could reduce disturbance and would promote species survival and enhance reproduction. Alternative A does not specifically address endemic species or those with restricted distributions.

In contrast to alternative A, alternative B (modified) would minimize or avoid potential impacts to wildlife survival, reproduction, or movements from alternative energy developments. A guideline requires alternative energy developments, such as for wind energy, to be designed to minimize or avoid impacts to other uses and resources, in particular wildlife and scenic integrity (FW-SpecUse-G-11).

Low-disturbance wildlife habitat is promoted on the steep slopes and other hard-to-access areas in the Inner Basin, Long Valley, East Clear Creek, and C.C. Cragin management areas (MA-InBsn-DC-6, MA-LongV-DC-5, MA-EastClr-DC-2, and MA-CCCrg-DC-2).

Unlike alternative A, alternative B (modified) has direction for timing restrictions for golden eagles (FW-WFP-S-2). This would reduce disturbances during the breeding season, which would better facilitate reproductive success and survival.

Alternative B (modified) lacks the specific seasonal timing restrictions for wetland-nesting birds, elk, deer, turkey or bear that are present in alternative A. Plan components in the Wildlife, Fish, and Plant section have sufficient flexibility to manage for low-disturbance habitat where and when needed. These plan components include desired conditions that support sustainable populations of native plant and animal species and habitat available at appropriate spatial, temporal, compositional, and structural levels for a wide variety of species (FW-WFP-DC-1), that keep common species common (FW-WFP-DC-2), that provide the necessary habitat components for carrying out key life cycle needs (FW-WFP-DC-3). Forest plan guidelines require management activities to comply with strategies, national guidelines, conservation agreements

and assessments to improve the status of species (FW-WFP-G-2) to maintain or improve habitat for native species (FW-WFP-G-3); to have movement corridors and pronghorn habitat free of impediments to movements (FW-WFP-G-6), and to have the locations of new road and new trail locations meet species life history requirements (FW-WFP-G-13). A guideline in the section for All Recreation requires recreational activities, locations, and/or settings to be managed to be in balance with the capacity of other resources to support them and to prevent wildlife access to food, trash, and human waste (FW-Rec-All-G-2).

Alternative B (modified) has a guideline in Wildlife, Fish, and Plants that would reduce small bird entrapments in open top vertical pipes. This threat was not recognized when the current plan was written, but was recognized by Brattstrom (1995) and again by Hathcock and Fair (2014). This guideline should reduce unnecessary mortality to small birds, which are prey for a variety of mammals and raptors, when they fall into open pipes and cannot escape.

Alternative B (modified) differs from alternative A because it recommends three wildernesses: Abineau (adjoins Kachina Peaks Wilderness), Strawberry (an addition to the Strawberry Crater Wilderness), and Davey's (an addition to the Fossil Creek Wilderness).

Recommended wilderness would be managed to maintain or enhance primitive and undeveloped characteristics, to preserve native species, and to have ecological systems substantially free from effects or evidence of human control or manipulation (SA-RWild-DC-1-3). These areas are not entirely protected from disturbance because mechanized recreation is permitted, providing it does not detract from wilderness values and motor vehicle use should only occur for limited administrative and permitted activities consistent with the area's wilderness character (SA-RWild-DC-6, SA-RWild-G-3). Motorized big game retrieval is permitted providing it is consistent with Travel Management Rule decisions. Nonetheless, recommended wilderness would remain in natural condition, be less disturbed than surrounding areas, have less soil compaction, less accelerated erosion, less vegetation damage from motorized activities, and be additions to designated wilderness and expand wildland block or corridor areas, benefitting the associated species. This could promote survival and reproduction of plant and animal populations in localized areas, provide access to suitable habitat, as well as provide more contiguous low disturbance habitat for species with larger home ranges like big game.

Although these wildernesses are not contiguous with or close to one another, the combination of these recommended wildernesses with already existing wildernesses would expand areas of relatively low disturbance in these localized areas.

Alternative C

Alternative C has the least disturbance to wildlife habitat of any alternative. It has the same effects as alternative B (modified) except there are eight management areas with reduced disturbance, a total of 13 recommended wildernesses, and areas not suitable for recreational shooting and not suitable for snowmobiling.

Eight management areas (Anderson Mesa, Blue Ridge, Hospital Ridge, Jack's Canyon, Knoll Lake, Limestone Pasture, Pine Grove, and Second Chance) would reduce disturbance from motorized traffic by reducing public access, prohibiting large group recreation events and large commercial tours except in developed sites (excluding research), and by having no net increase in the area of designated motorized dispersed camping corridors. These management areas total

335,371 acres. Motor vehicle traffic would be reduced in these management areas, but not eliminated because administrative or permitted uses could still occur.

A unique aspect of alternative C is that some areas would not suitable for recreational shooting. Recreational shooting is non-hunting shooting (like target practice) and the purpose is to reduce noise and the associated human activity. The areas not suitable for recreational shooting are: recommended and existing research natural areas, botanical and geological areas, and the following management areas: Anderson Mesa, Blue Ridge, Hospital Ridge, Jack's Canyon, Knoll Lake, Limestone Pasture, Pine Grove, Second Chance, Walnut Canyon, Sedona Neighborwoods, and Long Valley. Some portions of the Flagstaff Neighborwoods proximal to private property may also be not suitable for recreational shooting, depending on other factors such as existing laws, municipal regulation, or site-specific NEPA decisions.

About 216,037 acres on the forest are already subject to shooting restrictions and this is common to all alternatives. Such areas include recreational shooting within 150 yards from residences, buildings, campsites, developed recreation sites and occupied areas as well as across or on a National Forest System road or body of water adjacent to a National Forest System road (USDA Forest Service 2016f).

Alternative C could classify an additional 492,595 acres as not suitable for recreational shooting for a total of 708,632 acres on the forest; however, this would be subject to site-specific environmental analysis. The extent, intensity, and frequency of recreational shooting (and the associated disturbance) are assumed to be variable across these nearly 500,000 acres. There would be a generally contiguous not suitable area along the eastern side of the forest from Walnut Canyon south to the forest boundary and south central in the Long Valley MA. Restrictions on recreational shooting could result in reduced disturbance to wildlife in these areas depending on the wildlife species present, species behavior, home range, time of year, type of weapon used, duration of use, topography, and other variables.

Only alternative C has suitability determinations for snowmobile use. In alternative C, the Walnut Canyon MA, and areas classified as semi-primitive non-motorized and primitive ROS classes would not be suitable for snowmobile use. This is in addition to areas with forest closure orders and areas outside of wilderness. This represents about 13 percent of the forest according to the Recreation Report (USDA Forest Service 2016f). Subsequent site-specific environmental analysis would be required to officially close areas to snowmobiling. Disturbance would be reduced in the restricted areas compared to areas outside the restricted areas. The effect on individuals of particular species would be vary depending on a variety of factors such as location of the activity relative to area used by the species during that time of year (for example, near a bald eagle winter roost) or the ecology of the species (for example, are bats hibernating in a nearby cave? Does the species migrate? Is the area used for foraging by raptors or is the use occurring during the early part of the breeding season (February for some species)?). Other factors could be the intensity, frequency, and timing of use, and snowfall in any given year.

Alternative D

Alternative D has the same effects as alternative B (modified) except there is no recommended wilderness.

Summary: Generally, alternative C has the lowest disturbance, followed by alternatives B (modified) and D, then A.

Disturbance (plants)

Plants and their habitats may be damaged, degraded, destroyed, or altered by activities or uses that occur on Forest Service administered lands. Disturbances such as uncharacteristic wildfire, vegetation management, prescribed fire, or road building can degrade native plant communities and lead to the loss of individual plants. Motorized vehicles and mechanized forms of transportation can also damage plants and their habitat. These could include motorized equipment used to conduct management activities or permitted uses, recreational vehicles, all terrain cargo transports, mountain bikes, or other equipment. The following habitats have moderate to high departures (in fair to poor condition) from reference conditions: Cottonwood Willow Riparian Forest, Desert Communities, Semi-desert Grassland, Pinyon Juniper with Grass, Pinyon Juniper Evergreen Shrub, Ponderosa Pine, Mixed Conifer with Frequent Fire, Mixed Conifer with Infrequent Fire, and Spruce-Fir (see the Vegetation and Fire, and Riparian Areas sections of volume I of the FEIS). These departures increase the risk of uncharacteristic fire, flooding, and accelerated erosion within the habitats themselves. These departed habitats can also pose additional risks to the watersheds in which they occur because uncharacteristic fire or flooding in the watershed could also negatively affect adjacent ERUs that are in good condition. Although native species and their habitats would be adapted to a natural range of disturbance and variability in their environments, uncharacteristic disturbances could create higher levels of disturbance for all of the habitats and plants within them to which they may be poorly adapted.

Environmental Consequences

Common to All Alternatives

The Ponderosa Pine ERU has experienced many of the vegetation treatments, uncharacteristic fires, wildfires managed for resource objectives, and prescribed fire treatments across the forest. Ponderosa Pine ERU would improve to fair condition and trend toward desired conditions under all alternatives. Under the low treatment objectives (50,000 acres mechanical, 150,000 acres prescribed burn), the Ponderosa Pine ERU would improve over the existing condition of poor by trending toward desired conditions and would reach fair condition in the long term. The improved vegetation structure and composition would reduce the risk of uncharacteristic fire and flooding and create conditions in which characteristic fire would be more likely to occur. The risk of uncharacteristic disturbance to associated plants would also decrease. Under the high treatment objectives (260,500 acres mechanical, 200,000 acres prescribed burn), vegetation quality would improve faster (than the low objective) over existing condition because more acres would be treated. There is also an estimated 135,000 acres treated using naturally ignited fires for resource objectives during each 10-year period over the life of the plan. See FW-TerrERU-PP-O-1, 2, 3. The distribution and diversity of understory vegetation are expected to increase where open stands are created, such as in areas treated for restoration. The shift to more open canopy under all alternatives would improve the abundance and vigor of understory vegetation. Short-term effects

to plants would include potential loss of individuals and disturbance to habitat in treated areas, but treatments will move the areas toward the desired conditions.

Ground-disturbing activities create favorable conditions for the establishment of non-native invasive plants. Invasive plants compete with native species for resources and can alter community structure, soil productivity, fire regime, and can contribute to accelerated erosion, all of which are detrimental to native plant communities. All alternatives address the threat of invasive plants by pointing to the Final Environmental Impact Statement for the Treatment of Noxious or Invasive Weeds (USDA Forest Service 2005). This direction includes best management practices, among other guidance, which would help prevent, mitigate, and reduce the threat of invasive plants. All alternatives prioritize treatments, call for incorporating control measures in project planning and implementation, and emphasize coordination with partners (1987 Plan, pages 23, 69, 70, 182, 206-14, 206-76, 206-101, 201-116, FW-Invas-DC-1 and 2, FW Invas- G- 1, 2, -3, FW-Invas-MgtApp, FW-Graz-MgtApp, FW-RdsFac-G-8 ,FW-Rec-Dev-DC-9, FW-Rec-Dev-G-2). In alternative B (modified), C, and D, there are two management approaches that are particularly helpful for control of non-native invasive plants in the specialized habitats occupied by some of the species on the forest. These management approaches prioritize inventory and control for areas such as rare habitats, wilderness, research natural areas, botanical areas, wild and scenic areas, and riparian areas to maintain and restore the integrity of native species and ecosystems.

Roads can contribute to disturbance for plants by directly crushing plants, degrading habitat, causing soil loss, or increasing the risk of non-native invasive plant invasions. All alternatives would close or decommission unneeded roads, seasonally close wet roads when needed, construct roads with adequate drainage, and implement soil and water best management practices (1987 Plan, pages 71, 72, 72-1, 88, 91 FW-RdsFac-G-2, 5, 6). All alternatives can use temporary roads in lieu of constructing new roads and would close them after use (1987 Plan, page 89, FW-RdsFac-DC-3). Implementation of these plan components could crush or damage individual plants or plant populations, but in the long term, implementation would benefit plants through reducing disturbance to plants by reducing accelerated soil erosion, loss of vegetation, degradation of water quality, and long-term impacts to soil productivity.

Recreation-related activities can also trample or crush plants, facilitate accelerated soil erosion, compact the soil, or otherwise impact plant habitat. All alternatives have plan components that would benefit plants by reducing ground disturbance in particular areas or by particular uses. All alternatives would reduce ground disturbance from motorized vehicle use by requiring vehicles to remain on a designated system of roads, trails, or areas as defined on motor vehicle use maps (1987 Plan, page 58, FW-Rec-Disp-S-1, FW-RdsFac-S-1). Ground disturbance would be reduced in the Deadman Wash area because large tracts of land would remain unroaded (1987 Plan, page 206-87, MA-PntdDsert-DC-2, MA-VolcanWd-DC-4) and ground disturbance would be reduced in the Woody Ridge area because it is closed year-round to motorized use (1987 Plan, page 206-114, MA-PineBelt-DC-8, S-4). Ground disturbance from recreational activities would be reduced in the Kachina Peaks Wilderness and Inner Basin by limiting horse and pack stock use, recreational livestock, overnight camping, new trail construction, and off trail use in snow-free periods (1987 Plan, pages 90, 108, 110, FW-MA Peaks-S-3, MA-InBsn-S-1, SA-Wild-S-4, S-5). Ground disturbance from horse and pack stock use would also be limited on the portion of the Oldham Trail between Buffalo Park, the El Paso natural gas pipeline, and on the West Fork of Oak Creek Trail (1987 Plan pages 90, 119, MA-FlagN-S-1, MA-MtElden-S-1, and MA-OakCrk-S-6). Established and proposed research natural areas would have little evidence of human

activities and disturbance (1987 Plan, pages 194, 195, 196-1, SA-RNABotGeo-DC-1), except the lower end of the Oak Creek RNA in the lower part of West Fork would have higher recreational use and disturbance. In addition, all alternatives would locate trails and recreation to reduce impacts to vegetation, woody riparian vegetation, and riparian habitat in West Fork and Oak Creek (1987 Plan, pages 108-2, 187, FW-Rec-Trails-DC-11, G-1, G-3; MA-OakCrk-G-5).

All alternatives would manage the Cinder Hills Off-Highway Vehicle area (about 13,000 acres) for off-trail motorized recreation. Vegetation is present, but naturally scarcer than other areas with different soil types. Considerable ground disturbance from off-trail vehicles damages individual plants or populations within the area, but focuses off-trail use in one area rather than it being spread over a larger area (1987 Plan, pages 178-183; MA-VolcanWd-DC-3).

Disturbance can also be a side effect of plant collecting. All alternatives prohibit commercial plant collection in portions of the Sedona/Oak Creek Ecosystem (1987 Plan) or Red Rock, Oak Creek, and Sedona Neighborwoods Management Areas (proposed revised plan). See 1987 Plan, page 206-11, FW-FProd-G-4, MA-RedRock-S-6, MA-OakCrk-S-1, MA-SedN-S-1. This restriction would eliminate ground disturbance from this activity and would protect native plant species from over-collection.

All alternatives would incorporate management plans and recovery plans for Flagstaff pennyroyal and San Francisco Peaks ragwort. The proposed revised plan directs managers to incorporate habitat management and species protection measures from approved recovery plans (FW-WFP-G-1). This is beneficial for the ragwort. The recovery plan for the San Francisco Peaks ragwort incorporates the Alpine Management Plan (1987 Plan, page 65). All alternatives would follow the management plan for Flagstaff pennyroyal (1987 Plan, page 95). The proposed revised plan also directs managers to comply with species assessments and strategies that would include the management plan for Flagstaff pennyroyal (FW-WFP-G-2).

Alternative A

Recreational activities can contribute to disturbance to plants and habitat. There is guidance for disturbance to plants and habitat in alternative A, but as described under All Alternatives above, most plan components focus on specific areas or specific activities.

Alternative A has management direction in the Sedona/Oak Creek ecosystem and in the Flagstaff Lake Mary Ecosystem to discourage unneeded trail or social trails that can cause erosion or plant loss (1987 Plan, page 206-26, 206-68), but lacks this direction for the rest of the forest. This leaves managers without a consistent approach and vision on how to address social trails.

Alternative B (modified)

In contrast to alternative A, alternative B (modified) is replete with forestwide direction related to disturbance to plants. For alternative B (modified), the forestwide plan components in All Ecosystems, Soil, Biophysical Features, Water and Watersheds, Riparian Areas, Wetlands, Springs, All Terrestrial ERUs, and in each ERU are designed to promote properly functioning and resilient ecosystems and watersheds, address departure, promote natural disturbances, and maintain or move toward more sustainable ecosystems (FW-Eco-DC-1, 2, 3, and 4, FW-Soil-DC-1, 2, 3, 4, FW-TerrERU-All-DC 1 and 2) FW-BioPhys-Geo-G-1, FW-Water-DC-1, 2, 3, 6, FW-Rip-All-DC-1, 5, FW-Rip-Wtlnds-DC-1, FW-Rip-Spr-DC-1, FW-Rip-RipType-DC-1, FW-TerrERU-DC-DC-1, 3, FW-TerrERU-IC-DC-1-4, FW-TerrERU-PP-DC-1, FW-TerrERU-MC-All-DC-1, FW-TerrERU-SF-DC-1-4, FW-TerrERU-AT-DC-1). This includes addressing vegetation

departure through appropriate treatments and reintroduction of fire into departed ecosystems. It is assumed that all of the plants addressed in this FEIS that occur in the fire-adapted ecosystems across the forest are adapted to fire as well, but data supporting this assumption are limited. Based on this assumption and data available, it is assumed that the re-introduction of natural disturbances such as fire will benefit these species in the long term, but may result in short-term loss of individuals.

Desired conditions and guidelines in alternative B (modified) would reduce disturbance by promoting vegetative ground cover, stable soils, biological crusts, undisturbed geological features, and characteristic disturbances (FW-BioPhys-Geo-DC-1, FW-Water-G-1, 4, FW-Rip-Spr-G-3, FW-Soil-DC-3,4). Desired conditions acknowledge that localized short-term accelerated soil erosion may occur following high-severity fires, but not to the extent of risking long-term impairment of soil productivity (FW-Soil-DC-5). Project design features would avoid disturbance that would result in long-term impacts to soil function and productivity, especially on particularly vulnerable soils and slopes. Guidelines would promote litter and plant cover to resist erosion and compaction, to stabilize banks, and to ensure plant recovery following burning, mechanical treatments, and mineral or mining activities (FW-Soil-G-2, 3, FW-Rip-RipType-DC-3, 4, FW-TerrERU-Grass-DC-5, G-2, FW-TerrERU-IC-G-1, FW-Graz-G-3, and FW-Minerals-DC-1). Other plan components would reduce disturbance by not issuing land recreation special use permits for activities within 200 feet of waters that support sensitive resources (FW-SpecUse-G-3).

In contrast to alternative A, alternative B (modified) has forestwide language that addresses recreation, social trails, and disturbance. The language would result in recreational activities and locations being managed to be in balance with the capacity of other resources to support them and to move toward desired conditions for other resources (FW-Rec-All-DC-6, G-1 and 2, MA-VerdeV-G-2). Plan components would also require that unplanned, user-created trails be managed to prevent future access and that damaged resources be rehabilitated (FW-Rec-Trails-G-3). These plan components would maintain and enhance habitat for plant species at the forestwide level and assist managers in addressing widespread impacts from the increasing number of visitors.

Rare plant populations would be maintained and disturbance reduced with the implementation of a guideline in Wildlife, Fish, and Plants that encourages seed collection and cuttings rather than whole plant removal (with limited exceptions) (FW-WFP-G-15).

Three recommended wildernesses in alternative B (modified) could both reduce and increase the likelihood of ground disturbance for plants. Recommended wilderness could reduce the likelihood of ground disturbance by maintaining or enhancing primitive and undeveloped characteristics, preserving native species, and emphasizing ecological systems substantially free from effects or evidence of human control or manipulation (SA-RWild-DC-1-3). Mechanized recreation is permitted unless recommended wilderness become designated providing it does not detract from wilderness values. Motor vehicle use is permitted (until it is designated as wilderness) only for limited administrative and permitted activities consistent with the area's wilderness character (SA-RWild-DC-6, SA-RWild-G-3). Motorized big game retrieval is permitted providing it is consistent with Travel Management Rule decisions. Recommended wilderness would be less disturbed than surrounding areas. In contrast, limitations on motorized use could limit the activities or tools to restore habitat where needed and could subsequently increase the risk of uncharacteristic disturbances. Uncharacteristic disturbances could create higher levels of disturbance to which plants and their habitats may be poorly adapted.

Alternative C

Alternative C has the least disturbance to plants of any alternative. It has the same effects as alternative B (modified) except there are 8 management areas that emphasize reduced human-related disturbance and 13 recommended wildernesses.

Eight management areas (Anderson Mesa, Blue Ridge, Hospital Ridge, Jack's Canyon, Knoll Lake, Limestone Pasture, Pine Grove, and Second Chance) would reduce public motorized access in some areas, prohibit large group recreation events and large commercial tours except in developed sites (excluding research), and have no net increase in the area of designated motorized dispersed camping corridors. These management areas total 335,371 acres. Motor vehicle traffic would be reduced but not eliminated in these management areas, because administrative or permitted uses could still occur. If this alternative is selected, subsequent environmental analysis would need to be done for these restrictions to take effect.

Alternative D

Alternative D has the same effects as alternative B (modified) except there is no recommended wilderness.

Non-native or Invasive Species

Stakeholders expressed concern that the existing forest plan does not fully address non-native or invasive animals or plants, including disease. Commenters asked that forest plan language be revised to address non-native or invasive animals (including pathogens and invertebrates) and grasses.

Invasive exotic species, including plants, invertebrates, animals, pathogens, and diseases, are a primary threat to most terrestrial, aquatic, and riparian ecosystems and the associated species on Coconino NF. They can influence and significantly disrupt the composition and structure of ecosystems as well as natural processes including fire return intervals, soil stability, and ecosystem hydrology. They also eat, infect, compete with, and hybridize with native species and can significantly alter species diversity.

Affected Environment

Invasive plants were identified as a threat to terrestrial ecosystems in the Analysis of the Management Situation (AMS) (2010) and were included in the assessment of departure from reference condition (see Ecological Sustainability Report, USDA Forest Service 2009a). Almost every ERU is impacted by non-native or invasive plants. The only notable exception is the Alpine Tundra ERU where there are no documented occurrences of non-native or invasive plants.

Every 5th code watershed on the Coconino NF that supports native fish species contains non-native or invasive aquatic species. Table 32 in the Ecological Sustainability Report compares the number of native fish species and the number of non-native fish species by watershed (USDA Forest Service 2009a). Nearly every habitable stream on the Coconino NF currently contains non-native or invasive fish, amphibians, and crayfish. These non-native or invasive species prey on and/or compete with native species, can spread disease and parasites, and can alter the composition and structure of the aquatic and riparian environment. Chytrid fungus has been found on the forest and it is deadly to amphibians. White-nose syndrome has killed millions of bats and although it has not been reported on the forest, it has been moving across the United States in recent years. An exotic spruce aphid has been found in spruce-fir, which has the potential to kill a

significant proportion of Engelmann spruce trees. White pine blister rust is a potential threat to white pines, such as bristlecone pines, on the forest and has been found on other national forests in Arizona.

Environmental Consequences

All Alternatives

All alternatives address the threat of invasive plants by pointing to the Final Environmental Impact Statement for the Treatment of Noxious or Invasive Weeds (USDA Forest Service 2005). This direction includes best management practices, among other guidance, which would help prevent, mitigate, and reduce the threat of invasive plants. All alternatives prioritize treatments, call for incorporating control measures in project planning and implementation, and emphasize coordination with partners (1987 Plan, pages 23, 69, 70, 182, 206-14, 206-76, 206-101, 201-116; FW-Invas-DC-1, 2; FW Invas-G- 1, 2, 3; FW-Invas-MgtApp; FW-Graz-MgtApp; FW-RdsFac-G-8; FW-Rec-Dev-DC-9; FW-Rec-Dev-G-2). Disturbance increases the risk of non-native invasive plant spread and establishment. Disturbance is addressed in the section on Disturbance to Plants above.

All alternatives allow for the installation of stream barriers to separate native species from non-native or invasive species based on site-specific analysis (1987 Plan, page 175 and FW-WFP-DC-9).

Alternative A

Like the other alternatives, this alternative promotes prevention, containment, control, or eradication of non-native invasive plants, depending on invasiveness and risk, and incorporation of control measures into projects (1987 Plan, page 23, 69, 206-76). It incorporates the Final Environmental Impact Statement for the Treatment of Noxious or Invasive Weeds through Amendment 20 (1987 Plan, pages 69 and 69-1). It also promotes control and eradication of non-native and invasive plants in the Cinder Hills OHV area (1987 Plan, page 182). These plan components would reduce the abundance and distribution of new and existing non-native or invasive plant species. Plan components only address Forest Service administrative and permitted activities and lack direction on how managing public forest user activities contribute to this threat.

Alternative A would address the risk of exotic spruce aphid in the Spruce-Fir ERU through its inclusion of plan goals to “[m]anage resources to prevent a buildup of insects and diseases to prevent or reduce serious, long-lasting hazards through integrated pest management” (1987 Plan, page 23). Standards and guidelines for insect and disease management also stipulate monitoring of insect and disease activities on all land, and evaluation of the extent control measures are needed to protect suitable or unsuitable areas (1987 Plan, page 70).

Alternative A lacks forestwide plan components that address aquatic weeds, invasive or non-native grasses, invasive or non-native animal species, and disease (other than diseases that affect tree species). Since Amendment 20, the abundance and distribution of invasive or non-native grasses such as red brome (*Bromus rubens)* have increased in many of the ERUs. Red brome and other non-native annual grasses provide copious amounts of fine fuel in ecosystems that are not fire-adapted and shorten the fire return intervals in fire-adapted ecosystems. The resulting more frequent or uncharacteristic fires contribute to the departure of these ERUs from desired conditions.

Even though plan components under alternative A provide for some guidance for non-native aquatic species control; the quality of aquatic species habitats will continue to remain stable or decline because the plan direction does not apply forestwide. Control of the impacts of non-native plant and animal species and discouraging the introduction of new non-natives is advocated under alternative A (1987 Plan, pages 206-9, 206-72), but mainly in the Flagstaff Lake Mary Ecosystem Area and Sedona/Oak Creek Area.

Alternative A also has language to cooperate with the Arizona Game and Fish Department in evaluating proposals for re-introducing extirpated species into suitable habitat, on fish stocking and public access for fishing, and to prevent and/or remove unapproved introduced or invasive species (1987 Plan, page 65-12).

Although the language in all alternatives supports managing for sustainable populations of native animal species, alternative A lacks forestwide language that directly addresses the major threats of disease and invasive, non-native animals. Because of this, alternative A has a lower viability effectiveness than the other alternatives.

Alternative B (modified)

Alternative B (modified) better addresses the threat of invasive species and disease than alternative A by supporting native species and addressing disease and invasive or non-native species forestwide. The plan components for invasive species can be applied to any non-native plant or animal on the forest. The forestwide desired conditions for invasive species (FW-Invas-DC-1 and 2) and guidelines (FW-Invas-G-1 through 3) apply to all organisms. Unlike alternative A, invasive species guidance is incorporated in many portions of this alternative.

Alternative B (modified) emphasizes native species more than alternative A and addresses native species throughout the plan as a sustainable aspect of different ecosystems (FW-TerrERU-DC-DC-4, FW-TerrERU-Grass-DC-1, FW-TerrERU-IC-DC-1, FW-TerrERU-PJ-DC-4 and 9, FW-TerrERU-AspMpl-DC-1, FW-TerrERU-MC-All-DC–2, FW-TerrERU-SF-DC-1, FW-TerrERU-AT-DC-2, FW-WFP-DC-1, FW-WFP-DC-3). A desired condition in the Invasive Species section advocates invasive species at levels that do not disrupt ecological composition, structure, and function; do not affect the sustainability of native and desirable non-native species; and do not disrupt the natural fire regime (FW-Inv-DC-1). Native species and their habitat are supported by language throughout the plan (FW-Eco-DC-1, FW-Water-DC-6 and G-6, Fw-Rip-Strm-G-1, FW-Rip-Wtlnds-DC-1 and 2, FW-Rip-Spr-DC-2 and G-3, FW-Rip-RipType-DC-2, 6, and G-2, FW-TerrERU-All-G-3, and in various ERUs, FW-RdsFac-G-9, FW-Rec-Dev-G-2, SA-RWild-DC-3, SA-WSR-DC-3), and are part of the monitoring plan (Questions 12 and 13). This emphasis on native species and natural processes builds resiliency and addresses the uncharacteristic disturbances that may lead to increased risk of invasion. Alternative B (modified) would better address the threat of exotic spruce aphid and the resulting loss of spruce that would alter vegetative composition and structure and increase the risk of fire in the Spruce-Fir ERU.

A desired condition in the section on developed recreation has a goal that non-native or invasive plants and non-native or invasive aquatic organisms are not established or transported around these high-use areas of the forest (FW-Rec-Dev-DC-9). A guideline in the same section requires managers to control invasive species at these sites before they become established and widespread (FW-Rec-Dev-G-2). These components would help protect the natural habitats at recreation sites across the forest while addressing non-native or invasive species. A wildlife

guideline requires the use of established protocols to prevent the introduction and spread of disease (including chytrid fungus that kills amphibians) (FW-WFP-G-12).

Non-native grasses are problematic in the desert ecosystems on the forest. Forestwide desired conditions for interior chaparral and grasslands incorporate guidance for these non-natives. FW-TerrERU-IC-DC-3 and FW-TerrERU-Grass-DC-2 state that invasive plants do not alter the fire regime or facilitate the spread, intensity, or severity of uncharacteristic fire in these ERUs. This guidance is important for these areas and is absent from alternative A. This guidance would help reduce the threat of uncharacteristic disturbance, which can lead to increased risk of invasion, while addressing departure in these unique ecosystems.

Roads can be corridors for invasive plant introduction. Forestwide guidance for roads focuses on maintaining an adequate transportation system while addressing the desired conditions for other resources. Forestwide guidance for roads (FW-RdsFac-G-8) provides for naturalization of temporary roads, while reducing potential impacts such as possible introduction of invasive species. This and other guidance would reduce the threat of non-native or invasive plants from roads.

In contrast to alternative A, desired conditions for Spruce-Fir in alternative B (modified) seek levels of disturbance by invasive animals that are comparable to the outcomes of more characteristic insect disturbance (FW-Veg-SF-DC-2, 4, 5). Rather than focusing on the cause of the disturbance, the desired conditions focus on acceptable levels of declining trees, snags, and resilience to disturbance within the ERU. As a result, these alternatives would better provide for the viability of species associated with this ERU because they characterize that the disturbance may change over time, but set desired conditions for what outcomes provide for habitat conditions conducive to supporting associated species.

Other sections of the revised forest plan address disease in caves that could potentially affect cave-dwelling species like bats (FW-BioPhys-Geo-DC-3; FW-BioPhys-Geo-G-6), diseases that can be transmitted between domestic and wild sheep (FW-Graz-G-8, 9), and disease and non-native or invasive species specifically in the Inner Basin and Verde Valley management areas (MA-InBsn-G-2, MA-VerdeV-G-1).

Management approaches in Invasive Species remind managers to coordinate with stakeholders and the public to reduce or eliminate the potential or existence of non-native or invasive species as well as to encourage the prevention of accidental introduction and spread of invasive species carried by contaminated vehicles, equipment, people, or materials. A management approach in Geological Resources reminds managers to “educate the public about the unique ecological and aesthetic value of biophysical features including safety, etiquette, disease prevention, and resource protection.”

Alternative B (modified) recommends 8,733 acres of proposed wilderness. These additional acres are additions to three existing wilderness areas. The Strawberry Crater (6,579 acres) and Abineau (415 acres) recommended wilderness areas are additions to the existing Strawberry Crater and Kachina Peaks Wilderness Areas, and the Davey’s (1,739 acres) recommended wilderness area is an addition to the existing Fossil Springs Wilderness. The Davey’s recommended wilderness area is in a remote area that currently receives low visitation and has minimal impacts from management activities and roads. These recommended wildernesses will have minimal overall

effect on the treatment of invasive species on the forest because the individual recommended wilderness areas adjoin existing wilderness and the overall area is relatively small.

Alternative C

Alternative C has the same effects as alternative B (modified) except it has 335,371 acres of reduced public access or restrictions on large groups in certain areas of the forest (Anderson Mesa, Blue Ridge, Hospital Ridge, Jack's Canyon, Knoll Lake, Limestone Pasture, Pine Grove, and Second Chance Management Areas). People, equipment, and vehicles can spread or introduce some invasive plants or animals, and disease. Alternative C would reduce the potential for introduction or spread of non-native species and disease in these management areas because of these restrictions. This alternative would not eliminate the potential for spread or introduction because invasive species and disease could be spread or introduced through administrative or permitted activities, as well, but would reduce the risk of non-native invasive plant introduction and dispersal by vehicle traffic on roadways because public use in these areas would be restricted or eliminated.

Alternative C also differs from alternative B (modified) because there are 13 recommended wildernesses in this alternative totaling 90,852 acres. These areas occur through several ERUs and management areas. Currently, management of these areas is no different than adjacent areas that will not be included. Control of non-native or invasive species is the same across all areas. If these areas become designated wilderness, control of non-native or invasive species would need to comply with regulations currently applicable to wilderness. For example, no motorized vehicles could be used in the areas and herbicide treatments would need a higher level of approval. Alternately, approval of these recommended wilderness areas would eliminate mechanized and motorized travel except in emergency situations, which would eliminate the risk of introduction and dispersal of non-native or invasive species by vehicle travel. Management activities such as timber harvest would be eliminated from these areas, which would reduce the risk of introduction or spread of non-native or invasive plants. Management actions that would address departure in some of the ERUs promote resiliency may also occur in some of these areas.

Alternative D

Alternative D has the same effects as alternative B (modified).

At-risk Species

Some stakeholders were concerned that plan language does not fully address the needs for at-risk species and should be updated to do so. Some species may require plan components associated with their habitat, while others may need species-specific plan components. Plan language should address management of habitat and point to conservation agreements, both of which may preclude listing of proposed or candidate species.

At-risk species include threatened or endangered species, or those proposed for listing, Forest Service sensitive species, endemic species, or those with restricted distributions. Some species are naturally rare and the intent of management is not to make them more common. Rarity can assume different forms. Some species are geographically widespread, but never abundant in any location, such as ferns and orchids. These species tend to have large ranges and may occur in several habitats, but have consistently low population numbers in areas where they occur (Rabinowitz 1981). Endemic species have a small geographic range, but can be abundant with the

range (Rabinowitz 1981). Many endemic plants on the forest are in this second category. Other species may be known from only a few locations with only a few individuals known from within those locations, such as some aquatic invertebrates.

Limitation to certain soil types is a driving factor for rare plants on the forest. These are known as edaphic endemics and include many rare plant species discussed in this FEIS including the federally endangered Arizona cliffrose and other species that occur only on Verde Formation soils; Sunset Crater beardtongue, Diamond Valley suncup and serrate phacelia that occur cinder soils of the Sunset Crater Volcanic field, and Rusby's milkvetch that is known only from the San Francisco Peaks volcanic field. The limitation of particular species to certain soil types may help them escape competition from more common related species (Anderson 1996).

Environmental Consequences

All Alternatives

All alternatives would contribute to species viability and the recovery of the listed species with the following plan language. Plan components in all alternatives support managing for sustainable populations of native plant and animal species, contributing to the survival and recovery of listed species, and allowing for the repatriation of extirpated species (1987 Plan, page22-1; FW-WFP-DC-1, 2). All alternatives have a standard such that direction for species listed as threatened, endangered, proposed, or candidate take precedence over direction for species not listed by the U.S. Fish and Wildlife Service as well as direction to comply with approved recovery plans (1987 Plan, page 64; FW-WFP-S-1; FW-WFP-G-1, 2). Alternative A has a goal to manage habitat to maintain viable populations of wildlife and fish species (1987 Plan, page 22-1). Other goals are to improve habitat for listed threatened, endangered, or sensitive species of plants and animals and other species as they become threatened or endangered; to work toward recovery and delisting of threatened and endangered species; and to identify and protect areas that contain threatened, endangered, and sensitive species of plants and animals (1987 Plan, pages 23, 66, 206-9, and FW-WFP-DC-1, 2, 3, 4, 5).

All alternatives have language that would improve conditions for Southwestern Region sensitive species and would support and provide habitat and potentially suitable habitat for viable, self-sustaining populations (1987 Plan, pages11-1, 23-1; FW-WFP-DC-1-9).

The concept of rarity can also be applied to entire plant communities (Izco 1998). Within the National Forest System, these rare communities can receive special designation such as in botanical areas. There are four botanical areas designated on the forest. The Fern Mountain Botanical Area protects a unique high-elevation riparian community where Bebb's willow is the dominant species. Verde Valley Botanical Area protects the habitat of Arizona cliffrose, its unique associated plant community and soil type (Verde Formation). The Mogollon Rim Botanical Area is an example of the white fir/bigtooth maple community that occurs along the Mogollon Rim. The Fossil Springs Botanical Area is the smallest and protects deciduous riparian forest associated with a perennial spring.

All alternatives have protective language for botanical areas (1987 Plan, page 193, SA-RNABotGeo-DC 5-6). Plan language promotes management that would maintain, as nearly as possible, existing conditions, unique characteristics, and natural processes for public enjoyment, demonstration, and study. This guidance would have beneficial effects for the botanical resources

in these areas by maintaining or enhancing the survival, reproduction, or habitat for the associated species.

All alternatives have plan objectives or management emphasis to improve or restore riparian ecosystems (1987 Plan, pages 23, 172-177; FW-Rip-Wtlnds-O-1, FW-Rip-Spr-O-1, FW-Rip-RipType-O-1, and FW-WFP-O-4) and promote the use of best management practices to maintain or improve water quality (1987 Plan pages 71 and 72-1; FW-Water-G-4, FW-BioPhys-Geo-G-8, FW-Soil-G-1). Plan language in alternative A promotes implementation of filter strips to maintain natural processes and riparian composition and structure, while alternatives B (modified), C, and D update this language by providing for aquatic management zones to protect water quality and to avoid detrimental changes in water temperature, chemical composition, sediment deposits, or blockages (1987 Plan, pages 71 and 72; FW-Rip-All-G-3, FW-Rip-Strm-G-2). These plan components would maintain or improve water conditions, habitat for aquatic and riparian species (many of which are either federally listed or Forest Service sensitive), and connected downstream resources. This is beneficial for aquatic and riparian at-risk species.

All alternatives would contribute to species viability, especially edaphic endemics, with language that maintains soil quality and function (1987 Plan, page 23; FW-Soil-DC-1, 2, 3 and 4).

Non-native or invasive species are a major threat because they can compete or hybridize with native species, feed on them, spread disease or parasites, and significantly disrupt ecosystems. See Non-native or Invasive Species in the section on Wildlife and Plant Issues and Topics for discussion on this topic.

By law and policy, all alternatives would evaluate potential impacts to species and habitats using a biological assessment and projects would consult with the Fish and Wildlife Service when needed. The evaluation and consultation would result in various measures intended to mitigate or remove impacts to the species and habitat. Alternative A has this as plan language on page 65. The other alternatives strive to not repeat policy or laws in the plan. There is no difference between alternatives.

Alternative A

Alternative A has language to follow approved or more recent conservation strategies or assessments only for certain species: for bald eagles (1987 Plan, page 206-100), Arizona leatherflower (hairy clematis) (1987 Plan, page 65-7), Arizona bugbane (1987 Plan, page 206-10) and Flagstaff pennyroyal (1987 Plan, pages 65, 206-10), but lacks this direction for other species.

Alternative A would suppress fires that threaten habitat of threatened and endangered, or sensitive species (1987 Plan, page 95). Fires can result in habitat loss and damage, and plant and animal mortality or injury. Fire suppression is intended to reduce the effect of fire on habitat; however, the language does not address the techniques used to suppress wildfires, some of which (such as fire retardant) can be harmful to species or their habitat. Fire suppression has also resulted in missed fire return intervals in fire-adapted ecosystems, which, over time, has resulted in altered composition structure (high densities of trees), and can ultimately increase the vulnerability of habitat to future fires.

Some direction that specifically focuses on associated rare plants is limited to only certain management areas. Reasons for closing areas in the Cinder Hills OHV area may include locations of sensitive plants such as Sunset Crater beardtongue. Another guideline would make necessary

adjustments to this area to ensure the continued existence of this endemic plant (1987 Plan, pages 180 and 182). This would be beneficial for the species, but may not address all occurrences of this plant.

Alternative A is limited in terms of its overall ability to positively affect threatened and endangered species because it lacks clear desired conditions, standards, and guidelines developed using the best available science, and some direction is outdated. Alternative A does not reflect some of the changes in social, economic, and ecological conditions that have occurred since it was signed, and as a result, is the least able of the alternatives to adapt to changing conditions. It does not specifically address climate change issues and recommends no new wilderness. Alternative A has more prescriptive guidance for the management of old-growth forest than the other alternatives.and is focused more on the stand level, rather than collectively across the landscape. This approach does not reflect natural disturbance regimes and could negatively impact forest-dependent species like the Mexican spotted owl by putting forested ERUs at greater risk from stand-replacing fire or uncharacteristic outbreaks of insects or disease. Alternative A also lacks forestwide language that directly addresses the significant threats of disease and invasive, non-native animals. At a minimum, species viability will be maintained, but ecosystem recovery will be on a slower, and less focused trajectory than for the action alternatives.

Alternative B (modified)

Unlike alternative A, plan language in alternative B (modified) promotes habitat conditions that would provide microsites and refugia for species with restricted ranges (FW-WFP-DC-5) and would provide the resiliency and redundancy necessary to maintain species diversity and metapopulations (FW-WFP-DC-3). Projects and management activities should be designed and implemented to maintain refugia and primary life cycle needs of Southwestern Region sensitive species and to protect and provide for narrowly endemic species and species with restricted distributions where they are likely to occur (FW-WFP-G-10).

Like alternative A, alternative B (modified) has direction to follow conservation strategies, assessments or plans to improve the status of species and prevent Federal listing; however, rather than restrict this to a few species, alternative B (modified) expands this direction via a forestwide guideline to apply to all species (FW-WFP-G-2). This would result in improved survival and reproduction of species and improve the potential for recovery of threatened and endangered species.

Alternative B (modified) lacks the alternative A language to suppress fires in threatened, endangered, and sensitive species habitat and instead recognizes that fire is essential for the restoration of fire-dependent and fire-adapted ecosystems and the species that evolved with those ecosystems. In addition, unlike alternative A, alternative B (modified) has the following guideline: “Fire suppression techniques that minimize habitat and disturbance impacts should be used where there are federally listed and Southwestern Region sensitive species, consistent with public and firefighter safety” (FW-WFP-G-9). This is intended to mitigate potential impacts, such as ground disturbance from heavy equipment and hand lines that could occur with suppression tactics. Reducing ground disturbance would reduce the potential introduction of non-native invasive plants, reduce soil compaction and erosion, and reduce damage to existing vegetation.

Sensitive soils are protected because project-specific design features that minimize or avoid soil impacts would be used when projects occur on soils sensitive to degradation (FW-Soil-G-3). This would contribute to the viability of edaphic endemic plant species (such as those associated with

the Verde Formation) because the design features would protect the plant habitats from soil compaction and erosion.

Another important aspect of alternative B (modified) is that wildland fires would not result in loss of ecosystem function (FW-Fire-DC-3). Ecosystem function is important because an underlying assumption of the revised plan is that sustainable populations of native species would be maintained or enhanced where the ecosystems in which they occur or evolved are functioning properly, including at-risk species. The emphasis on ecosystem function, contributions, and resiliency is better articulated in alternative B (modified) than alternative A. See FW-Eco-DC-1, 2, FW-Soil-DC-1 and 2, FW-Water-DC-1, 2 and 3, FW-Rip-All-DC-1, G-2, FW-Rip-Wtlnds-DC-1, FW-Rip-Spr-DC-1, and FW-WFP-DC-1.

Alternative B (modified) has objectives to implement at least 20 actions for federally listed species that contribute to recovery or implement recovery plan actions during each 10-year period of the life of the plan (FW-WFP-O-1); to implement at least 10 activities to benefit sensitive species that contribute to positive trends to avoid the need for listing during each 10-year period over the life of the plan (FW-WFP-O-2), and to restore or enhance at least 60,000 acres of terrestrial wildlife habitat during each 10-year period of the life of the plan (FW-WFP-O-3). This could enhance the survival or reproduction of species affected by future treatments or actions.

Unlike alternative A, alternative B (modified) specifically supports refugia and conditions for endemic, rare, or specialized species (in general FW-WFP-DC-5 and FW-WFP-G-10; for caves and karst FW-BioPhys-Geo-DC-3 and FW-BioPhys-Geo-G-6, 7; for cliffs FW-BioPhys-Geo-DC-6; for talus slopes FW-BioPhys-Geo-DC-7; for springs FW-Rip-Spr-DC-5, FW-Rip-Spr-G-4, and MA-InBsn-G-3; and for Desert Communities and Alpine Tundra ERUs FW-TerrERU-DC-DC-4 and FW-TerrERU-AT-DC-2). This language would promote survival and sustainability of these species and their habitats. For example, spring sources would be protected, which is where many spring specialist species reside. Microclimates in caves that provide specific conditions for bat maternity colonies or winter roosts would be maintained.

In addition to the existing botanical areas, alternative B (modified) includes the establishment of the Cottonwood Basin Geological and Botanical Area, which protects unique geologic formations (fumaroles) and vegetation associated with the uplands and springs within the area. The proposed geological and botanical area contains most of the known Bigelow’s onion (a rare species) occurrences on the forest. These areas would be protected by the same plan language as described for botanical areas under All Alternatives.

Guidance in alternative B (modified) for forest products (FW-FProd-G-4) provides an added layer of protection, compared to alternative A, from disturbances associated with plant collection. This guideline provides direction for collecting rare plants and those on the Southwestern Region’s sensitive species list, stating that they should not be collected unless the forest has information that the species can withstand collection and will persist on the forest.

Alternative B (modified) has a higher contribution to the viability of at-risk species over time than alternative A. This alternative is better than alternative A at moving ecosystems that support at-risk species on a trajectory toward achieving desired conditions within the 10- to 15-year life of the plan. Alternative B (modified) better addresses climate change than alternative A (see section on Climate Change under Wildlife and Plant Issues and Topics). This alternative has more

clearly defined plan components that better address all ecosystems, species needs at a fine scale level, species with restricted distributions, invasive and non-native species, and disease.

Alternative C

Alternative C has the same effects as alternative B (modified) except for the following: Alternative C has more recommended wilderness than any other alternatives. This would have both positive and negative effects for some threatened and endangered species. While disturbance (e.g., invasives, noise) caused by human interactions might be minimized in these proposed areas, and connectivity may be improved, the forest would also be more limited in its ability to protect these ecosystems from natural disturbance, which could make them more vulnerable to uncharacteristic stand-replacing fire and other effects that are likely to become more frequent and intense with a changing climate. Additionally, like alternative A, alternative C has more prescriptive guidance for managing old-growth forest and does not reflect natural disturbance regimes. This prescriptive guidance would increase the risk for uncharacteristic disturbances and potential loss of the habitat in the long term.

Alternative D

Alternative D has the same effects as alternative B (modified) except it only includes the Cottonwood Basin Geological Area, not the Botanical Area as in alternatives B (modified) and C. The geological area portion does not include the known occurrences of Bigelow’s onion. Alternative D proposes no new wilderness areas. It also allows for more semi-primitive recreation (e.g., biking) and more energy transmission corridors; guidance which could potentially impact some threatened and endangered species by causing more disturbance and increasing the chances for wildlife injury or mortality as a result of collisions with expanded areas of transmission line or other energy infrastructure.

Coarse Filter: Habitat

The species viability analysis uses a two-stage process. The coarse filter analysis, which looks at habitat, is the first stage. The fine filter analysis discussed below will look at species with specific needs. This section applies the coarse filter analysis process that is described above in the Analysis subsection of the Species Viability section. Of particular importance, the Analysis subsection provides detailed information and definitions on the factors and ratings (e.g., abundance, likelihood of habitat limitation variable, and management effect) that are used in the coarse filter analysis for every habitat. See tables Table 6, Table 7, Table 8, Table 9, and Table 10 for an explanation of the factors and ratings that are used to develop the summary of the coarse filter analysis tables in this section. Those factors and ratings are used to evaluate the primary habitats considered in this section. Detailed information for the habitats is located in the respective specialist reports, volume I of the Final Environmental Impact Statement, and in the section on Wildlife and Plant Issues and Topics. The analysis of alternatives focuses on the most relevant threats, resources, uses, and activities that are expected to have the greatest impact on each habitat.

Desert Communities and the Verde Formation

Affected Environment

Amount

There are about 81,128 acres of Desert Communities within the forest boundary and about 77 percent (62,877 acres) of this is managed by Coconino NF. The remainder is primarily private with a mix of State, city, county, and Indian reservation.

Table 12 summarizes the information used to estimate the likelihood that the Desert Communities ERU would be a limiting factor to the viability of the associated species. The abundance of Desert Communities is categorized as Occasional, because, at nearly 63,000 acres, it occupies about 3 percent of the forest. Habitats classified as Occasional generally cover 1 to 10 percent of the forest and are encountered occasionally.

Habitat Quality and Distribution

The Desert Communities ERU occurs in the lower elevations of the Verde Valley in creosote-dominated, alluvial position and on old stream terraces. It encompasses the Verde Valley Botanical Area (1,209 acres) and 178 acres of the proposed Cottonwood Basin Geological and Botanical Area. There are 877 acres or about 1.3 percent of Desert Communities are in the Sycamore Canyon Wilderness.

The dominant species in Desert Communities are creosote bush and mesquite, but other species may include: cat claw acacia, saltbush, desert broom, desert willow, Apache plume, hedgehog cacti, cholla, and tobosa grass. Some areas may be barren with abundant sand, rock, gravel, scree, or talus. The Desert Communities ERU supports a unique community of endemic plants adapted to its calcium-rich soils; it also supports a plant, Arizona cliffrose, which is federally listed as endangered and only occurs in a very restricted portion of this ERU. Climate is the primary natural disturbance, and extreme climate variability (namely from temperature and precipitation) can cause temporary and localized shifts in vegetative composition.

Most of the ERU occurs in soils associated with the Verde Formation which are ancient lakebed soils. The Verde Formation covers about 69,039 acres in soil units 350, 381, and 385 of the Terrestrial Ecosystem Survey (TES), which classifies ecological types and maps terrestrial ecological units across the forest. In the Verde Formation soils, primary natural disturbances are weather, climate, soil chemistry, and natural soil movement (inherent erosional processes) and fire is infrequent and low to mixed severity. In areas outside the Verde Formation soils, primary natural disturbances are climate, low intensity/high severity fire, and natural soil movement (e.g., natural shrink-swell and seasonal surface cracking). The white soft soils of the Verde Formation have high levels of calcium carbonate, a high pH, limited soil moisture potential, generally sparse vegetation, low litter, and have low productivity compared to the surrounding areas. They are easily eroded.

The Verde Formation supports a variety of relict, disjunct, and endemic plant species because the surrounding dominant species are generally excluded from this soil type, thereby reducing competition for moisture and allowing the rarer species to survive (Anderson 1986 and 1996). These species include: Arizona cliffrose, Heath-leaf wild buckwheat, Ripley’s wild buckwheat, Rusby’s milkwort, Verde breadroot, Verde Valley sage, and Verde four-nerve daisy.

Using the analysis process described under the Species Viability section above, table 12 shows that the vegetation quality of Desert Communities is classified as poor and trending away from reference conditions. It has high departure and the number, size of habitat areas, or evenness in distribution across the landscape is greatly reduced. There is increased density of shrubs and understory species compared to reference conditions and increased fragmentation from urbanization.

The quality of soils in Desert Communities (including the Verde Formation) is classified as fair. This means it has a moderate departure from reference conditions and the number, size of habitat areas, or evenness in distribution across the landscape is somewhat reduced relative to reference conditions.

Table 12 shows that there is a high likelihood that Desert Communities habitat could be limiting to the associated species. The likelihood that habitat would be limiting to the associated species was derived by combining the value for habitat abundance with the value for vegetation quality. Vegetation quality was used instead of soil quality because vegetation is assumed to respond faster than soil to treatments or disturbances and thus would better reflect differences between alternatives.

Table 12. Summary of coarse filter analyses for Desert Communities ERU

Habitat	Existing	Alternative A	Alternatives B (modified), C, and D	Associated Species
Abundance	Occasional	Occasional		Arizona cliffrose, Arizona phlox, Philip's (Grand Canyon) agave, Heath-leaf wild buckwheat, Ripley's wild buckwheat, Rusby's milkwort, Sacred Mountain agave, Tonto Basin agave, Verde breadroot, Verde Valley sage, Basin bladderpod, Bigelow's onion, Mearn's lotus, Verde four-nerve daisy
Quality-Vegetation	Poor, trending away	Poor, trending away		
Quality-Soil	Fair, static	Fair, static	Fair, trending slowly toward	
Likelihood of Limitation	High	High		
Management effect		3: Plan components maintain or improve protection and management for some habitat occurrences in the plan area.	2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.	

Table 12 also compares management effect by alternative. Management effect categorizes the relative expected outcome of plan language in each alternative in terms of maintaining habitat quality and is the result of plan decisions, including plan objectives. Management effect category values are 1, 2, 3, and 4. The lower the management effects rating, the more effective the alternative is for maintaining the habitat. The effects of the alternatives are explained in greater detail in the discussions on the alternatives that follow.

There are about 877 acres of Desert Communities in the Sycamore Canyon Wilderness.

There are 1,029 acres of Desert Communities in the Verde Valley Botanical Area.

Risk Factors

Invasive plants, uncharacteristic fires, and dispersed recreation off of designated trails are primary threats to Desert Communities ERU. Vegetation in this ERU is generally widely spaced and limited by arid soils and climate. Increased abundance and distribution of invasive exotic annual grasses would fill in the spaces between plants, increase competition for water and nutrients, and increase the continuity of fuels. This could result in increased frequency and severity of wildfires. Because most species in this habitat are not adapted to more frequent fire disturbance, mortality of native species would occur and disturbance-adapted invasive or non-native annual vegetation could spread.

Excessive disturbance of Verde Formation soils could result in accelerated erosion, soil compaction, or an increase in soil pH. The main threat to the Verde Formation ecosystem is dispersed recreation off of designated trails due to increasing recreation demand in the Verde Valley. Social trails and off-trail activities on this type of soil can remove vegetation and accelerate erosion more rapidly than on other sites within Desert Communities and Semi-desert Grasslands. In addition, off-trail mountain biking entering the 1,208-acre Verde Valley Botanical Area from Dead Horse State Park has led to a proliferation of social trails that has accelerated erosion within the botanical area and habitat for associated plant species.

Associated Species

Associated species are listed in table 12.

Environmental Consequences

Common to All Alternatives

Plan components in all alternatives contribute to species viability by managing habitat to maintain viable and sustainable populations of wildlife and fish species and by improving and protecting habitat for threatened, endangered, and sensitive species (1987 Plan, pages 22-1, 23; FW-Eco-DC-1; FW-WFP-DC-1, 2, 3, 5, 6, 8; FW-WFP-G-3, G-10). See At-risk Species in the Wildlife and Plant Issues and Topics section above for more information.

All alternatives address the threat of invasive plants. Invasive plants can increase as a consequence of ground disturbance, and once established, would compete with native species for water and nutrients or could alter the fire regime. All alternatives address the threat of invasive plants by pointing to the Final Environmental Impact Statement for the Treatment of Noxious or Invasive Weeds (USDA Forest Service 2005). This direction includes best management practices, among other guidance, which would help prevent, mitigate, and reduce the threat of invasive plants. All alternatives prioritize treatments, call for incorporating control measures in project planning and implementation, and emphasize coordination with partners (1987 Plan, pages 23, 69, 70, 182, 206-14, 206-76, 206-101, 201-116: FW-Invas-DC-1, 2; FW Invas-G-1, 2, 3; FW-Invas-MgtApp; FW-Graz-MgtApp; FW-RdsFac-G-8; FW-Rec-Dev-DC-9; FW-Rec-Dev-G-2). Additional information and analysis is discussed under the Non-native or Invasive Species topic in the Wildlife and Plant Topics and Issues section.

Plan language under all alternatives directs implementing site-specific best management practices (BMPs) for ground-disturbing projects (1987 Plan, page 71; FW-Soil-G-1, 2, 3). Implementation

of this direction would avoid or limit ground-disturbing activities that could cause loss of protective vegetative ground cover. This direction would also avoid or limit detrimental impacts to soil condition and productivity, including to soils with high burn severity, sensitive soils with moderate or severe erosion hazard, and calcareous soils that have high wind erodibility when exposed. Where such disturbances cannot be avoided, project-specific BMPs should be developed. Finally, specific project design features would be required on projects occurring on slopes greater than 40 percent grade where soils with moderate or severe erosion hazard ratings occur or where soils are sensitive to degradation when disturbed.

About 766 acres (1 percent) of Desert Communities are in designated wilderness. Designated wilderness areas would be managed according to applicable laws, policy and Forest Plan direction to preserve wilderness resource values and wilderness quality, and to emphasize wilderness recreation (1987 Plan, pages 105 to 112; SA-Wild-DC-1 to 11; SA-Wild-DC-S-1, 2; SA-Wild-DC-G-1 to 7). Wilderness designation limits most active vegetation management because motorized use and mechanized use is not allowed. Motorized and mechanized access can kill or damage plants, can degrade the habitat through soil compaction and soil loss, and can introduce non-native species that compete with native plants for resources. This can negatively affect the reproduction and survival of individual plants or populations. Ground-disturbing activities are primarily confined to main trails, trailheads, and key points of interest, at which invasive species introduction and establishment, or accelerated erosion could occur depending on the level of use. The lack of ground-disturbing activities elsewhere would be beneficial by reducing the risk of invasive plant introduction and dispersal by motorized or mechanized use. However, limited access associated with designated wilderness could preclude restoration treatments that require motorized equipment for treatments or for safety or make them harder to do logistically. Lack of restoration treatments could result in missed fire return intervals, an unnatural increase in fuels, increased density of shrubs and trees, or establishment and spread of invasive or non-native species. This could slow the trend toward desired conditions or increase the risk of uncharacteristic fires in localized areas more so than in the other alternatives. Uncharacteristic fire could facilitate the spread or establishment of invasive or non-native species, which could then alter area hydrology, fire regime, and biodiversity.

Off-road travel in the Verde Valley Botanical Area is not allowed in any alternative (1987 Plan, page 194; SA-RNABotGeo-DC-5; SA-RNABotGeo-G-1). New utility corridors would also avoid the Verde Valley Botanical Area (1987 Plan, page 79; FW-SpecUse-G-10). This would result in less disturbance to soil and plants, in less erosion and soil compaction, and eliminate habitat damage from these activities.

A portion of the Desert Communities ERU lies in the Ladders Bald Eagle Breeding Area Seasonal Closure, whose purpose is to protect wildlife habitat and rare wildlife. In the current plan, this closure is referred to as Closure Order 16-52 (1987 Plan, page 167). Alternatives B (modified), C, and D include direction to close the area to motor vehicle use from December 1 to June 15, and also prohibit watercraft from landing, using the beach, or delaying passage within the closure area (MA-VerdeV-DC-7; MA-VerdeV-S-1). This would be beneficial to native species and their habitat because motor vehicle use and associated soil impacts (compaction, accelerated soil erosion, soil disturbance) or vegetation impacts (crushing or introduction of non-native plants) would be eliminated during this time period. This would be particularly beneficial for low-elevation plants and their pollinators, because they are actively growing and reproducing during this time period.

Alternative A

Table 12 shows that under alternative A, vegetation quality would remain poor and trend away from desired conditions. The poor condition means that this ERU has a high departure from desired conditions and the number, size of habitat areas, or evenness in distribution across the landscape is greatly reduced. Soil quality, including in the Verde Formation, would remain fair with a static trend. This means it has a moderate departure from reference conditions and the number, size of habitat areas, or evenness in distribution across the landscape is somewhat reduced relative to reference conditions.

There is a high likelihood that Desert Communities could be a limiting factor to the viability of the associated species. This likelihood was derived by combining the value for habitat abundance with the value for vegetation quality. Vegetation quality was used instead of soil quality because vegetation is assumed to respond faster than soil to treatments or disturbances and thus would better reflect differences between alternatives.

The management effect rating for all habitats is a 3, which means that plan components in alternative A maintain or improve protection and management for some habitat occurrences in the plan area. Alternative A contributes less to the maintenance and sustainability of Desert Communities than the other alternatives.

The current plan contains no specific desired conditions for Desert Communities or the Verde Formation and has outdated direction for fragile desert soils. About 87 percent of the ERU is included in the Verde Valley Management Area (MA 11) with the remaining percentage spread throughout nine management areas. The management emphasis for MA 11 is watershed condition, range management, wildlife habitat for upland game birds, and dispersed recreation (1987 Plan, page 166). The direction for soil in MA 11 focuses on achieving range improvement by identifying areas suitable for soil scarification and seeding of early seral species to a “more productive state” and to evaluate soils to determine the best species to promote stabilization (1987 Plan, page 169). This direction does not move this ERU toward the ecologically based desired conditions in alternative B (modified). Scarification would disturb the soil surface in the Verde Formation and lead to increased erosion. Scarification and seeding of early seral species can introduce non-native species like Lehmann love grass (*Eragrostis lehmanniana*) that compete with native plants and facilitate fire spread. Range management focuses on less than satisfactory range conditions, broadcast seeding following burning to increase production, and forage improvement. See 1987 Plan, pages 166, 168, 169. Vegetative treatments to improve Desert Communities would be reviewed for soil potential for revegetation and erosion potential prior to treatment. Verde Formation could be avoided or mitigation measures could be employed to avoid severe impairment of soil productivity. This could be protective of Verde Formation soils. The current plan would also improve conditions on prioritized watersheds in unsatisfactory condition, which could improve vegetation and soil conditions toward desired conditions in Desert Communities depending on the methods used.

Desert Communities and the Verde Formation occur within the Verde Valley Botanical Area, which is within MA 17 (special areas) of this alternative. Plan components in alternative A are generally protective of the composition, structure, and function of the different vegetation types within botanical areas. For example, existing conditions and natural processes would be maintained; natural events would not be rehabilitated; and off-road driving would be prohibited (1987 Plan, page 194). Visitors should be limited in some areas depending on carrying capacity and the uniqueness and ecological condition of these areas should be protected and maintained,

including in allotment management plans. In addition, timber harvest and firewood cutting is prohibited (1987 Plan, page 195). Other protective measures include: Special-use authorizations that would or could adversely affect the areas would not be allowed; adjacent roads would be managed to prevent vehicular intrusion, and road access would be blocked and obliterated. Fire suppression tactics would minimize damage to character of the areas and prescribed fire with planned ignitions may be used as a management tool, provided it is a compatible use (1987 Plan, page 196). Collectively, these standards and guidelines mitigate the soil disturbance and plant damage that can result from these activities and maintain the conditions and characteristics for which this botanical area was established.

Mechanized use in botanical areas is not explicitly addressed, resulting in vague direction to managers. It is unclear as to whether mechanized use is prohibited, is allowed only on trails, or is allowed on and off trail in these areas. Consequently, mechanized use could damage vegetation or contribute to accelerated soil erosion within localized areas in this ERU.

Alternative B (modified)

Table 12 shows that vegetation quality would remain poor and still trend away from desired conditions. This is primarily because management is not expected to increase substantially over current levels. Soil quality would remain fair, but the trend shifts slowly toward desired conditions, and thus, would improve faster than under alternative A. Although there are no treatment objectives for this ERU, any action that occurs in this ERU would follow the proposed revised plan direction and would either maintain or move the ERU toward the proposed desired conditions. The likelihood remains high that Desert Communities would be limiting to the associated species, however.

The management effect would be a 2, which means that plan components in alternative B (modified) maintain or improve protection and management for most habitat occurrences in the plan area, and thus, contribute more to the maintenance and sustainability of Desert Communities and the viability of the associated species than alternative A.

Goals in the proposed revised plan have greater potential to reduce ERU departure and move toward desired conditions than alternative A. Goals promote: properly functioning ecosystems that are resilient to natural disturbances and climate change, the reduction of uncharacteristic disturbances; endemic levels of invertebrates (including pollinators), and disease with occasional outbreaks; and a balance of desirable non-native species and subspecies with properly functioning ecosystems (FW-Eco-DC-1 to 4). Goals include a mosaic of vegetation conditions, densities and structures and various scales that reflect natural disturbance regimes, resilience to disturbances, adaptions to climate variability, connections based on natural patterns, and allowances for inclusions, variability, and ecotones (FW-TerrERU-All-1 to 4).

This alternative contains explicit desired conditions for Desert Communities that promote various seral stages of native species in natural patterns of abundance and distribution; promote native endemic plants species and beneficial relationships with microbes (key for plant species in arid environments), as well as the recovery of arroyos and gullies (which are a prominent yet undesirable legacy of past uses and activities) (FW-TerrERU-DC-DC-1, 2, 4). There is a goal that uncharacteristic fires would be infrequent and localized (FW-TerrERU-DC-DC-3). This is particularly relevant because this ERU is not fire-adapted.

Desired conditions in the soil section would promote proper functioning soils, soil protection and stabilization, and nutrient cycling (FW-Soil-DC-1 to 4). Forestwide soil guidelines would avoid excessive ground disturbance, limit accelerated erosion, and minimize bringing more calcareous soil to the surface (FW-Soil-G-1 to 3). Bringing calcareous soil to the surface would limit soil plant nutrient availability. This is particularly positive for the Verde Formation soils that are soft, calcareous, and easily erodible.

Forestwide direction for recreation would improve conditions in Desert Communities and the Verde Formation more than alternative A. This is because it integrates the need to protect sensitive resources from the impacts of motorized and non-motorized recreation; the need to rehabilitate unauthorized trails so as to prevent accelerated erosion; and the need to potentially restrict national forest visitor activities where they would inhibit site restoration or cannot be made compatible through appropriate mitigations (FW-Rec-All-DC-6; FW-Rec-All-G-1, 2; FW-Rec-Trails-DC-3, 4, 11; FW-Rec-Trails-G-1, 3.

There are 1,207 acres (about 2 percent of the ERU) of Desert Communities in designated or proposed botanical areas: Verde Valley (1,029 acres) and Cottonwood Basin (178 acres). Plan language in alternative B (modified) promotes protection and maintenance of the unique characteristics of botanical areas and sustainability of their inherent physical and biological processes that are not negatively impacted from human activities or permitted uses (SA-RNABotGeo-DC-6; SA-RNABotGeo-G-1). Fires and allotment management plans would be protective of the resources for which these areas were designated (SA-RNABotGeo-G-3, 4).

Unlike alternative A, mechanized use in botanical and geological areas is not suitable except mechanized travel would be suitable on routes designated for mechanized travel. This plan language is intended to limit soil and vegetation impacts to the trail prism (see Chapter 4 Recreation and Transportation Suitability). Subsequent environmental analysis would need to be done for this direction to take effect. This direction applies to the Verde Valley Botanical Area (1,029 acres of Desert Communities) and the proposed Cottonwood Basin Geological and Botanical Area (178 acres of Desert Communities). Currently, only the Verde Valley Botanical Area has designated trails, whereas there are none in the proposed Cottonwood Basin Geological and Botanical Area, which also has most of the occurrences of Bigelow’s onion on the forest (SEINet 2016). This alternative has specific guidance restricting travel to foot traffic within the Cottonwood Basin Geological and Botanical Area (SA-RNABotGeo-G-7). Designation of this area would preserve this unique botanical community and help protect the area from such threats as illegal off-road vehicle use. This guidance would remove vehicle travel and would better protect the unique rock formations and plants occurring in this area.

About 97 percent of Desert Communities ERU occurs within the Verde Valley Management Area. Desired conditions and guidelines would maintain or improve conditions in the Desert Communities ERU by promoting watershed function and balancing recreational opportunities and dispersed recreation with resource protection and/or maintaining or moving toward other desired conditions (MA-VerdeV-DC-4; MA-VerdeV-G-1, 2).

Desert Communities does not occur in recommended wilderness in alternative B (modified).

Alternative C

Alternative C has the same effects as alternative B (modified), except there are 949 acres (1 percent) of Desert Communities ERU in five recommended wildernesses: Black Mountain

(588 acres), Cedar Bench (189 acres), Cimarron-Boulder (65 acres), Deadwood Draw (42 acres), and Hackberry (65 acres). Recommended wilderness would promote non-motorized and non-mechanized activities, which would reduce motorized impacts to soil and vegetation in this ERU (SA-RWild-DC-1, 2, 5, 6; SA-RWild-G-1, 3, 5). However, limited access would make it more difficult to suppress wildfires and to treat invasive species, which can spread fire and shorten fire return intervals if they become widespread. This could increase the risk of uncharacteristic fires in scattered localized areas more so than in the other alternatives. This would have little effect on the ERU at the landscape level due to the relative small proportion of the ERU affected.

Another difference between alternative B (modified) and alternative C is that mechanized use on designated trails in botanical and geological areas is not suitable in alternative C. There are no provisions for mechanized use on designated trails. Subsequent environmental analysis would need to be done for this direction to take effect. Compared to the other alternatives, this is most protective for the plants and their habitat because one of the potential disturbances to soil and vegetation would not be allowed. Not all potential disturbances to botanical and geological areas would be eliminated, because horseback use and foot traffic would still be permitted. This would remove vegetation and soil impacts from mechanized use along designated trails in the Verde Valley Botanical Area, but would have no effect in the proposed Cottonwood Basin Geological and Botanical Area, which currently lacks designated trails.

Alternative D

Alternative D has the same effects as alternative B (modified), except it only proposes the Cottonwood Basin Geological Area. The geological area does not overlap the Desert Communities ERU. The area covered by the Cottonwood Basin Botanical Area in alternative B (modified) would be managed under the forestwide and management area direction applicable to the area in alternative D. Alternative D includes no recommended wilderness areas. The recommended wilderness areas of alternative B (modified) would be managed under the forestwide and management area direction applicable to the area in alternative D.

Interior Chaparral

Affected Environment

Amount

There are about 50,736 acres of Interior Chaparral ERU within the forest boundary and about 99 percent (50,471 acres) of this is managed by the Coconino NF. The portion not managed by the Coconino is primarily private.

Table 13 summarizes the information used to estimate the likelihood that Interior Chaparral ERU would be a limiting factor to the viability of the associated species. The abundance of Interior Chaparral is categorized as Occasional, because at 50,471 acres, it occupies about 3 percent of the forest. Habitats classified as Occasional generally cover 1 to 10 percent of the forest and are encountered occasionally.

Habitat Quality and Distribution

Interior Chaparral occurs at lower elevations, mostly in the Verde River basin, between the Semi-desert Grassland and Pinyon Juniper Evergreen Shrub ERUs. This shrub-dominated ERU varies from widely scattered pockets within grasslands and woodlands to more extensive areas on steep

slopes. Species composition and dominance varies across the landscape, depending on fire history, soils, and topography.

Interior chaparral vegetation includes: turbinella oak, mountain mahogany, manzanita, desert ceanothus, silk tassel, Stansbury cliffrose, and sumac. Fire is the primary natural disturbance. Some chaparral species have fire adaptations such as needing fire or smoke for seedling germination and establishment. Soil productivity is naturally low and most soils are inherently unstable due to the steep slopes. Interior Chaparral is characterized by high-severity fire that occurs primarily every 200+ years; however, some mixed severity fire may occur every 0 to 35 years. The fire return interval departure is high and trending away from reference conditions. A few invasive exotic plant species are present in this ERU; however, because their populations are few in number and acreage, this ERU is rated low for departure from reference conditions with respect to weeds.

There are 8 acres of Interior Chaparral in the Casner Canyon Research Natural Area. About 707 acres (1.4 percent of the ERU) fall within the Oak Creek Research Natural Area, which has a high level of recreation use and overlaps the Red Rock-Secret Mountain Wilderness. About 77 percent of the ERU occurs within designated wilderness.

Using the analysis process described under the Species Viability section above, table 13 shows that the vegetation quality of Interior Chaparral is classified as good. It has a low departure and the number, size of habitat areas, or evenness in distribution across the landscape is similar to or only slightly reduced relative to reference conditions. The projected trend for vegetation structure and composition is static, relative to reference conditions, but the trend for invasive exotic species is away from desired conditions because of the anticipated spread of non-native grasses from adjacent ERUs.

The quality of soils is classified as good with a static trend relative to reference conditions. About 89 percent of the ERU is classified in satisfactory but inherently unstable soil condition. This means that erosion is naturally happening faster than the soil can renew itself, generally on steep slopes. The remainder of the ERU is considered satisfactory.

Table 13 shows that there is a low likelihood that Interior Chaparral habitat would be limiting to the associated species. The likelihood that Interior Chaparral would be limiting was based on integrating the habitat abundance value with the habitat quality value.

Table 13. Summary of coarse filter analysis for Interior Chaparral ERU

Habitat	Existing	Alternative A	Alternative B (modified), C, and D	Associated Species
Abundance	Occasional	Occasional		Bigelow's onion, Flagstaff pennyroyal, Mt. Dellenbaugh sandwort
Quality-Vegetation	Good, static	Good, trending away then fair, away	Good, away	
Quality-Soil	Good, static	Good, static	Good, trending toward	
Likelihood of Limitation	Low	Low at short term Moderate at long term	Low	

Habitat	Existing	Alternative A	Alternative B (modified), C, and D	Associated Species
Management effect		4: Decline in habitat quality as a result of management or lack of management that result from plan components. Plan components may not exist or may be few.	2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.	

Table 13 also compares management effect by alternative. Management effect categorizes the relative expected outcome of plan language in each alternative in terms of maintaining habitat quality and is the result of plan decisions, including plan objectives. Management effect category values are 1, 2, 3, and 4. The lower the management effects rating, the more effective the alternative is for maintaining the habitat. The effects of the alternatives are explained in greater detail in the discussions on the alternatives that follow.

Risk Factors

Non-native invasive plant species, such as annual grasses can alter the natural fire return interval and fire regime.

Associated Species

Associated species are listed in table 13.

Environmental Consequences

Common to All Alternatives

Plan components in all alternatives contribute to species viability by managing habitat to maintain viable and sustainable populations of wildlife and fish species and by improving and protecting habitat for threatened, endangered, and sensitive species (1987 Plan, pages 22-1, 23; FW-Eco-DC-1; FW-WFP-DC-1, 2, 3, 5, 6; FW-WFP-G-3, 10). See At-risk Species in the Wildlife and Plant Issues and Topics section above for more information.

The majority of Interior Chaparral is found in wilderness. There are restrictions on the types of activities that can occur within designated wilderness; some of which are based on the provisions of the Wilderness Act (1964) and some are based on the direction provided in the current forest plan. Under the Wilderness Act, the use of motorized or mechanized equipment is not allowed because it is not compatible with wilderness objectives. Vegetation may not be managed through mechanical harvest activities and ground disturbance from mechanical treatments would not occur. If wildfires can be appropriately managed to meet resource objectives, then they, and prescribed fires, could be used for restoration. Plan language promotes properly functioning ecosystems that support a natural assemblage of native species indigenous to the wilderness area; management activities and permitted uses that maintain or move toward desired conditions for wilderness and other resources, and use levels that prevent wilderness values from being compromised (1987 Plan, pages 105, 108-1 to 108-4; SA-Wild-DC-2, 3; SA-Wild-G-1, 2).

Motorized and mechanized access can kill or damage plants and can degrade the habitat through soil compaction, soil loss, and the potential introduction of non-native species that compete with native plants for resources and alter the fire regime.

All alternatives include guidance for management of research natural areas that would be beneficial for Interior Chaparral in those areas by allowing natural processes and natural conditions to prevail. This guidance would minimize recreational impacts by restricting camping, prohibiting recreation fires, and limiting non-commercial group size (1987 Plan, page 196-1; SA-RNABotGeo-S-1; SA-RNABotGeo-G-6). In addition, access should be restricted as needed to maintain their natural, unmodified condition, and commercial tours would be prohibited except in support of approved research (1987 Plan, page 196-2; SA-RNABotGeo-S-2). This guidance would reduce the potential for human-caused fires and maintain the natural conditions for which the RNA was designated, which include properly functioning soils and vegetation. This guidance would also mitigate soil compaction, soil loss, and vegetation damage from some recreational activities. Designated wilderness direction would prevail in the Oak Creek RNA.

Plan language under all alternatives directs implementing site-specific best management practices (BMPs) for ground-disturbing projects (1987 Plan, page 71; FW-Soil-G-1, 2, 3). Implementation of this direction would avoid or limit ground-disturbing activities that could cause loss of protective vegetative ground cover, and detrimental soil disturbance including compaction or soils with high burn severity and sensitive soils with moderate or severe erosion hazard and calcareous soils that have high wind erodibility when exposed. Where such disturbances cannot be avoided, project-specific BMPs should be developed. Finally, specific project design features would be required on projects occurring on slopes greater than 40 percent grade where soils with moderate or severe erosion hazard ratings occur or where soils are sensitive to degradation when disturbed. This would help maintain good soil condition in this ERU.

All alternatives address the threat of invasive plants. Invasive plants can increase as a consequence of ground disturbance, and once established, would compete with native species for water and nutrients or could alter the fire regime. All alternatives address the threat of invasive plants by pointing to the Final Environmental Impact Statement for the Treatment of Noxious or Invasive Weeds (USDA Forest Service 2005). This direction includes best management practices, among other guidance, which would help prevent, mitigate, and reduce the threat of invasive plants. All alternatives prioritize treatments, call for incorporating control measures in project planning and implementation, and emphasize coordination with partners (1987 Plan, pages 23, 69, 70, 182, 206-14, 206-76, 206-101, 201-116; FW-Invas-DC-1, 2,3; FW Invas-G-1, 2, 3; FW-Invas-MgtApp; FW-WFP-DC-10; FW-Graz-MgtApp; FW-RdsFac-G-8; FW-Rec-Dev-DC-9; FW-Rec-Dev-G-2; FW-TerrERU-Grass-DC-2). Additional information and analysis is discussed under the Non-native or Invasive Species topic in the Wildlife and Plant Topics and Issues section.

All alternatives would protect vegetation and soil in Interior Chaparral from trampling and compaction by not allowing horse and pack stock in areas such as Fay, Wilson Mountain, West Fork of Oak Creek, Devil's Bridge, and Boynton Canyon Trails within the Red Rock-Secret Mountain Wilderness (1987 Plan, page 90; MA-RedRock-S-9).

Alternative A

Using the analysis process described under the Species Viability section above, table 13 shows that under alternative A the vegetation quality of Interior Chaparral is classified as good in the

short term, which means similar or only slightly reduced from desired conditions. In the short term, structure and composition is expected to trend away from desired conditions as invasive plant species expand and fire suppression prevents fire from playing its natural role in the ERU. In the long term (after about 50 years), vegetation structure and composition is expected to be even more departed from desired conditions, resulting in vegetation quality shifting to a fair condition. Soil condition and soil productivity are currently in good (satisfactory) condition and are expected to remain satisfactory under alternative A. Litter, vegetative composition, and understory productivity are expected to remain about the same.

There is a low likelihood in the short term and a moderate likelihood in the long term that Interior Chaparral could be a limiting factor to the viability of the associated species. These likelihoods were derived by combining the value for habitat abundance with the value for vegetation quality. Vegetation quality was used instead of soil quality because vegetation is assumed to respond faster than soil to treatments or disturbances, and thus, would better reflect differences between alternatives.

The management effect is a 4. This means that there could be a decline in habitat quality as a result of management or lack of management that result from plan components. The existing Forest Plan provides little to no direction and no desired conditions for this ERU, except for what is in wilderness. The Sedona/Oak Creek Ecosystem-wide plan direction includes some beneficial guidance, but it only covers a small proportion of Interior Chaparral ERU. Sedona/Oak Creek Ecosystem-wide plan direction includes provisions to conserve or restore natural ecosystem disturbance patterns and function and to promote the natural ecological role of fire within the constraints of human health and safety, while the mosaic of vegetative conditions reduces the occurrence of catastrophic fires (1987 Plan, pages 206-9, 206-11, 206-19). The ecosystem-wide direction would reduce fire risk by prohibiting camping and campfires in the Neighborwoods, Oak Creek Canyon, and Redrock-Front Country MAs, except in designated places (1987 Plan, page 206-24). Alternative A contributes less to the maintenance and sustainability of Interior Chaparral and the viability of the associated species than the other alternatives.

Prescribed fire and wildfires managed for resource objectives may be used in Interior Chaparral, but there is no provision for using wildfires managed for resource objectives in the wildland-urban interface (1987 Plan, pages 92, 155, 165) and the language to manage wildfires for resource objectives in wilderness impedes the use of this tool (1987 Plan, pages 111, 112). This plan language limits the restoration of fire as a natural process in the wildland-urban interface and in wilderness, and canopy cover and shrub density would be expected to increase in these areas. There would also be increased potential for uncharacteristic fire in the wildland-urban interface and wilderness portions of this ERU. This is particularly problematic where the landownership pattern is intermixed with different ownerships. This is a negative impact on the composition and age class distribution of Interior Chaparral, which is a fire-dependent ecosystem.

Alternative B (modified)

Table 13 shows that vegetation quality will remain the same as in alternative A, i.e., good condition with a trend away from desired conditions. Soil quality would be expected to remain in good (satisfactory) condition and trend toward desired conditions under alternative B (modified). Interior Chaparral would continue to have a low likelihood of being limiting to the associated species. The management effect is a 2, which means that plan components in alternative B (modified) maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area. Alternative B

(modified) contributes more to the maintenance and sustainability of Interior Chaparral and the viability of the associated species than alternative A.

This alternative has desired conditions and guidelines specific to this ERU, whereas these are absent in the current plan. Although alternative B (modified) lacks plan objectives for this ERU, any vegetative treatments or uses that occur in the future would maintain, improve, or not affect desired conditions and would follow the intent of the guidelines.

Vegetative quality may improve by managing wildfires for resource objectives when burning conditions permit (FW-TerrERU-All-G-2), an option that was not available within wildland-urban interface under alternative A. Fire and vegetation management in the wildland-urban interface would favor low-severity surface fires and higher frequency of disturbance than the natural disturbance regime from prescribed burning, wildfires managed for resource objectives, and/or vegetative treatments (FW-WUI-DC-4, 8). Although intended to reduce the risk of wildfire to surrounding communities and values-at-risk, conditions and activities in the wildland-urban interface could have the positive effect of stimulating seed release, germination, or causing a temporary increase in nutrient availability in the understory, which could benefit native species (Satterthwaite et al. 2002). On the other hand, areas with increased disturbance from management activities could degrade habitat through accelerated soil erosion, soil compaction, depletion of the seedbank in the soil, and establishment of non-native species, which could collectively degrade portions of this habitat (Cione et al. 2002). Plants could respond negatively or positively to more frequent fire, depending on timing (actively growing, or when carbohydrate reserves are relatively low), frequency, severity, duration, and extent of burning and how these factors interface with other existing conditions like drought (DeBano et al. 1998). Furthermore, more frequent low-severity ground fires are not the natural fire regime for Interior Chaparral (FW-TerrERU-IC-DC-8), so the composition and structure of this ERU in wildland-urban interface could shift. The effect of these altered conditions in the wildland-urban interface on Interior Chaparral is dependent on the site-specific and species-specific interaction of the above-mentioned possible effects and conditions.

From a soil condition and productivity standpoint, soil quality would remain good because desired conditions would emphasize maintenance of vegetative ground cover to protect soil from accelerated erosion (FW-Soil-DC-3), and therefore, maintain soil productivity. Soil nutrient cycling would be improved through maintenance of biological soil crusts (FW-Soil-DC-4). There is a guideline that directs treatment location rotations to re-establish seed banks and control fuels spatially to protect soils from accelerated erosion (FW-TerrERU-IC-G-1). This would indirectly improve soil nutrient cycling and reduce the risk of moderate-severity wildfires that may pose risk to soil productivity, connected waters, and water quality. Collectively, these plan components result in a trend toward desired conditions compared to a static trend with alternative A.

Alternative B (modified) lacks the plan language from alternative A that impedes the ability to manage wildfires for resource objectives in wilderness. Where implemented, the use of wildfires for resource objectives would help restore fire as a natural process, reduce the risk of uncharacteristic fire, and move the ERU toward desired conditions. None of the three wildernesses that are recommended under alternative B (modified) contain Interior Chaparral.

Alternative B (modified) includes plan components that promote wildland fires within historic fire regimes with the caveat that they do not result in the loss of life, property, or ecosystem function (FW-Fire-DC-2, 3); encourage the restoration of desired disturbance regimes, including

fire, when practical (FW-TerrERU-All-DC-2); and encourage fire management where conditions permit and where consistent with maintenance of or moving toward desired conditions for other resources (FW-Fire-G-2, Management Approaches for Fire Management) without the additional constraints found under alternative A. Although wilderness designation does not allow motorized or mechanized use, there would be more opportunities to treat fire-adapted ERUs with fire compared to alternative A.

Interior Chaparral ERU overlaps six management areas with the majority (78 percent) in the Red Rock Management Area. Most of the plan direction is focused on scenery and recreation, although one beneficial desired condition would promote a balance between recreation experiences and natural resources (MA-RedRock-DC-2).

Alternative C

Alternative C has the same effects as alternative B (modified) except a total of 13 wildernesses are recommended instead of 3. In addition to the 39,065 acres of Interior Chaparral in designated wilderness (77 percent of the ERU), there are 1,720 acres of Interior Chaparral ERU in the Walker Mountain recommended wilderness (3 percent of the ERU) for a total of about 80 percent of the ERU in either designated or recommended wilderness. Recommended wilderness would reduce impacts from motorized use by promoting motorized vehicle use only for limited administrative and permitted activities (SA-RWild-DC-1, 2, 5, 6; SA-RWild-G-1, 3, 5). Mechanized uses that maintain and do not detract from wilderness values would be allowable. However, new trails should be designed for non-motorized and non-mechanized activities that preserve wilderness character (SA-RWild-DC-6; SA-RWild-G-5). Implementation of these plan components would reduce disturbance to soil and vegetation from motorized or mechanized uses that could be beneficial to associated species on about 10 percent of the ERU; the remaining portion of the ERU is on steep slopes. However, limited access associated with recommended (and designated) wilderness could preclude restoration treatments that require motorized equipment for treatments or safety, or make them harder to do logistically. Site-specific circumstances would influence which or whether restoration treatments might be precluded. Delay or absence of restoration treatments could result in missed fire return intervals, increased and unnatural levels of fuels, increased density of shrubs and trees, or establishment and spread of invasive or non-native species. This could slow the trend toward desired conditions or increase the risk of uncharacteristic fires in localized areas more so than in the other alternatives. Uncharacteristic fire could facilitate the spread or establishment of invasive or non-native species, which could then alter area hydrology, fire regime, and biodiversity.

Alternative D

Alternative D has the same effects as alternative B (modified).

Semi-desert Grassland and the Verde Formation

Affected Environment

Amount

There are about 108,531 acres of Semi-desert Grassland within the forest boundary and about 83 percent of this is managed by Coconino NF. The portion not managed by the Coconino is primarily private and State with a mix of city and county ownership. It contains numerous roads

and private land parcels, and adjoins the communities of Camp Verde, Cottonwood, and Cornville.

Table 14 summarizes the information used to estimate the likelihood that Semi-desert Grassland would be a limiting factor to the viability of the associated species. The abundance of Semi-desert Grassland is categorized as Occasional, because at nearly 89,700 acres it occupies about 5 percent of the forest. Habitats classified as Occasional generally cover 1 to 10 percent of the forest and are encountered occasionally.

Habitat Quality and Distribution

This ERU is located in the Verde Valley, which has the highest density of archaeological sites (including prehistoric agricultural fields) on the forest. Certain agave species were cultivated by pre-Columbian farmers dating to at least A.D. 600, and probably were exchanged and moved along prehistoric trade routes. Some of these agaves persist in this ERU and are associated with archaeological sites. Current vegetation is dominated by perennial bunchgrasses; shrubs such as crucifixion thorn, velvet mesquite, cat claw mimosa, agaves, and turbinella oak; forbs which may include various buckwheat species; and trees such as Utah juniper and red berried juniper. Wildfire is a natural disturbance within this ERU, and Semi-desert Grassland was historically characterized by low-severity fire that occurred every 0 to 35 years.

A portion of the ERU occurs in soils associated with the Verde Formation which are ancient lakebed soils. The Verde Formation covers about 69,039 acres in soil units 350, 381, and 385 of the Terrestrial Ecosystem Survey (TES), which classifies ecological types and maps terrestrial ecological units across the forest. In the Verde Formation soils, primary natural disturbances are weather, climate, soil chemistry, and natural soil movement (inherent erosional processes) and fire is infrequent and low to mixed severity. In areas outside the Verde Formation soils, primary natural disturbances are climate, low-intensity/high-severity fire, and natural soil movement (e.g., natural shrink-swell and seasonal surface cracking). The Verde Formation supports a variety of relict, disjunct, and endemic plant species because the surrounding dominant species are generally excluded from this soil type, thereby reducing competition for moisture and allowing the rarer species to survive (Anderson 1986 and 1996). These species include: Arizona cliffrose, Heath-leaf wild buckwheat, Ripley’s wild buckwheat, Rusby’s milkwort, Verde breadroot, Verde Valley sage, and Verde four-nerve daisy.

Using the analysis process described under the Species Viability section above, table 14 summarizes vegetation and soil quality. The vegetation quality of Semi-desert Grassland is classified as poor, which means there is a high departure relative to reference conditions and that the number, size, and evenness of distribution of the habitat areas is greatly reduced. This ERU is trending away from reference conditions, because it is more shrub- and tree-dominated than in reference conditions and there is more human development.

Soils in Semi-desert Grassland (including the Verde Formation) are classified as poor or highly departed with a slow trend toward reference. Large amounts of impaired and unsatisfactory soils result in reduced nutrient-cycling functions (low amount of litter, low organic matter, and poor species composition), low understory productivity, and decreased ability of soil to infiltrate water. This is primarily due to historic grazing, past and current OHV use, recreational impacts, shrub and tree dominance, and recent drought.

Table 14 shows that there is a high likelihood that Semi-desert Grassland habitat could be limiting to the associated species. The likelihood that habitat would be limiting to the associated species was derived by combining the value for habitat abundance with the value for vegetation quality. Vegetation quality was used instead of soil quality because vegetation is assumed to respond faster than soil to treatments or disturbances, and thus, would better reflect differences between alternatives.

Table 14. Summary of coarse filter analyses for Semi-desert Grassland ERU

Habitat	Existing	Alternative A	Alternatives B (modified), C, and D	Associated Species
Abundance	Occasional	Occasional		Arizona cliffrose, Arizona phlox , Phillip's (Grand Canyon) agave, Page Springs agave, Mt. Dellenbaugh sandwort, Rusby's milkwort, Sacred Mountain agave, Tonto Basin agave, Verde breadroot, Verde Valley (Mearn's) sage, ferruginous hawk, pronghorn, Basin bladderpod, Bigelow's onion, Mearn's lotus, skunk-top scurfpea
Quality-Vegetation	Poor, trending away	Poor, static	Poor, trending away	
Quality-Soil	Poor, trending slowly toward	Poor, trending slowly toward	Poor, trending toward	
Likelihood of Limitation	High	High		
Management effect		3: Plan components maintain or improve protection and management for some habitat occurrences in the plan area.	2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.	

Table 14 also compares management effect by alternative. Management effect categorizes the relative expected outcome of plan language in each alternative in terms of maintaining habitat quality and is the result of plan decisions, including plan objectives. Management effect category values are 1, 2, 3, and 4. The lower the management effects rating, the more effective the alternative is for maintaining the habitat. The effects of the alternatives are explained in greater detail in the discussions on the alternatives that follow.

About 3,640 acres of this ERU are distributed in five designated wildernesses: Sycamore Canyon (1,657 acres), Red Rock-Secret Mountain (1,313 acres), West Clear Creek (275 acres), Mazatzal (271 acres), and Munds Mountain (115 acres). This is about 4 percent of the ERU. There are 162 acres in the Verde Valley Botanical Area.

Risk Factors

Non-native invasive plant species can disrupt the composition and structure of ecosystems as well as natural processes including fire return intervals, soil stability, and ecosystem hydrology. Fragmentation, or the lack of connectivity, can alter the ability of species to disperse and meet their life history needs.

Associated Species

Associated species are listed in table 14.

Environmental Consequences

Analysis related to the risks arising from non-native invasive plant species and fragmentation are addressed under the Non-native or Invasive Species and Connectivity topics above in the Wildlife and Plant Issues and Topics section.

Common to All Alternatives

Plan components in all alternatives contribute to species viability by managing habitat to maintain viable and sustainable populations of wildlife and fish species and by improving and protecting habitat for threatened, endangered, and sensitive species (1987 Plan, pages 22-1, 23; FW-Eco-DC-1; FW-WFP-DC-1, 2, 3, 5, 6, 8; FW-WFP-G-3, 10). See At-risk Species in the Wildlife and Plant Issues and Topics section above for more information.

All alternatives address the threat of invasive plants. Invasive plants can increase as a consequence of ground disturbance and once established would compete with native species for water and nutrients or could alter the fire regime. All alternatives address the threat of invasive plants by pointing to the Final Environmental Impact Statement for the Treatment of Noxious or Invasive Weeds (USDA Forest Service 2005). This direction includes best management practices, among other guidance, which would help prevent, mitigate, and reduce the threat of invasive plants. All alternatives prioritize treatments, call for incorporating control measures in project planning and implementation, and emphasize coordination with partners (1987 Plan, pages 23, 69, 70, 182, 206-14, 206-76, 206-101, 201-116; FW-Invas-DC-1,2; FW Invas-G-1, 2, 3; FW-Invas-MgtApp; FW-Graz-MgtApp; FW-RdsFac-G-8; FW-Rec-Dev-DC-9; FW-Rec-Dev-G-2). Additional information and analysis is discussed under the Non-native or Invasive Species topic in the Wildlife and Plant Topics and Issues section.

Plan language under all alternatives directs implementing site-specific best management practices for ground-disturbing projects (1987 Plan, page 71; FW-Soil-G-1, 2, 3). Implementation of this direction would avoid or limit ground-disturbing activities that could cause loss of protective vegetative ground cover. This direction would also avoid or limit detrimental impacts to soil condition and productivity, including soils with high burn severity, sensitive soils with moderate or severe erosion hazard, and calcareous soils that have high wind erodibility when exposed. Where such disturbances cannot be avoided, project-specific best management practices should be developed. Finally, specific project design features would be required on projects occurring on slopes greater than 40 percent grade where soils with moderate or severe erosion hazard ratings occur or where soils are sensitive to degradation when disturbed.

About four percent of Semi-desert Grassland ERU occurs in designated wilderness. It is distributed in six designated wildernesses: Mazatzal (271 acres), Munds Mountain (115 acres), Red Rock-Secret Mountain (1,313 acres), Sycamore (1,657 acres), West Clear Creek (275 acres), and Wet Beaver (11 acres). Designated wilderness areas would be managed according to applicable laws, policy, and Forest Plan direction to preserve wilderness resource values and wilderness quality, and to emphasize wilderness recreation (1987 Plan, pages 105 to 112; SA-Wild-DC-1 to 11; SA-Wild-DC-S-1, 2; SA-Wild-DC-G-1 to 7). Wilderness designation limits most active vegetation management because motorized and mechanized use is not allowed. Motorized and mechanized access can kill or damage plants and can degrade the habitat through soil compaction and soil loss. Ground-disturbing activities are primarily confined to main trails, trailheads, and key points of interest at which invasive species introduction and establishment, or accelerated erosion could occur, depending on the level of use. The lack of ground-disturbing activities elsewhere would be beneficial by reducing the risk of invasive plant introduction and dispersal by motorized or mechanized use. However, limited access associated with designated wilderness could preclude restoration treatments that require motorized equipment for treatments or safety, or make them harder to do logistically. Lack of restoration treatments could result in missed fire return intervals, increased and unnatural levels of fuels, increased density of shrubs and trees, or establishment and spread of invasive or non-native species. This could slow the

trend toward desired conditions or increase the risk of uncharacteristic fires in localized areas more so than in the other alternatives. Uncharacteristic fire could facilitate the spread or establishment of invasive or non-native species, which could then alter area hydrology, fire regime, and biodiversity.

Off-road travel in the Verde Valley Botanical Area is not allowed in any alternative (1987 Plan, page 194; SA-RNABotGeo-DC-5; SA-RNABotGeo-G-1). New utility corridors would also avoid the Verde Valley Botanical Area (1987 Plan, page 79; FW-SpecUse-G-10). This would result in less disturbance to soil and plants and in less erosion and soil compaction. Potential habitat damage from these activities would be eliminated.

Alternative A

Using the analysis process described under the Species Viability section above, table 14 shows that under alternative A the vegetation quality of Semi-desert Grassland is classified as poor, which means it has a high departure from desired conditions and the number, size, and evenness of distribution of habitat areas across the landscape is greatly reduced. Under the plan direction in alternative A, vegetation quality is expected to be static relative to desired conditions primarily due to the lack of plan objectives for treatment, thus tree and shrub cover would continue to increase and understory would decrease in abundance and vigor.

Soil condition and soil productivity would also be in poor condition with a slow trend toward desired conditions. Soil quality is expected to slowly improve as improved grazing strategies are implemented and roads are closed although progress will be slow due to the arid climate, lack of plan emphasis on treating this ERU, and the continued lack of fire.

There is a high likelihood that Semi-desert Grassland could be a limiting factor to the viability of the associated species. This likelihood was derived by combining the value for habitat abundance with the value for vegetation quality. Vegetation quality was used instead of soil quality because vegetation is assumed to respond faster than soil to treatments or disturbances, and thus, would better reflect differences between alternatives.

The management effect is a 3, which means that plan components maintain or improve protection and management for some habitat occurrences in the plan area. Alternative A contributes less to the maintenance and sustainability of Semi-desert Grassland and the viability of the associated species than the other alternatives.

The different types of grasslands were not distinguished in the current forest plan, so consequently, there are no specific desired conditions for this ERU in the current plan. Direction for the majority of Semi-desert Grassland ERU is located in the Verde Valley Management Area (MA 11) (over 46,000 acres) and in the Savannah Management Area (MA 27) (almost 24,000 acres). Part of the guidance in the Verde Valley Management Area is outdated and part of the guidance in the Savannah Management Area better reflects current science.

In the portion of Semi-desert Grassland that overlaps the Verde Valley Management Area, the current forest plan emphasizes watershed condition and range management and prioritizes improvement in watersheds in unsatisfactory condition, which could improve vegetation and soil conditions. Range management focuses on less than satisfactory range conditions, broadcast seeding following burning to increase production (for livestock), and forage improvement. The direction for soil in this alternative focuses on achieving range improvement by identifying areas

suitable for soil scarification and seeding of early seral species to a "more productive state" and to evaluate soils to determine the best species to promote stabilization. This direction does not move this ERU toward the ecologically-based desired conditions in alternative B (modified). Scarification would disturb the soil surface in the Verde Formation and other soil types and lead to increased erosion. Alternative A specifies that the seed mix should be shade-tolerant and a mix of warm and cool season grasses, and does not specify that the seed mix should be native. Scarification and seeding of early seral species can introduce non-native species like Lehmann love grass (*Eragrostis lehmanniana*) that compete with native plants and facilitate fire spread. However, vegetative treatments to improve Semi-desert Grassland would be reviewed for soil potential for revegetation and erosion potential prior to treatment. The Verde Formation could be avoided or mitigation measures could be employed to avoid severe impairment of soil productivity (1987 Plan, pages 166, 168, 169).

In contrast, in the portion of Semi-desert Grassland that overlaps the Savannah Management Area, the current forest plan emphasizes that ecosystem processes play a natural role and that high quality grasslands support a diversity of wildlife. The current plan would have this MA characterized by open vegetation structure, using prescribed fire and mechanical treatments, and would increase the area occupied by grasses and forbs while decreasing the area occupied by shrubs and trees in comparison to recent historic levels (1987 Plan, page 206-50). Implementation of this language would move this ERU toward desired conditions.

Although prescribed fire and wildfires managed for resource objectives may be used in Semi-desert Grassland, there is no provision for using wildfires managed for resource objectives in the wildland-urban interface (1987 Plan, pages 92, 155, 165) and the language to manage wildfires for resource objectives in wilderness impedes the use of this tool (1987 Plan, pages 111,112). This plan language limits the restoration of fire as a natural process in the wildland-urban interface and in wilderness, and canopy cover and shrub density would be expected to increase in these areas. There would also be increased potential for uncharacteristic fire in the wildland-urban interface and wilderness portions of this ERU. This is particularly problematic where the landownership pattern is intermixed with different ownerships. This is a negative impact on the composition and age class distribution of Semi-desert Grassland.

There are 162 acres (0.1 percent of the ERU) and 2 percent of the Verde Formation in the Verde Valley Botanical Area. Botanical area direction in Management Area 17 will protect this portion of the ERU and the Verde Formation by restricting new transmission corridors, emphasizing existing conditions and natural processes, restricting off-road driving, limiting visitors to meet carrying capacity, maintaining their ecological condition, prohibiting firewood cutting, not allowing special-use authorizations that could adversely affect these areas, managing roads to prevent vehicular intrusion, and managing fire to minimize damage to the character of this area (1987 Plan, pages 79, 194 to 196).

However, mechanized use in botanical areas is not explicitly addressed resulting in vague direction to managers. It is unclear as to whether mechanized use is prohibited, is allowed only on trails, or is allowed on and off trail in these areas. Consequently, mechanized use could damage vegetation or contribute to acceleration erosion within localized areas in this ERU.

Alternative B (modified)

Under alternative B (modified), vegetation quality and soil quality would be poor (see table 14), the same as alternative A. Quality would improve faster than alternative A because of a treatment

objective (FW-TerrERU-Grass-O-2) that would move Semi-desert Grassland ERU toward desired conditions at a slightly faster pace than alternative A. Under this alternative, wildfires may be managed for resource objectives in more areas of the landscape than in alternative A, allowing increased opportunities to reduce the risk of uncharacteristic fire and to restore fire-adapted ecosystems (FW-TerrERU-All-G-2; FW-WUI-DC-4). Vegetation modeling shows that grasses and forbs would increase by 6 percent by year 15 and by 15 percent by year 50 as woody vegetation is cleared. Soil desired conditions would promote proper functioning soils, soil protection and stabilization, and nutrient cycling (FW-Soil-DC-1, 2, 3, 4). Forestwide soil guidelines would avoid excessive ground disturbance, limit accelerated erosion, and minimize bringing more calcareous soil to the surface (FW-Soil-G-1, 2, 3).

Under alternative B (modified), there is a high likelihood that Semi-desert Grassland could be limiting to the associated species. This likelihood was derived by combining the value for habitat abundance with the value for vegetation quality. Vegetation quality was used instead of soil quality because vegetation is assumed to respond faster than soil to treatments or disturbances and thus would better reflect differences between alternatives.

The management effect is a 2 for alternative B (modified) which means that plan components maintain or improve protection and management for most habitat occurrences in the plan area. Alternative B (modified) contributes more to the maintenance and sustainability of Semi-desert Grassland and to the viability of the associated species than alternative A.

Unlike alternative A, this alternative clearly distinguishes between different grassland types on the forest and provides updated and improved plan direction that would guide future projects. Alternative B (modified) provides plan components to promote properly functioning and resilient ecosystems, promote characteristic disturbances, reduce the threat of uncharacteristic disturbances, and promote balance between desirable non-native species and subspecies and properly functioning ecosystems thereby furthering sustainability and adaptability (FW-Eco-DC-1, 2, 3, 4; FW-TerrERU-All-DC-2). In addition for all terrestrial ERUs, it promotes a mosaic of vegetation conditions, densities, and structures at different scales; ecosystems that are interconnected based on natural patterns; and restoration of desired disturbance regimes (FW-TerrERU-All-DC-1 to 5, FW-TerrERU-All-G-1, 3). ERU specific direction would provide for a variety of native species with varying seral stages in natural patterns of abundance and distribution that support natural disturbances (FW-TerrERU-Grass-DC-1 to 5, 7, 8; FW-TerrERU-Grass-G-2).

Under this alternative, wildfires may be managed for resource objectives in more areas of the landscape than in alternative A (including wildland-urban interface and wilderness) allowing increased opportunities to reduce the risk of uncharacteristic fire and to restore fire-adapted ecosystems (FW-TerrERU-All-G-2; FW-WUI-DC-4). Native understory species would be capable of supporting frequent surface fires except in the Verde Formation soils, which support infrequent fires of low to mixed severity (FW-TerrERU-Grass-DC-2).

In addition to the 3,640 acres of designated wilderness, about 132 acres (0.1 percent of the ERU) are in the Davey’s recommended wilderness area under this alternative. Recommended wilderness would reduce impacts from motorized use by promoting motorized vehicle use only for limited administrative and permitted activities (SA-RWild-DC-1, 2, 5, 6; SA-RWild-G-1, 3, 5). Mechanized uses that maintain and do not detract from wilderness values would be allowable, however, new trails should be designed for non-motorized and non-mechanized activities that

preserve wilderness character (SA-RWild-DC-6; SA-RWild-G-5). Implementation of these plan components would reduce disturbance to soil and vegetation from motorized or mechanized uses which could be beneficial to associated species. However, limited access associated with recommended and designated wilderness could preclude restoration treatments that require motorized equipment for treatments or safety, or make them harder to do logistically. Site-specific circumstances would influence which or whether restoration treatments might be precluded. Delay or absence of restoration treatments could result in missed fire return intervals, increased and unnatural levels of fuels, increased density of shrubs and trees, or establishment and spread of invasive or non-native species. This could slow the trend toward desired conditions or increase the risk of uncharacteristic fires in localized areas more so than in the other alternatives. Uncharacteristic fire could facilitate the spread or establishment of invasive or non-native species, which could then alter area hydrology, fire regime, and biodiversity. Impacts to the ERU from wilderness recommendation and the combination of designated wilderness plus recommended wilderness would be localized and are unlikely to affect the ERU at the landscape level because of the small proportion affected.

There are 737 total acres of Semi-desert Grassland ERU in the Cottonwood Basin Geological and Botanical Area (575 acres) and Verde Valley Botanical Area (162 acres). Plan language in alternative B (modified) promotes protection and maintenance of the unique characteristics of botanical areas and sustainability of their inherent physical and biological processes that are not negatively impacted from human activities or permitted uses (SA-RNABotGeo-DC-6; SA-RNABotGeo-G-1). Fires and allotment management plans would be protective of the resources for which these areas were designated (SA-RNABotGeo-G-3, 4).

Mechanized travel is not suitable in these areas except on designated trails (see Chapter 4 Recreation and Transportation Suitability). Subsequent environmental analysis would need to be done for this direction to take effect. This suitability recommendation is clearer than in alternative A, and is considered to be protective of vegetation and soil because potential impacts, such as damage to vegetation and accelerated erosion, would be evaluated during the environmental analysis and impacts would be limited to the trail prism.

Alternative C

Alternative C has the same effects as alternative B (modified), except a total of 13 wildernesses are recommended instead of 3. In addition to the 3,640 acres of Semi-desert Grassland in designated wilderness (4 percent of the ERU), there are 12,041 acres recommended wilderness (13.4 percent of the ERU) The recommended wilderness acres are distributed among seven recommended wildernesses: Hackberry (4,327 acres), Black Mountain (2,444 acres), Cedar Bench (1,972 acres), Cimarron-Boulder (1,907 acres), Deadwood Draw (753 acres), Walker Mountain (506 acres), and Davey’s (132 acres). There would be a total of 17 percent of the ERU in either designated or recommended wilderness. Impacts to the ERU from wilderness recommendation and the combination of designated wilderness plus recommended wilderness would be same as in alternative B (modified), but would cover a higher proportion of the ERU. Because the 3,500-acre plan objective (FW-TerrERU-Grass-O-1) is small compared to the size of the ERU, it is unlikely that designated wilderness, recommended wilderness, and proposed treatment areas would overlap, so the consequences to the ERU associated with the plan objective are similar to alternative B (modified).

Mechanized use on designated trails in botanical and geological areas is not suitable in alternative C. There are no provisions for mechanized use on designated trails. Subsequent environmental

analysis would need to be done for this direction to take effect. This is most protective alternative for the plants and their habitat because one of the potential disturbances to soil and vegetation would not be allowed. This would not eliminate all potential disturbances to botanical and geological areas because horseback use and foot traffic would still be permitted. This would remove the potential for damaged vegetation and accelerated erosion from mechanized use along designated trails in the Verde Valley Botanical Area, but would have little impact in the Cottonwood Basin Geological and Botanical Area, which currently lacks designated trails.

Alternative D

Alternative D would have the same effects as alternative B (modified) except for the following. Alternative D proposes only the Cottonwood Basin Geological Area, which has 185 acres of Semi-desert Grassland. The 390 acres of Semi-desert Grassland in the Cottonwood Basin Botanical Area of alternative B (modified) would be guided by applicable forestwide or management area plan direction rather than plan components relating to botanical areas. There are no recommended wilderness areas. In alternative D, the recommended wilderness areas of alternative B (modified) would be guided by applicable forestwide or management area plan direction rather than plan components relating to recommended wilderness.

Great Basin Grassland

Affected Environment

Amount

There are about 96,233 acres of Great Basin Grassland within the forest boundary and about 96 percent (92,842 acres) of this is managed by Coconino NF. The portion not managed by the Coconino is primarily private.

Table 15 summarizes the information used to estimate the likelihood that Great Basin Grassland ERU would be a limiting factor to the viability of the associated species. The abundance of Great Basin Grassland ERU is categorized as Occasional because it occupies about 5 percent of the forest. Habitats classified as Occasional generally cover 1 to 10 percent of the forest and are encountered occasionally.

Habitat Quality and Distribution

Great Basin Grassland ERU occurs at elevations between 4,800 and 7,500 feet. Great Basin Grassland ERU covers approximately 92,842 acres (approximately 5 percent) of the Coconino NF within lands managed by the Coconino NF. These grasslands are more arid than Montane/Subalpine Grassland ERU. Typical locations are Anderson Mesa and near Wupatki National Monument. They consist mostly of grasses with smaller amounts of forbs and shrubs. Trees can be present in trace amounts depending on the soil; however, tree canopy is increasing in some areas. Species include, but are not limited to, western wheatgrass, black grama, blue grama, galleta grass, hairy grama, spike muhly, and needle and thread grass. Trees may include sparse one-seed juniper, alligator juniper, red berry juniper, Utah juniper, and Colorado pinyon pine. Natural disturbances are weather, low-intensity/high-severity fire (from adjacent ERUs), and natural soil movement (e.g., natural shrink swell and seasonal surface cracking).

There are about 190 acres of Great Basin Grassland in designated wilderness (all within the Strawberry Crater Wilderness).

Using the analysis process described under the Species Viability section above, table 15 summarizes vegetation and soil quality. The vegetation quality of this ERU is classified as good and trending away from reference condition because shrub and tree invasion is occurring along the edge of grasslands and there has been a shift from small to large tree sizes. This results in alterations to canopy closure, mosaic patterns, structural stages, fire severity, and fire frequency. The structure, composition, and/or functioning is similar to reference conditions. Number and size of habitat areas and /or their evenness in distribution across the landscape is similar to or only slightly reduced relative to reference conditions.

Soils in Great Basin Grassland ERU are classified as highly departed with a trend toward reference condition. Soil nutrient cycling and hydrology functions are appreciably reduced primarily due to drought, past grazing by cattle, and past and current grazing by wildlife. Understory vigor and productivity is somewhat reduced; however, current grazing strategies are improving vegetative layer and ground cover. Consequently, habitat quality from a soil perspective is considered poor.

Table 15 shows that there is a low likelihood that Great Basin Grassland habitat could be limiting to the associated species. The likelihood that habitat would be limiting to the associated species was derived by combining the value for habitat abundance with the value for vegetation quality. Vegetation quality was used instead of soil quality because vegetation is assumed to respond faster than soil to treatments or disturbances, and thus, would better reflect differences between alternatives.

Table 15. Summary of coarse filter analysis for Great Basin Grassland ERU

Habitat	Existing	Alternative A	Alternative B (modified), C, and D	Associated Species
Abundance	Occasional	Occasional		Black-footed ferret, western burrowing owl, ferruginous hawk, Gunnison's prairie dog, pronghorn, black dropseed
Quality-Vegetation	Good, trending away	Good, trending away then fair, away	Good, static	
Quality-Soil	Poor, trending toward	Poor, slowly trending toward	Poor, trending toward	
Likelihood of Limitation	Low	Short term: Low Long term: Moderate	Low	
Management effect		3: Plan components maintain or improve protection and management for some habitat occurrences in the plan area.	2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.	

Table 15 also compares management effect by alternative. Management effect categorizes the relative expected outcome of plan language in each alternative in terms of maintaining habitat quality and is the result of plan decisions, including plan objectives. Management effect category values are 1, 2, 3, and 4. The lower the management effects rating, the more effective the

alternative is for maintaining the habitat. The effects of the alternatives are explained in greater detail in the discussions on the alternatives that follow.

Risk Factors

Non-native invasive plant species can disrupt the composition and structure of ecosystems as well as natural processes including fire return intervals, soil stability, and ecosystem hydrology.

Associated Species

Associated species are listed in table 15.

Environmental Consequences

Analysis related to the risks arising from non-native invasive plant species and fragmentation are addressed under the Non-native or Invasive Species and Connectivity topics above in the Wildlife and Plant Issues and Topics section.

Common to All Alternatives

Plan components in all alternatives contribute to species viability by managing habitat to maintain viable and sustainable populations of wildlife and fish species and by improving and protecting habitat for threatened, endangered, and sensitive species (1987 Plan, pages 22-1, 23; FW-Eco-DC-1, FW-WFP-DC-1, 2, 3, 5, 6, 8; FW-WFP-G-3, 10). See At-risk Species in the Wildlife and Plant Issues and Topics section above for more information.

All alternatives address the threat of invasive plants. Invasive plants can increase as a consequence of ground disturbance and, once established, would compete with native species for water and nutrients or could alter the fire regime. All alternatives address the threat of invasive plants by pointing to the Final Environmental Impact Statement for the Treatment of Noxious or Invasive Weeds (USDA Forest Service 2005). This direction includes best management practices, among other guidance, which would help prevent, mitigate, and reduce the threat of invasive plants. All alternatives prioritize treatments, call for incorporating control measures in project planning and implementation, and emphasize coordination with partners (1987 Plan, pages 23, 69, 70, 182, 206-14, 206-76, 206-101, 201-116; FW-Invas-DC-1, 2; FW Invas-G-1, 2, 3; FW-Invas-MgtApp; FW-Graz-MgtApp; FW-RdsFac-G-8; FW-Rec-Dev-DC-9; FW-Rec-Dev-G-2). Additional information and analysis is discussed under the Non-native or Invasive Species topic in the Wildlife and Plant Topics and Issues section.

Plan language under all alternatives directs implementing site-specific best management practices (BMPs) for ground-disturbing projects (1987 Plan, page 71, FW-Soil-G-1, 2, 3). Implementation of this direction would avoid or limit ground-disturbing activities that could cause loss of protective vegetative ground cover. This direction would also avoid or limit detrimental impacts to soil condition and productivity, including soils with high burn severity, sensitive soils with moderate or severe erosion hazard, and calcareous soils that have high wind erodibility when exposed. Where such disturbances cannot be avoided, project-specific BMPs should be developed. Finally, specific project design features would be required on projects occurring on slopes greater than 40 percent grade where soils with moderate or severe erosion hazard ratings occur or where soils are sensitive to degradation when disturbed. This would help maintain good soil condition in this ERU.

Less than 1 percent of Great Basin Grassland ERU occurs in designated wilderness (all in the Strawberry Crater Wilderness. Designated wilderness areas would be managed according to applicable laws, policy and Forest Plan direction to preserve wilderness resource values and wilderness quality, and to emphasize wilderness recreation (1987 Plan, pages 105 to 112; SA-Wild-DC-1 to 11; SA-Wild-S-1, 2; SA-Wild-G-1 to 7). Wilderness designation limits most active vegetation management because motorized use and mechanized use is not allowed. Motorized and mechanized access can kill or damage plants and can degrade the habitat through soil compaction and soil loss. Ground-disturbing activities from recreation are primarily confined to main trails, trailheads, and key points of interest at which invasive species introduction and establishment, or accelerated erosion could occur depending on the level of use. The lack of ground-disturbing activities elsewhere would be beneficial by reducing the risk of invasive plant introduction and dispersal by motorized or mechanized use. However, limited access associated with designated wilderness could preclude restoration treatments that require motorized equipment for treatments or safety, or make them harder to do logistically. Lack of restoration treatments could result in missed fire return intervals, increased and unnatural levels of fuels, increased density of shrubs and trees, or establishment and spread of invasive or non-native species. This could slow the trend toward desired conditions or increase the risk of uncharacteristic fires in localized areas more so than in the other alternatives. Uncharacteristic fire could facilitate the spread or establishment of invasive or non-native species which could then alter area hydrology, fire regime, and biodiversity. However, due to the small percentages of Great Basin Grassland ERU involved, restrictions on access that might be needed to conduct vegetative treatments in wilderness would not affect the overall quality of the ERU.

Alternative A

Using the analysis process described under the Species Viability section above, table 15 shows that under alternative A, vegetation quality would be in good condition in the short term and would trend away from desired conditions until it transitioned to fair condition in the long term, still with a trend away from desired conditions. This is because tree and shrub cover would continue to increase and understory would decrease in abundance and vigor in the absence of vegetation treatments or fire that would decrease tree and shrub cover. Small mammals, birds, invertebrates, pronghorn, and prairie dogs rely on the diversity, abundance, and vigor of understory vegetation for food and cover which is reduced as tree and shrub cover increases. Invertebrates are food for birds and small mammals which in turn are prey for western burrowing owls and ferruginous hawks. An increase in trees and shrubs could provide more cover for coyotes and mountain lions that prey on pronghorn. Trends away from desired conditions would reduce habitat quality for species associated with these grasslands.

Soil quality is poor and is expected to slowly improve toward desired conditions as improved grazing strategies and mechanical treatments are implemented.

There is a low likelihood that Great Basin Grassland ERU could be a limiting factor to the viability of the associated species in the short term and a moderate likelihood in the long term. This likelihood was derived by combining the value for habitat abundance with the value for vegetation quality. Vegetation quality was used instead of soil quality because vegetation is assumed to respond faster than soil to treatments or disturbances, and thus, would better reflect differences between alternatives.

The management effect is 3, which means that plan components in alternative A maintain or improve habitat quality by maintaining or improving protection and management for some habitat

and habitat element occurrences in the plan area. Alternative A contributes less to the maintenance and sustainability of Great Basin Grassland than the other alternatives.

Alternative A does not distinguish between the different grassland types that differ from each other in terms of precipitation patterns, composition, soil types, elevation, and structure. In the older sections of the current plan, guidance for composition is focused on a balanced composition of cool and warm season forage species (1987 Plan, page 160). More recently amended sections of the plan, such as in the Flagstaff-Lake Mary Ecosystem Area (FLEA), have a more ecological approach to composition by promoting diverse healthy populations of native plants and animals with a natural variety of plant species, age classes, and structures (1987 Plan, pages 206-72, 78, 97, 98, 100; 206-103; 209-108; 206-114). This guidance is limited to the FLEA analysis area and does not apply forestwide. Alternative A has limited guidance on structure and function however there is some guidance related to invasive plants, soil, fire management, water resources, wildlife habitat, and range improvement (1987 Plan, pages 162 to165, 206-72, 75 to 78, 206-89). Alternative A provides guidance to maintain and improve grasslands, including removing invading overstory, stabilizing gullies, scarifying soils, appropriate seeding, controlling livestock, raising the water table, reducing road and motorized use impacts, and re-introducing fire (1987 Plan, pages 159, 160, 164, 206-87 to 206-88). There are guidelines regarding relocation, obliteration, or closure of roads that are damaging or could damage meadows (1987 Plan, pages 206-70, 206-77, 78, 206-116). The current plan also promotes the maintenance of seral grasslands in Management Area 10 and focuses road and trail maintenance in damaged meadows in the Doney Management Area (1987 Plan, pages 206-93).

There are no provisions for using wildfires managed for resource objectives in the wildland-urban interface (1987 Plan, page 93). Restrictions on the use of wildfires in the wildland-urban interface have a detrimental effect on reintroducing fire or reducing the potential for uncharacteristic fire in the wildland-urban interface portions of Great Basin Grassland ERU because the landownership pattern is intermixed between public and private ownerships.

Alternative B (modified)

Using the analysis process described under the Species Viability section above, table 15 shows that the vegetation quality of Great Basin Grassland is classified as good with a static trend away relative to desired conditions varying only slightly over years.

The soil quality would improve faster than under alternative A, but not fast enough to shift the condition from poor to fair. The improvement would be the result of a plan objective that would restore or improve 10,800 to 12,400 acres of Great Basin Grassland during each 10-year period over the life of the plan (FW-TerrERU-Grass-O-2). Treatments would likely remove tree and shrubs, reduce canopy cover, and expand the area occupied by grasses and forbs, which would improve soil condition and maintain soil productivity. Additional language that is not present in alternative A would promote satisfactory and functional soils in a portion of Great Basin Grassland by not using prescribed fires and wildfires managed for resource objectives on areas with clayey soils until natural vegetative ground cover is near potential (FW-TerrERU-Grass-G-1).

There would be a low likelihood that Great Basin Grassland ERU could be a limiting factor to the viability of the associated species. Likelihood was derived by combining the value for habitat abundance with the value for vegetation quality. Vegetation quality was used instead of soil

quality because vegetation is assumed to respond faster than soil to treatments or disturbances and thus would better reflect differences between alternatives.

The management effect is a 2 for alternative B (modified) which means that plan components maintain or improve protection and management for most habitat occurrences in the plan area. The management effect variable categorizes the relative expected outcome of plan language in each alternative in terms of minimizing species viability risk and are the result of plan decisions, including plan objectives. Alternative B (modified) has a higher viability effectiveness than alternative A because alternative B (modified) distinguishes between the different grassland types and has an objective to restore/enhance between 10,800 and 12,400 acres of this ERU every 10-year period during the life of the plan (FW-TerrERU-Grass-O-2). This alternative contributes more to the maintenance and sustainability of Great Basin Grassland than alternative A.

Alternative B (modified) clearly distinguishes between different grassland types on the forest and provides desired conditions, objectives and guidance that are specific to the each type. Management direction would promote properly functioning ecosystems that are resilient to natural disturbances and climate change; promote characteristic disturbances and reduce the threat of uncharacteristic disturbances, and promote balance between desirable non-native species and subspecies and properly functioning ecosystems, thereby furthering sustainability and adaptability (FW-Eco-DC-1, 2, 3, 4; FW-TerrERU-All-DC-2). Plan components for all terrestrial ERUs promote a mosaic of vegetation conditions, densities, and structures at different scales; ecosystems that are interconnected based on natural patterns; and restoration of desired disturbance regimes (FW-TerrERU-All-DC-1 to 5, FW-TerrERU-All-G-1, 3). Goals in the proposed revised plan have greater potential to reduce ERU departure and move toward desired conditions than alternative A. Goals promote: properly functioning ecosystems that are resilient to natural disturbances and climate change, the reduction of uncharacteristic disturbances; endemic levels of invertebrates, (including pollinators), and disease with occasional outbreaks; and a balance of desirable non-native species and subspecies with properly functioning ecosystems (FW-Eco-DC-1, 2, 3, 4). Goals include a mosaic of vegetation conditions, densities and structures and various scales that reflect natural disturbance regimes, resilience to disturbances, adaptations to climate variability, connections based on natural patterns, and allowances for inclusions, variability, and ecotones (FW-TerrERU-All-DC-1 to 4).

ERU-specific direction would provide for a variety of native species with varying seral stages in natural patterns of abundance and distribution that support natural disturbances (FW-TerrERU-Grass-DC-1, 2, 3, 4, 7, 8; FW-TerrERU-Grass-O-2; FW-TerrERU-Grass-G-1, 2).

In addition to the 190 acres of Great Basin Grassland ERU in designated wilderness, there are an additional 2,327 acres of this ERU in the recommended Strawberry Crater Wilderness. Collectively, this is about 2.7 percent of the ERU. Impacts to the ERU from wilderness recommendation and the combination of designated wilderness plus recommended wilderness are unlikely to affect the ERU at the landscape level because of the small proportion affected. Plan components for recommended wilderness are generally protective. Recommended wilderness would be managed to maintain or enhance primitive and undeveloped characteristics; to preserve native species and unique features; to reduce evidence of modern human control and manipulations; and motor vehicle uses should only occur for limited administrative and permitted activities to be consistent with wilderness character (FW- RWild-DC-1, 2, 3; FW- RWild-G-3). Needed treatments could be conducted using motorized equipment until a wilderness designation decision is made, providing the treatments are consistent with wilderness character. If designated

by Congress, the wilderness areas would be managed according to applicable laws, policy and Forest Plan direction (SA-Wild-DC-1 to 11; SA-Wild-O-1, 2; SA-Wild-S-1 to 5; SA-Wild-G-1 to 11). This designation typically limits active vegetation management and may have negative consequences with respect to meeting the ERU's vegetation or watershed desired conditions over the 2,327 acres in the long term within the Strawberry Crater recommended wilderness. Under this alternative, wildfires may be managed for resource objectives in more areas of the landscape than in alternative A, allowing increased opportunities to reduce the risk of uncharacteristic fire and to restore fire-adapted ecosystems (FW-TerrERU-All-G-2; FW-WUI-DC-4).

Alternative C

Alternative C is the same as alternative B (modified). There are no additional acres of Great Basin Grassland in recommended wilderness other than those proposed in alternative B (modified).

Alternative D

Alternative D is the same as alternative B (modified) except there is no recommended wilderness. In alternative D, the recommended wilderness areas of alternative B (modified) would be guided by applicable forestwide or management area plan direction rather than plan components relating to recommended wilderness.

Montane/Subalpine Grassland

Affected Environment

Amount

There are about 43,055 acres of Montane/Subalpine Grassland within the forest boundary. The Coconino NF manages about 23,656 acres (55 percent) of these acres. The portion not managed by the Coconino is primarily private and State, with a mix of county and other Federal (Navajo Army Depot) ownership.

Table 16 summarizes the information used to estimate the likelihood that Montane/Subalpine Grassland ERU would be a limiting factor to the viability of the associated species. The abundance of Montane/Subalpine Grassland is categorized as Occasional because at 23,656 acres it occupies about 1.3 percent of the forest (table 16). Habitats classified as Occasional generally cover 1 to 10 percent of the forest and are encountered occasionally.

Habitat Quality and Distribution

This ERU consists of two subtypes: Montane Grasslands and Subalpine Grasslands. Montane Grasslands occur above the Mogollon Rim and extend upward to about 7,800 feet in elevation and include locations such as Kendrick Park, Antelope Park, and Mule Park. Species in this subtype include: mutton grass, mountain muhly, spike muhly, Arizona fescue, blue grama, red threeawn, squirreltail, yarrow, and pine dropseed.

Subalpine Grasslands typically occur above 7,800 feet in areas such as Freidlein Prairie on the San Francisco Peaks. Species in this subtype include: pine dropseed, nodding brome, various sedges, Arizona fescue, mountain junegrass, mountain muhly, muttongrass, and squirreltail. In both subtypes, trees may be present in trace amounts within the grasslands and along their periphery.

There are about 150 acres of Montane/Subalpine Grassland in the Fern Mountain Botanical Area, 26 acres in the Mogollon Rim Botanical Area, 11 acres in the Griffith Springs Environmental Study Area, and 43 acres in the Old Caves Crater Environmental Study Area. About 628 acres are in three designated wildernesses: Kachina Peaks (619 acres), Sycamore Canyon (6 acres), and West Clear Creek (3 acres).

A small portion of this ERU (9 acres) is in the addition to the San Francisco Peaks Research Natural Area that is proposed in alternative A.

According to reference conditions, Montane/Subalpine Grassland ERU was less fragmented before land ownership changes occurred and there were no invasive or non-native plant species. Its open vegetative structure was maintained mainly by fire entering from adjacent ERUs. Fire reduces the number of tree seedlings and saplings that establish in grasslands, especially along the perimeter. This ERU has a 0 to 35 year fire frequency and fires of high severity (more than 75 percent of the dominant overstory replaced) to mixed severity (less than 75 percent of dominant overstory replaced).

Using the analysis process described under the Species Viability section above, table 16 shows that the vegetation quality of Montane/Subalpine Grassland is classified as good. This means it has a low departure and the number, size of habitat areas, or evenness in distribution across the landscape is similar to or only slightly reduced relative to reference conditions. Vegetation structure is trending away from reference conditions due to fire exclusion. Current predicted fire return interval departure is high and trending away from reference conditions. The departures in composition and structure that resulted from fire exclusion include tree encroachment and alterations in the pattern and diversity of vegetation resulting from fire intrusions. The presence of a few invasive species that are ranked high for invasiveness, such as leafy spurge, also represent a departure from reference conditions.

Soils in Montane Grassland are classified as poor, e.g. highly departed, with a trend toward reference. They have low vegetative ground cover, poor species composition and productivity, and show signs of extensive compaction and reduced ability to infiltrate water due to high levels of herbivory from elk, past grazing from livestock, past and current OHV and recreational impacts. In contrast, soils in the Subalpine Grassland subtype have more extensive vegetative ground cover, good species composition and plant productivity, and porous soils with high amounts of organic matter. They are in satisfactory soil condition with low departure and static trend.

Table 16 shows that there is a moderate likelihood that Montane/Subalpine Grassland habitat could be limiting to the associated species. The likelihood that habitat would be limiting to the associated species was derived by combining the value for habitat abundance with the value for vegetation quality. Vegetation quality was used instead of soil quality because vegetation is assumed to respond faster than soil to treatments or disturbances, and thus, would better reflect differences between alternatives.

Table 16. Summary of coarse filter analysis for Montane/Subalpine Grassland ERU

Habitat	Existing	Alternative A	Alternatives B (modified), C, and D	Associated Species
Abundance	Occasional	Occasional		Black-footed ferret, Western burrowing owl, Arizona sneezeweed, Rusby's milkvetch, ferruginous hawk, Alberta arctic, Gunnison's prairie dog, pronghorn black dropseed, common moonwort, Hall's milkweed
Quality-Vegetation	Fair, trending away	Good, trending away at short term then Fair, trending away at long term	Good, trending toward	
Quality-Soil	Montane: Poor, trending away Subalpine: Good, static	Montane: Poor, static Subalpine: Good, static	Montane: Poor, trending toward Subalpine: Good, trending toward	
Likelihood of Limitation	Moderate	Low then Moderate	Low	
Management effect		3: Plan components maintain or improve protection and management for some habitat occurrences in the plan area.	2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.	

Table 16 also compares management effect by alternative. Management effect categorizes the relative expected outcome of plan language in each alternative in terms of maintaining habitat quality and is the result of plan decisions, including plan objectives. Management effect category values are 1, 2, 3, and 4. The lower the management effects rating the more effective the alternative is for maintaining the habitat. The effects of the alternatives are explained in greater detail in the discussions on the alternatives that follow.

Risk Factors

Fire exclusion within the ERU and adjacent fire-adapted ERUs. Non-native invasive plant species, such as leafy spurge can alter the natural fire return interval, fire regime, and soil condition, and can compete with native species.

Associated Species

Associated species are listed in table 16.

Environmental Consequences

Analysis related to the risks arising from non-native invasive plant species are addressed under the Non-native or Invasive Species topic in the Wildlife and Plant Issues and Topics section above.

Common to All Alternatives

Plan components in all alternatives contribute to species viability by managing habitat to maintain viable and sustainable populations of wildlife and fish species and by improving and protecting

habitat for threatened, endangered, and sensitive species (1987 Plan, pages 22-1, 23; FW-Eco-DC-1; FW-WFP-DC-1, 2, 3, 5, 6, 8; FW-WFP-G-3, 10). See At-risk Species in the Wildlife and Plant Issues and Topics section above for more information.

All alternatives address the threat of invasive plants. Invasive plants can increase as a consequence of ground disturbance and, once established, would compete with native species for water and nutrients or could alter the fire regime. All alternatives address the threat of invasive plants by pointing to the Final Environmental Impact Statement for the Treatment of Noxious or Invasive Weeds (USDA Forest Service 2005). This direction includes best management practices, among other guidance, which would help prevent, mitigate, and reduce the threat of invasive plants. All alternatives prioritize treatments, call for incorporating control measures in project planning and implementation, and emphasize coordination with partners (1987 Plan, pages 23, 69, 70, 182, 206-14, 206-76, 206-101, 201-116; FW-Invas-DC-1, 2; FW Invas-G-1, 2, -3; FW-Invas-MgtApp; FW-Graz-MgtApp; FW-RdsFac-G-8; FW-Rec-Dev-DC-9; FW-Rec-Dev-G-2). Additional information and analysis is discussed under the Non-native or Invasive Species topic in the Wildlife and Plant Topics and Issues section.

Almost 3 percent of the ERU is in designated wilderness. Designated wilderness areas would be managed according to applicable laws, policy, and Forest Plan direction to preserve wilderness resource values and wilderness quality, and to emphasize wilderness recreation (1987 Plan, pages 105 to 112; SA-Wild-DC-1 to 11; SA-Wild-S-1, 2; SA-Wild-G-1 to 7). Wilderness designation limits most active vegetation management because motorized and mechanized use is not allowed. Motorized and mechanized access can kill or damage plants, can degrade the habitat through soil compaction and soil loss, and can introduce non-native species that compete with native plants for resources. This can negatively affect the reproduction and survival of individual plants or populations. Ground-disturbing activities are primarily confined to main trails, trailheads, and key points of interest at which invasive species introduction and establishment, or accelerated erosion could occur depending on the level of use. The lack of ground-disturbing activities elsewhere would be beneficial by reducing the risk of invasive plant introduction and dispersal by motorized or mechanized use. However, limited access associated with designated wilderness could preclude restoration treatments that require motorized equipment for treatments or safety, or make them harder to do logistically. Lack of restoration treatments could result in missed fire return intervals, increased and unnatural levels of fuels, increased density of shrubs and trees, or establishment and spread of invasive or non-native species. This could slow the trend toward desired conditions or increase the risk of uncharacteristic fires in localized areas more so than in the other alternatives. Uncharacteristic fire could facilitate the spread or establishment of invasive or non-native species which could then alter area hydrology, fire regime, and biodiversity.

There are about 176 acres of Montane/Subalpine Grassland ERU in two botanical areas: Mogollon Rim and Fern Mountain. Off-road travel in botanical areas is not allowed in any alternative (1987 Plan, page 194; SA-RNABotGeo-DC-5; SA-RNABotGeo-G-1). New utility corridors would also avoid botanical areas (1987 Plan, page 79; FW-SpecUse-G-10). This would result in less disturbance to soil and plants, in less erosion and soil compaction, and eliminate habitat damage from these activities. Although protective, this would have a negligible effect because less than 1 percent of the ERU occurs within botanical areas.

Alternative A

Using the analysis process described under the Species Viability section above, table 16 shows that under alternative A the vegetation quality of Montane/Subalpine Grassland is classified as

good, which means it has a low departure and the number, size of habitat areas, or evenness in distribution across the landscape is similar to or only slightly reduced relative to desired conditions. However, because fire exclusion would be expected to continue, vegetation quality would transition to fair in the long term and trend away. The continued lack of fire would allow trees and shrubs to further encroach, and there would be a corresponding decline in herbaceous species. Fire return interval is expected to remain moderate and also trend away from desired conditions. Composition, structure, and function are at risk in localized areas due to highly invasive plant species such as leafy spurge.

Soil quality would be poor in the Montane Grassland subtype with a static trend relative to desired conditions. Historic and continued grazing by livestock and wildlife have contributed to areas with reduced surface litter and herbaceous production. Consequently, there is reduced nutrient cycling, reduced ability to infiltrate water, and an inability of the soil to resist erosion in about 69 percent of the ERU with impaired soil conditions. Soil quality is expected to remain unchanged due to continued grazing, especially by elk. Areas that are excluded from grazing would trend toward desired conditions.

Soil quality would be good in the Subalpine Grassland subtype with a static trend relative to desired conditions. Litter, understory, and forage production are expected to remain high.

Initially, there would be a low likelihood that Montane/Subalpine Grassland would be a limiting factor to the associated species, but as time goes on, the likelihood would transition to moderate as trees and shrubs continue to increase. This likelihood was derived by combining the value for habitat abundance with the value for vegetation quality. Vegetation quality was used instead of soil quality because vegetation is assumed to respond faster than soil to treatments or disturbances, and thus, would better reflect differences between alternatives.

The management effect is 3 (table 16) because it lacks plan language for the different grassland types and plan language is outdated. For example there is an emphasis on forage species rather than ecological conditions. Alternative A contributes less to the maintenance and sustainability of Montane/Subalpine Grassland ERU and the viability of the associated species than the other alternatives.

Alternative A does not distinguish between the different grassland types which differ from each other in terms of precipitation patterns, composition, soil types, elevation, and structure. In the older sections of the current plan, guidance for composition is focused on a balanced composition of cool and warm season forage species, but with no emphasis on native species (1987 Plan, page 160). More recently amended sections of the plan, such as in the Flagstaff-Lake Mary Ecosystem Area (FLEA), have a more ecological approach to composition by promoting diverse healthy populations of native plants and animals with a natural variety of plant species, age classes, and structures (1987 Plan, pages 206-72, 78, 97, 98, 100; 206-103; 209-108; 206-114). This guidance is limited to the FLEA analysis area and does not apply forestwide. Alternative A has limited guidance on structure and function; however, there is some guidance related to invasive plants, soil, fire management, water resources, wildlife habitat, and range improvement (1987 Plan, pages 162-165, 206-72, 75 through 78, 206-89). Alternative A provides guidance to maintain and improve grasslands, including removing invading overstory, stabilizing gullies, scarifying soils, appropriate seeding, controlling livestock, raising the water table, reducing road and motorized use impacts, and re-introducing fire (1987 Plan, pages 159, 160, 164, 206-87 to 206-88). There are guidelines regarding relocation, obliteration, or closure of roads that are damaging or could

damage meadows (1987 Plan, pages 206-70, 206-77, 78, 206-116). The current plan also promotes the maintenance of seral grasslands in Management Area 10 and focuses on road and trail maintenance in damaged meadows in the Doney Management Area (1987 Plan, pages 206-93).

Prescribed fire and wildfires managed for resource objectives may be used in Montane/Subalpine Grassland, but there is no provision for using wildfires managed for resource objectives in the wildland-urban interface (1987 Plan, pages 92, 155, and 165) and the language to manage wildfires for resource objectives in wilderness impedes the use of this tool (1987 Plan, pages 111-112). This plan language limits the restoration of fire as a natural process in the WUI and in wilderness, and tree and shrub density would be expected to increase in these areas. There would also be increased potential for uncharacteristic fire in the wildland-urban interface and wilderness portions of this ERU. This is particularly problematic where the landownership pattern is intermixed with different ownerships. Due to the small percentage of Montane/Subalpine Grassland ERU in designated wilderness, restrictions on access that might be needed to conduct vegetative treatments in wilderness would not affect the overall quality of the ERU.

There are 176 acres (less than 1 percent of the ERU) of Montane/Subalpine Grassland in designated botanical areas. Plan components in alternative A are generally protective of the composition, structure, and function of the different vegetation types within botanical areas. For example, existing conditions and natural processes would be maintained; natural events would not be rehabilitated; and off-road driving would be prohibited (1987 Plan, page 194). Visitors should be limited in some areas, depending on carrying capacity, and the uniqueness and ecological condition of these areas should be protected and maintained, including in allotment management plans. In addition, timber harvest and firewood cutting is prohibited (1987 Plan, page 195). Special-use authorizations that would or could adversely affect the areas would not be allowed (1987 Plan, page 196). Adjacent roads would be managed to prevent vehicular intrusion, and road access would be blocked and obliterated (1987 Plan, page 196). Fire suppression tactics would minimize damage to character of the areas and prescribed fire with planned ignitions may be used as a management tool, provided it is a compatible use (1987 Plan, page196). The overall quality of this ERU would not be affected because the percentage of the ERU that overlaps designated botanical areas is small.

There are 9 acres of Montane/Subalpine Grassland in one of the additions to the San Francisco Peaks Research Natural Area. Watershed condition and natural ecological conditions would be emphasized and protected and research natural areas would be assigned no grazing capacity (1987 Plan, pages 194 and 195). Even though this language is protective, the overall effect is negligible because the percentage of the ERU that overlaps the proposed research natural area is less than 1 percent of the ERU.

There are 54 acres of Montane/Subalpine Grassland in environmental study areas (Old Caves Crater and Griffith Springs). The overall quality of this ERU would not be affected because the percentage of the ERU that overlaps the proposed research natural area is less than 1 percent of the ERU. The plan direction for these areas is generally protective. Plan components would reduce the risk of uncharacteristic fire, improve watershed health, restore bare soil areas, reduce soil compaction, close areas to motorized vehicles, and protect unique features using fencing or other means. Areas are not currently open to livestock grazing. Special-use authorizations (new or amendments) that would or could adversely affect the areas would not be allowed. See 1987 Plan, pages 197, 198, and 199.

Alternative B (modified)

Using the analysis process described under the Species Viability section above, table 16 shows that under alternative B (modified) the vegetation quality of Montane/Subalpine Grassland is classified as good with a trend toward desired conditions. This means it has a low departure and the number, size of habitat areas, or evenness in distribution across the landscape is similar to or only slightly reduced relative to desired conditions. Plan objectives would remove closed canopy trees and shrubs at a rate of between 7,600 and 11,400 acres every 10-year period over the life of the plan (FW-TerrERU-Grass-O-3). Consequently, there would be more open conditions, and more herbaceous understory compared to alternative A. The rate of improvement would be faster under the higher treatment objective.

Soil condition and productivity for the Montane Grassland subtype would be poor under alternative B (modified), but there would be a trend toward desired conditions. Treatments would improve soil condition and maintain soil productivity. In treated areas, soil productivity and function would improve, so water infiltrates and disperses properly, withstands accelerated erosion, and recycles nutrients. Herbaceous cover would be improved or maintained at levels that contribute to hydrologic function, soil stability, and nutrient cycling.

Soil quality for the Subalpine Grassland subtype would be good with a trend toward desired conditions.

Montane/Subalpine Grassland ERU has a low likelihood of being limiting to the associated species using vegetation quality. This likelihood was derived by combining the value for habitat abundance with the value for vegetation quality. Vegetation quality was used instead of soil quality because vegetation is assumed to respond faster than soil to treatments or disturbances, and thus, would better reflect differences between alternatives. Alternative B (modified) contributes more to the maintenance and sustainability of Montane/Subalpine Grassland ERU and the viability of the associated species than alternative A.

The management effect is a 2, because alternative B (modified) distinguishes between the different grassland types, has updated language compared to alternative A, and has an objective to restore or enhance this ERU.

Desired conditions in alternative B (modified) have greater potential to reduce ERU departure and move toward desired conditions than alternative A. Desired conditions promote: properly functioning ecosystems that are resilient to natural disturbances and climate change; the reduction of uncharacteristic disturbances; endemic levels of invertebrates (including pollinators) and disease with occasional outbreaks; and a balance of desirable non-native species and subspecies with properly functioning ecosystems (FW-Eco-DC-1 to 4). Desired conditions include a mosaic of vegetation conditions, densities, and structures and various scales that reflect natural disturbance regimes, resilience to disturbances, adaptions to climate variability, connections based on natural patterns, and allowances for inclusions, variability, and ecotones (FW-TerrERU-All-DC-1 to 4).

Unlike alternative A, alternative B (modified) clearly distinguishes between different grassland types. Grassland direction would provide for a variety of native species with varying seral stages in natural patterns of abundance and distribution that support natural disturbances (FW-TerrERU-Grass-DC-1, 2, 3, 4, 6,7, 8). A guideline would require managers to protect or enhance grassland composition, structure, and productivity, and soil function (FW-TerrERU-Grass-G- 2). In

addition, mollisol soils would be managed toward grassland desired conditions in all pinyon juniper ERUs (FW-TerrERU-PJ-G-1).

Plan components in the sections on Scenery, Grazing, and the Long Valley Management Area would also contribute to the maintenance and sustainability of this ERU. Soil function and long-term soil productivity would be additionally protected in the Long Valley Management Area through a guideline that would manage dispersed camping opportunities and motorized recreation outside the vicinity of meadows (MA-LongV-G-1). Evidence of physical impacts to meadows would be confined to specific areas such as road crossings, trail crossings, and access points (FW-Scenic-DC-5). Permanent and temporary road construction and relocation should avoid seasonally wet meadows and montane meadows (FW-RdsFac-G-5). Structural range improvements (such as fences, troughs, earthen stock ponds, and pipelines) should be located, constructed, reconstructed, maintained, and used in a manner consistent with the desired conditions for wet meadows and other sensitive resources (FW-Graz-G-4).

Under this alternative, wildfires may be managed for resource objectives in more areas of the landscape than in alternative A (including wildland-urban interface and wilderness), allowing increased opportunities to move toward desired conditions, reduce the risk of uncharacteristic fire, and restore fire-adapted ecosystems adjacent to grasslands (FW-TerrERU-All-G-2, FW-WUI-DC-4).

In contrast to alternative A, Montane/Subalpine Grassland ERU does not occur in any research natural area in alternative B (modified).

No acres of Montane/Subalpine Grassland ERU occur in recommended wilderness under alternative B (modified).

Alternative C

Alternative C is the same as alternative B (modified) except for recommended wilderness. In addition to the 628 acres of Montane/Subalpine ERU in designated wilderness, there are an additional 6 acres of this ERU in the Railroad Draw recommended wilderness. Collectively, this is about 2.6 percent of the ERU on the forest. Impacts to the ERU from wilderness recommendation and the combination of designated wilderness plus recommended wilderness are unlikely to affect the ERU at the landscape level because of the small proportion affected. Plan components for recommended wilderness are generally protective. Recommended wilderness would be managed to maintain or enhance primitive and undeveloped characteristics; to preserve native species and unique features; to reduce evidence of modern human control and manipulations; and motor vehicle uses should only occur for limited administrative and permitted activities to be consistent with wilderness character (FW-RWild-DC-1, 2, 3, FW-RWild-G-3). Needed treatments could be conducted using motorized equipment until a wilderness designation decision is made, providing the treatments are consistent with wilderness character. If designated by Congress, the wilderness areas would be managed according to applicable laws, policy, and Forest Plan direction (see Common to All Alternatives above).

Alternative D

Alternative D would have the same effects related to Montane/Subalpine Grassland as alternative B (modified).

Pinyon Juniper All

There are three pinyon juniper ERUs on Coconino NF: Pinyon Juniper with Grass (includes Juniper with Grass), Pinyon Juniper Evergreen Shrub, and Pinyon Juniper Woodland (also called Pinyon Juniper (persistent). Pinyon juniper ERUs are dominated by one or more species of pinyon pine and/or juniper, and can occur with a grass and forb-dominated understory (i.e., Pinyon Juniper with Grass ERU), a shrub-dominated understory (i.e., Pinyon Juniper Evergreen Shrub ERU), or a sparse discontinuous understory of some grasses and/or shrubs (i.e., Pinyon Juniper Woodland ERU). Pinyon pine (including two-needle pinyon and single-leaf pinyon) is common as well as one-seed, Utah, redberry, Rocky Mountain, and alligator juniper and a lesser abundance of oaks. Species composition and stand structure vary by location primarily due to precipitation, elevation, topography, temperature, and soil type. In some locations, grassland soil types are interspersed with Pinyon Juniper soil types. Spreading, low-intensity surface fires had a very limited role in molding stand structure and dynamics of many or most pinyon and juniper communities in the historical landscape. However, where tree density is sparse and grass cover is significant, the Pinyon Juniper with Grass ERU may be an exception.

Risk Factors

Pinyon juniper forests throughout the Southwest continue to incur increased mortality as a result of drought and bark beetle activity (Breshears et al. 2005, USDA Forest Service 2015a). Pinyon juniper forests are water-limited systems, and pinyon juniper ecotones are sensitive to feedbacks from environmental fluctuations and existing canopy structure that may provide trees a buffer against drought. Severe multi-year droughts periodically cause dieback of pinyon pines, which may overwhelm local buffering (USDA Forest Service 2010a). The recent dieback is historically unprecedented in its combination of fire suppression, low precipitation, and high temperatures. Increased drought stress via higher temperatures is the predisposing factor, and pinyon pine mortality and fuel accumulations are inciting factors. These factors can lead to large severe fires that in turn lead to colonization of invasive species, which further compromises the ability of pinyon pines to re-establish (USDA Forest Service 2010a). Both localized and widespread mortality events have occurred over time in the pinyon juniper forests on the forest, typically being pinyon Ips outbreaks associated with periods of drought, such as occurred in the mid-1990s and 2001–2003 (Lynch et al. 2007). Bark beetles are natural disturbance agents and exist in the environment at endemic levels, but occasional eruptions can lead to high mortality in areas.

Pinyon Juniper with Grass

Affected Environment

Amount

There are about 270,624 acres of Pinyon Juniper with Grass ERU within the forest boundary; it is the third largest ERU on the forest. About 261,454 acres (97 percent) of this ERU is managed by the Coconino NF. The portion not managed by the forest is primarily private with a small amount of State ownership.

Table 17 summarizes the information used to estimate the likelihood that Pinyon Juniper with Grass ERU would be limiting factor to the viability of the associated species. The abundance is categorized as Common because at 261,454 acres, it occupies about 14 percent of the forest. Habitats classified as Common generally cover over 10 percent of the forest, and are abundant and frequently encountered.

Habitat Quality and Distribution

Pinyon Juniper with Grass ERU generally occurs between 5,000 and 8,300 feet in upland and valley settings or where local conditions are inherently favorable for grasses. It is often found on moderately deep soils with gentle topography. Tree species includes: pinyon pine and Utah and one-seed juniper (which are most common) and alligator juniper at higher elevations. Its understory consists of annual and perennial grasses (with forbs) including: blue grama, needle and thread grass, and western wheatgrass. Shrubs may be present, but they are a minor component. Pinyon Juniper with Grass is characterized by low-severity to mixed-severity fire that occurs every 0 to 35 years.

About 4,184 acres (about 2 percent) of this ERU are in the Strawberry Crater wilderness. There are about 1,152 acres of Pinyon Juniper with Grass in the Red Mountain Geological Area and 64 acres in the Old Caves Crater Environmental Study Area.

Using the analysis process described under the Species Viability section above, table 17 shows that the vegetation quality of Pinyon Juniper with Grass is classified as fair. This means it has a moderate departure from reference conditions and the number, size of habitat areas, or evenness in distribution across the landscape is somewhat reduced relative to reference conditions. Vegetation quality is trending away from reference conditions, because there are currently more trees per acre and greater cover due to fire exclusion and weather patterns that have favored tree germination and establishment. As a result, understory abundance and diversity has decreased, decreasing the potential for surface fires. Fire exclusion has also altered structural stage; stand age; canopy cover; mosaic pattern; fuel composition; and fire frequency, severity, and pattern. Areas that have been affected by the Ips bark beetle infestation over the past decade, however, are expected to trend toward reference conditions.

Part of this ERU consists of soils with significant quantities of calcium carbonate and commonly have a pH of 8 or more (TES soil units 437 and 460). Soil unit 437 is derived from limestone parent material while soil unit 460 is derived from basalt. Soil disturbance in soil units 437 and 460 could bring excessive amounts of calcareous soil to the surface. Soil unit 437 also has shallow soils and a high amount of surface rock fragments. Soil conditions in these soil types are assumed to be the same as in the rest of the ERU. Soil quality is good and it is trending away from reference conditions. Most of Pinyon Juniper with Grass ERU has satisfactory or satisfactory, but inherently unstable soil conditions, and so are functioning normally. About 28,512 acres (nearly 11 percent) have unsatisfactory soil conditions and 45,106 acres (about 17 percent) have impaired soil conditions. Lack of fire has contributed to the development of areas with high canopy cover and loss of herbaceous understory. Herbaceous understory helps hold soil in place and carries fire. Current litter and plant cover is low, species composition is poor, and visual sheet and rill erosion are common in areas with high tree density. There is declined nutrient cycling, reduced ability to infiltrate water, and an inability of soil to resist erosion in about 28 percent of the ERU with impaired or unsatisfactory soil conditions especially where the canopy is more than about 30 to 40 percent. Some areas are eroding faster than they are renewing themselves, putting soil productivity at risk. It takes dozens of years to build one inch of soil in this ERU. The areas with low productivity are associated with unsatisfactory and impaired soils.

Table 17 shows that there is a low-moderate likelihood that Pinyon Juniper with Grass habitat could be limiting to the associated species. The likelihood that habitat would be limiting to the associated species was derived by combining the value for habitat abundance with the value for

vegetation quality. Vegetation quality was used instead of soil quality because vegetation is assumed to respond faster than soil to treatments or disturbances, and thus, would better reflect differences between alternatives.

Table 17. Summary of coarse filter analysis for Pinyon Juniper with Grass

Habitat	Existing	Alternative A	Alternatives B (modified), C, and D	Associated Species
Abundance	Common	Common		Black-footed ferret, western burrowing owl, disturbed rabbitbrush, Mt. Dellenbaugh sandwort, Sunset Crater beardtongue pinyon jay, Gunnison's prairie dog, black dropseed, Jones' wild buckwheat, Yavapai wild buckwheat
Quality-Vegetation	Fair, trending away	Fair, trending toward, but trends away in long term	Fair, trending toward then trends away (low objective) or static (high objective) in long term	
Quality-Soil	Good, trending away	Good, static		
Likelihood of Limitation	Low-Moderate	Low-Moderate		
Management effect		3: Plan components maintain or improve protection and management for some habitat occurrences in the plan area.	2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.	

Table 17 also compares management effect by alternative. Management effect categorizes the relative expected outcome of plan language in each alternative in terms of maintaining habitat quality and is the result of plan decisions, including plan objectives. Management effect category values are 1, 2, 3, and 4. The lower the management effects rating, the more effective the alternative is for maintaining the habitat. The effects of the alternatives are explained in greater detail in the discussions on the alternatives that follow.

Risk Factors

Non-native invasive plant species, such as annual grasses can alter the natural fire return interval and fire regime.

Associated Species

Associated species are listed in table 17.

Environmental Consequences

Analysis related to the risks arising from non-native invasive plant species is addressed under the Non-native or Invasive Species topic above in the Wildlife and Plant Issues and Topics section.

Common to All Alternatives

Plan components in all alternatives contribute to species viability by managing habitat to maintain viable and sustainable populations of wildlife and fish species and by improving and protecting habitat for threatened, endangered, and sensitive species (1987 Plan, pages 22-1, 23; FW-Eco-DC-1; FW-WFP-DC-1, 2, 3, 5, 6, 8; FW-WFP-G-3, 10). See At-risk Species in the Wildlife and Plant Issues and Topics section above for more information.

All alternatives address the threat of invasive plants. Invasive plants can increase as a consequence of ground disturbance and, once established, would compete with native species for water and nutrients or could alter the fire regime. All alternatives address the threat of invasive plants by pointing to the Final Environmental Impact Statement for the Treatment of Noxious or Invasive Weeds (USDA Forest Service 2005). This direction includes best management practices, among other guidance, which would help prevent, mitigate, and reduce the threat of invasive plants. All alternatives prioritize treatments, call for incorporating control measures in project planning and implementation, and emphasize coordination with partners (1987 Plan, pages 23, 69, 70, 182, 206-14, 206-76, 206-101, 201-116; FW-Invas-DC-1, 2, 3; FW Invas-G-1, 2, 3: FW-Invas-MgtApp; FW-WFP-DC-10; FW-Graz-MgtApp; FW-RdsFac-G-8; FW-Rec-Dev-DC-9; FW-Rec-Dev-G-2; FW-TerrERU-Grass-DC-2). Additional information and analysis is discussed under the Non-native or Invasive Species topic in the Wildlife and Plant Topics and Issues section.

About 2 percent of Pinyon Juniper with Grass ERU occurs in the Strawberry Crater Wilderness. Designated wilderness areas would be managed according to applicable laws, policy, and Forest Plan direction to preserve wilderness resource values and wilderness quality, and to emphasize wilderness recreation (1987 Plan, pages 105-112; SA-Wild-DC-1 to 11; SA-Wild-S-1, 2; SA-Wild-G-1 to 7). Wilderness designation limits most active vegetation management because motorized use and mechanized use is not allowed. Motorized and mechanized access can kill or damage plants, can degrade the habitat through soil compaction and soil loss, and can introduce non-native species that compete with native plants for resources. This can negatively affect the reproduction and survival of individual plants or populations. Ground-disturbing activities are primarily confined to main trails, trailheads, and key points of interest at which invasive species introduction and establishment, or accelerated erosion could occur, depending on the level of use. The lack of ground-disturbing activities elsewhere would be beneficial by reducing the risk of invasive plant introduction and dispersal by motorized or mechanized use. However, limited access associated with designated wilderness could preclude restoration treatments that require motorized equipment for treatments or for safety or make them harder to do logistically. Lack of restoration treatments could result in missed fire return intervals, increased and unnatural levels of fuels, increased density of shrubs and trees, or establishment and spread of invasive or non-native species. This could slow the trend toward desired conditions or increase the risk of uncharacteristic fires in localized areas more so than in the other alternatives. Uncharacteristic fire could facilitate the spread or establishment of invasive or non-native species that could then alter area hydrology, fire regime, and biodiversity.

Alternative A

Using the analysis process described under the Species Viability section above, table 17 shows that under alternative A, the vegetation quality of Pinyon Juniper with Grass is classified as fair, which means it has a moderate departure from desired conditions and the number, size, and evenness of distribution of habitat areas across the landscape is somewhat reduced. Under the plan direction in alternative A, vegetation quality is initially expected to trend toward desired conditions, but in the long term would trend away from desired conditions. Expected mechanical treatments and burning using wildfire for resource objectives would result in a trend toward desired conditions initially. Vegetation modeling suggests there would be a lower proportion of large trees in open condition, and a lower proportion of uneven-aged open habitat than desired over the long term. Understory vegetation is expected to decrease in distribution and diversity as crown cover increases. Less sunlight would reach the forest floor, and availability of water and nutrients to understory plants would decline as tree cover increase. Conditions that favor a diverse

and robust understory would decline because generally the treatment level is insufficient to offset the negative effects of excess regeneration and closing canopies in the long term. Fire return interval is expected to remain moderately departed with a trend away from the desired conditions.

Soil condition and productivity would remain good with a static trend relative to desired conditions at both the low and high expected treatment levels. In thinned areas, soil condition should move toward desired condition with the return of an herbaceous understory. In areas that need treatment but are not thinned, soil condition is projected to move slowly away from desired conditions.

There is a low-moderate likelihood that Pinyon Juniper with Grass could be a limiting factor to the viability of the associated species. This likelihood was derived by combining the value for habitat abundance with the value for vegetation quality. Vegetation quality was used instead of soil quality, because vegetation is assumed to respond faster than soil to treatments or disturbances, and thus, would better reflect differences between alternatives.

The management effect is a 3, because alternative A does not distinguish between the three pinyon juniper types that occur on the forest that differ in composition, structure, and processes. Alternative A contributes less to the maintenance and sustainability of Pinyon Juniper with Grass and the viability of the associated species than the other alternatives.

The Plan provides little explicit direction on desired conditions for this ERU as it is lumped into the broad vegetation category of Pinyon Juniper, which is divided into two management areas based on slope. Plan language emphasizes the use of prescribed fire and mechanical treatments to achieve management objectives associated with range, watershed condition, and wildlife habitat (1987 Plan, pages 148 to 155, 162 to 165). There is an emphasis on prescribed burning and individual tree removal to achieve range improvements (1987 Plan, page 164) as well as mechanical treatment of vegetation, emphasizing sustained-yield for firewood and miscellaneous convertible products (1987 Plan, pages 148, 169).

Direction in the current Forest Plan is generally outdated. Different management objectives occur for slopes greater than 15 percent and slopes less than 15 percent. For example, old growth, cover, and snags are generally provided on slopes greater than 15 percent, while mechanical treatment should be managed on slopes less than 15 percent (1987 Plan, page 148). The recommended silvicultural systems provide sufficient flexibility to move toward desired conditions; however, the direction to manage cover in Pinyon Juniper with Grass would leave too much canopy cover across the landscape to return to the desired grassland state of this ERU.

Although prescribed fire and wildfires managed for resource objectives may be used in Pinyon Juniper with Grass ERU, there is no provision for using wildfires managed for resource objectives in the wildland-urban interface (1987 Plan, pages 92, 155, 165) and the language to manage wildfires for resource objectives in wilderness impedes the use of this tool (1987 Plan, pages 111, 112). This plan language limits the restoration of fire as a natural process in the wildland-urban interface and in wilderness, and canopy cover and tree density would be expected to increase in these areas. There would also be increased potential for uncharacteristic fire in the wildland-urban interface and wilderness portions of this ERU. This is particularly problematic where the landownership pattern is intermixed with different ownerships. This is a negative impact on the composition and age class distribution of Pinyon Juniper with Grass.

Plan components in alternative A are generally protective of the composition, structure, and function of the different vegetation types within geological areas. For example, existing conditions and natural processes would be maintained; natural events would not be rehabilitated; and off-road driving would be prohibited (1987 Plan, page 194). Visitors should be limited in some areas depending on carrying capacity and the uniqueness and ecological condition of these areas should be protected and maintained, including in allotment management plans. In addition, timber harvest and firewood cutting is prohibited (1987 Plan, page 195). Other protective measures include: Special-use authorizations that would or could adversely affect the areas would not be allowed; adjacent roads would be managed to prevent vehicular intrusion, and road access would be blocked and obliterated. Fire suppression tactics would minimize damage to character of the areas, and prescribed fire with planned ignitions may be used as a management tool provided it is a compatible use (1987 Plan, page 196). Collectively, these standards and guidelines mitigate the soil disturbance and plant damage that can result from these activities and maintain the conditions and characteristics for which this geological area was established.

The plan direction for environmental study areas is generally protective. Improvements at Old Caves Crater would improve watershed health, restore bare soil areas, and close the area to motorized vehicles. Environmental study areas are not currently open to livestock grazing and special-use authorizations that would or could adversely affect the areas would not be allowed (1987 Plan, page 199).

Alternative B (modified)

Using the analysis process described under the Species Viability section above, table 17 shows that vegetation quality would be fair, the same as alternative A, under the low and high treatment objectives (FW-TerrERU-PJ-O-1, 2). Under both treatment objectives, the trend initially moves toward desired conditions, but in the long term either remains nearly static or slowly moves away from desired conditions. The first objective would mechanically treat between 1,000 to 10,000 acres of Pinyon Juniper with Grass during each 10-year period over the life of the plan. The second objective would use naturally ignited fires to treat at least 3,750 acres of Pinyon Juniper with Grass within the natural fire regime during each 10-year period over the life of the plan. Under this alternative, wildfires may be managed for resource objectives in more areas of the landscape (including wildland-urban interface and wilderness) than in alternative A, allowing increased opportunities to reduce the risk of uncharacteristic fire and to restore fire-adapted ecosystems (FW-TerrERU-All-G-2; FW-WUI-DC-4). Modeling predicts that medium-sized trees with open canopies would increase and move toward the desired conditions (especially at the high treatment level) in the short and long term. In other size classes, seedlings/saplings, small trees, and very large trees with open canopies would approach desired conditions in the short term, but drop below desired conditions in the long term. This is because treatments at these levels would not maintain the desired open conditions as canopy cover and competition increased. The understory is predicted to increase in the short term, but decrease over time as tree growth and tree establishment exceed the treated acres.

Soil condition and productivity would remain good with a static trend relative to desired conditions at both the low and high expected treatment levels. In thinned areas, soil condition should move toward desired condition (with a faster rate at the higher treatment level) with the return of an herbaceous understory. Over time, regeneration could fill in the openings, canopies could close, the understory would decrease and gains to soil condition and productivity could decrease. In areas that need treatment, but are not thinned, soil condition is projected to move slowly away from desired conditions.

There is a low-moderate likelihood that Pinyon Juniper with Grass could be a limiting factor to the viability of the associated species. This likelihood was derived by combining the value for habitat abundance with the value for vegetation quality. Vegetation quality was used instead of soil quality because vegetation is assumed to respond faster than soil to treatments or disturbances, and thus, would better reflect differences between alternatives.

The management effect would be a 2, which means that plan components in alternative B (modified) maintain or improve protection and management for most habitat occurrences in the plan area, and thus, contribute more to the maintenance and sustainability of Pinyon Juniper with Grass and the viability of the associated species than alternative A.

Unlike alternative A, this alternative updates pinyon juniper management by identifying three ERUs in the pinyon juniper forest type: Pinyon Juniper with Grass, Pinyon Juniper Evergreen Shrub, and Pinyon Juniper Woodland. ERU-specific plan components provide more explicit information for managers. A one-size-fits-all approach for pinyon juniper would not be appropriate, because the pinyon juniper ERUs differ in terms of species composition, structure, and fire regime.

Implementation of desired conditions would result in structure and species composition that both reflect and support natural disturbance regimes. Scattered shrubs and an herbaceous understory consisting of native grasses, forbs, and annuals would support frequent surface fires. Plant composition would be similar to site potential at the landscape level, yet could vary considerably at the fine and mid-scale in response to differing seral stages (FW-TerrERU-PJ-DC-3, 4). Mollisol soils would be managed toward grassland desired conditions, which would stay within the natural potential of the site and provide spatial heterogeneity and increased biodiversity within the ERU (FW-TerrERU-PJ-G-1)

Pinyon Juniper with Grass would be generally uneven-aged and open, with varying age and size classes of trees distributed in groups, clumps, and individual trees (FW-TerrERU-PJ-DC-1). Old-growth components and structure would occur throughout the landscape as individual components or as clumps. They would shift in time and space as a result of succession and tree growth and mortality. Habitat and food for wildlife and their prey would be provided by snags 8 inches and greater at diameter at root collar that would average five snags per acre and by snags 18 inches and greater that would average one snag per acre (FW-TerrERU-PJ-DC-2, 5). To further assure the distribution and sustainability of old-growth forest components, the development of old growth would be encouraged in areas where it is lacking (FW-TerrERU-PJ-G-5).

Coarse woody debris would increase with succession and average 1 to 3 tons per acre. Plan components promote the retention of slash piles across the landscape for several years instead of being immediately burned where coarse woody debris is deficient. This would provide cover for various species of wildlife. However, scenic integrity objectives, bark beetles, big game movements, and fire and fuel concerns would be factors when considering the number and distribution of slash piles or scattered slash to be retained (FW-TerrERU-PJ-DC-2; FW-TerrERU-PJ-G-4). Slash treatments would be used to improve herbaceous vegetation, watershed condition, and soil productivity in areas where there is little overstory. However, large accumulation of green material would be managed to reduce the risk of uncharacteristic bark beetle outbreaks (FW-TerrERU-PJ-G-2, 3). Coarse woody debris provides microsites for establishment of native vegetation, provides food and cover for a variety of wildlife species, is critical for soil

productivity and nutrient cycling, and important for soil condition and preventing accelerated soil erosion.

Under this alternative, wildfires may be managed for resource objectives in more areas of the landscape than in alternative A (including wildland-urban interface and wilderness) allowing increased opportunities to reduce the risk of uncharacteristic fire and to restore fire-adapted ecosystems (FW-TerrERU-All-G-2; FW-WUI-DC-4).

Overarching management direction would promote properly functioning ecosystems that are resilient to natural disturbances and climate change; promote characteristic disturbances and reduce the threat of uncharacteristic disturbances; and promote balance between desirable non-native species and subspecies and properly functioning ecosystems, thereby furthering sustainability and adaptability (FW-Eco-DC-1 to 4; FW-TerrERU-All-DC-2).

Under this alternative, the Pinyon Juniper with Grass ERU would have approximately 3,618 acres included as part of the recommended Strawberry Crater wilderness, which is small fraction (1.4 percent) of the total ERU. While policy and forest plan direction for managing wilderness areas in alternative B (modified) make mechanical treatments unlikely to occur, the cinder soil type within these locations and lack of understory vegetation make wildfires less likely. Taken in combination, the relatively small area and the low likelihood of wildfire suggest that the recommended wilderness area would have little effect on vegetation or fire return interval departure. The recommended wilderness is within the known range of the endemic plant Sunset Crater beardtongue. The primitive setting benefits a variety of species and cultural resources. This would include the increased protection of Sunset Crater beardtongue (*Penstemon clutei*), a Southwestern Region sensitive species. Pronghorn would also benefit from reduced disturbance as a result of the primitive surroundings.

This ERU occurs within eight management areas. The largest is the Anderson Mesa Management Area that comprises approximately 50 percent of the ERU. The desired conditions in this management area provide for the needs of wildlife, such as antelope, by providing open areas and grasslands that allow them to move freely across the landscape (MA-AMesa-DC-3) and minimizing roads and trails (MA-AMesaDC-1).

The second largest management area in the Pinyon Juniper with Grass ERU is the Volcanic Woodlands, comprising about 38 percent of the area. One of the desired conditions for this area is for large tracts of unroaded landscape in the Deadman Wash to provide remote recreational experience and to benefit disturbance sensitive species (MA-VolcanWd-DC-4). This would reduce ground-disturbing activities in this area, help maintain soil condition and productivity, and reduce the potential for accelerated soil erosion that could occur in response to motorized use.

There are 1,152 acres of Pinyon Juniper with Grass in the Red Mountain geological area. Plan language in alternative B (modified) promotes protection and maintenance of the unique characteristics of geological areas and sustainability of their inherent physical and biological processes that are not negatively impacted from human activities or permitted uses (SA-RNABotGeo-DC-6; SA-RNABotGeo-G-1). Fires and allotment management plans would be protective of the resources for which these areas were designated (SA-RNABotGeo-G-3, 4).

Unlike alternative A, mechanized use in botanical and geological areas is not suitable, except mechanized travel would be suitable on routes designated for mechanized travel. This plan language is intended to limit soil and vegetation impacts to the trail prism (see Chapter 4

Recreation and Transportation Suitability). Subsequent environmental analysis would need to be done for this direction to take effect. The overall quality of this ERU would not be affected because the percentage of the ERU that overlaps designated geological areas is small, however, the plan language is protective.

There are 64 acres of Pinyon Juniper with Grass in the Old Caves Crater environmental study area. The plan direction for these areas is generally protective. For example, management activities and new special uses (and amendments) would be designed to retain and promote the character of these areas and to promote educational opportunities (MA-FlagN-G-1). New transmission corridors would avoid environmental study areas to protect the settings and educational resources (MA-FlagN-G-2), and educational opportunities would be consistent with resource desired conditions as well (MA-FlagN-DC-7). The overall quality of this ERU would not be affected by this management direction, because the percentage of the ERU that overlaps the environmental study area is less than 1 percent of the ERU.

Alternative C

Alternative C would have the same consequences as alternative B (modified), except mechanized use in botanical and geological areas would be not suitable. This plan language would remove soil and vegetation impacts to the trail prism from mechanized uses but foot traffic and horseback use could still be permissible. Subsequent environmental analysis would need to be done for this direction to take effect. Although the plan language is the most protective of the four alternatives and conditions could be improved in localized areas, the overall quality of this ERU would not be affected because the percentage of the ERU that overlaps designated botanical areas is small.

Even though alternative C includes more total acres of recommended wilderness, the amount of Pinyon Juniper with Grass ERU in recommended wilderness is the same as alternative B (modified).

Alternative D

Alternative D would have the same consequences as alternative B (modified). There are no recommended wildernesses. In alternative D, the recommended wilderness areas of alternative B (modified) would be guided by applicable forestwide or management area plan direction rather than plan components relating to recommended wilderness.

Pinyon Juniper Evergreen Shrub

Affected Environment

Amount

There are about 271,347 acres of Pinyon-Juniper Evergreen Shrub ERU within the forest boundary; it is the second largest ERU on the forest. The Coconino NF manages about 263,554 acres (97 percent) of these acres. The portion that is not managed by the forest is mainly private.

Table 18 summarizes the information used to estimate the likelihood that Pinyon Juniper Evergreen Shrub ERU would be limiting factor to the viability of the associated species. The abundance is categorized as Common because at 271,347 acres it occupies 14 percent of the forest. Habitats classified as Common generally cover over 10 percent of the forest and are abundant and frequently encountered.

Habitat Quality and Distribution

This ERU usually occurs at elevations between 4,000 and 6,900 feet. It usually occupies hills, plains, mountains, and escarpments below the Mogollon Rim. This ERU is dominated by open to closed shrub canopy of evergreen oaks, such as turbinella oak, some tree forms of Emory and Arizona white oak, and Stansbury cliffrose. Codominant species include single-needle pinyon pine and Utah juniper, and some areas contain alligator juniper and Arizona cypress. A grassy understory may be present in areas with decreased tree cover, and herbaceous ground cover is dominated by warm season grasses including blue and side oats grama and needle and thread grass. Pinyon-Juniper Evergreen Shrub is characterized by mixed-severity fire that occurs every 35 to 200+ years.

Portions of this ERU are located in the Verde Valley, which has the highest density of archaeological sites (including prehistoric agricultural fields) on the forest. Certain agave species were cultivated by pre-Columbian farmers dating to at least A.D. 600 and probably were exchanged and moved along prehistoric trade routes (Hodgson 1999). Some of these agaves persist in this ERU and are associated with archaeological sites.

There are 47,893 acres (about 18 percent of the ERU) within seven designated wildernesses: Fossil Springs (5,329 acres), Mazatzal (2,106 acres), Munds Mountain (10,554 acres), Red Rock-Secret Mountain (10,394 acres), Sycamore Canyon (5,094 acres), West Clear Creek (8,652 acres), and Wet Beaver (5,763 acres).

There are about 602 acres (less than 1 percent) of this ERU in the Casner Canyon Research Natural Area.

Using the analysis process described under the Species Viability section above, table 18 shows that the vegetation quality of Pinyon Juniper with Grass is classified as fair. This means it has a moderate departure from reference conditions and the number, size of habitat areas, or evenness in distribution across the landscape is somewhat reduced relative to reference conditions. In reference conditions, Pinyon-Juniper Evergreen Shrub was dominated by shrubs and medium to very large open, grown trees, and invasive exotic species were not present. Vegetation quality is considered fair because there are currently more closed tree canopies and less herbaceous vegetation than what was present historically. This is due to fire exclusion. The fire return interval departure is high and trending away from reference conditions. There are a few invasive weed species but these are few in number and acreage.

Soil quality is fair and trending away from reference conditions.

Table 18 shows that there is a low-moderate likelihood that Pinyon Juniper Evergreen Shrub habitat could be limiting to the associated species. The likelihood that habitat would be limiting to the associated species was derived by combining the value for habitat abundance with the value for vegetation quality. Vegetation quality was used instead of soil quality because vegetation is assumed to respond faster than soil to treatments or disturbances, and thus, would better reflect differences between alternatives.

Table 18. Summary of coarse filter analysis for Pinyon Juniper Evergreen Shrub by alternative

Habitat	Existing	Alternative A	Alternatives B (modified), C, and D	Associated Species
Abundance	Common	Common		Flagstaff beardtongue, Phillip's (Grand Canyon) agave, Metcalfe's tick trefoil, Mt. Dellenbaugh sandwort, Page Springs agave, Rusby's milkwort, Tonto Basin agave, Verde Valley sage, pinyon jay, basin bladderpod, black dropseed, MacDougal's aletes Mearn's lotus, skunk-top scurfpea, western mousetail
Quality-Vegetation	Fair, trending away	Fair, trending away		
Quality-Soil	Fair, trending away	Fair, trending away	Poor, trending slowly toward desired conditions	
Likelihood of Limitation	Low-Moderate	Low-Moderate		
Management effect		3: Plan components maintain or improve protection and management for some habitat occurrences in the plan area.	2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.	

Table 18 also compares management effect by alternative. Management effect categorizes the relative expected outcome of plan language in each alternative in terms of maintaining habitat quality and is the result of plan decisions, including plan objectives. Management effect category values are 1, 2, 3, and 4. The lower the management effects rating, the more effective the alternative is for maintaining the habitat. The effects of the alternatives are explained in greater detail in the discussions on the alternatives that follow.

Risk Factors

Fire exclusion and non-native invasive plant species.

Associated Species

Associated species are listed in table 18.

Environmental Consequences

Analysis related to the risks arising from non-native invasive plant species are addressed in the Non-native or Invasive Species topic in the Wildlife and Plant Issues and Topics section.

Common to All Alternatives

Plan components in all alternatives contribute to species viability by managing habitat to maintain viable and sustainable populations of wildlife and fish species and by improving and protecting habitat for threatened, endangered, and sensitive species (1987 Plan, pages 22-1, 23; FW-Eco-DC-1; FW-WFP-DC-1, 2, 3, 5, 6, 8; FW-WFP-G-3, 10). See At-risk Species in the Wildlife and Plant Issues and Topics section above for more information.

All alternatives address the threat of invasive plants. Invasive plants can increase as a consequence of ground disturbance and, once established, would compete with native species for water and nutrients or could alter the fire regime. All alternatives address the threat of invasive plants by pointing to the Final Environmental Impact Statement for the Treatment of Noxious or

Invasive Weeds (USDA Forest Service 2005). This direction includes best management practices, among other guidance, which would help prevent, mitigate, and reduce the threat of invasive plants. All alternatives prioritize treatments, call for incorporating control measures in project planning and implementation, and emphasize coordination with partners (1987 Plan, pages 23, 69, 70, 182, 206-14, 206-76, 206-101, 201-116; FW-Invas-DC-1, 2; FW Invas-G-1, 2, -3; FW-Invas-MgtApp; FW-Graz-MgtApp; FW-RdsFac-G-8; FW-Rec-Dev-DC-9; FW-Rec-Dev-G-2). Additional information and analysis is discussed under the Non-native or Invasive Species topic in the Wildlife and Plant Topics and Issues section.

About 18 percent of the ERU is in designated wilderness. Designated wilderness areas would be managed according to applicable laws, policy and Forest Plan direction to preserve wilderness resource values and wilderness quality, and to emphasize wilderness recreation (1987 Plan, pages 105 to 112; SA-Wild-DC-1 to 11; SA-Wild-S-1, 2; SA-Wild-G-1 to 7). Wilderness designation limits most active vegetation management because motorized use and mechanized use is not allowed. Motorized and mechanized access can kill or damage plants, can degrade the habitat through soil compaction and soil loss, and can introduce non-native species that compete with native plants for resources. This can negatively affect the reproduction and survival of individual plants or populations. Ground-disturbing activities are primarily confined to main trails, trailheads, and key points of interest at which invasive species introduction and establishment, or accelerated erosion could occur depending on the level of use. The lack of ground-disturbing activities elsewhere would be beneficial by reducing the risk of invasive plant introduction and dispersal by motorized or mechanized use. However, limited access associated with designated wilderness could preclude restoration treatments that require motorized equipment for treatments or safety, or make them harder to do logistically. Lack of restoration treatments could result in missed fire return intervals, increased and unnatural levels of fuels, increased density of shrubs and trees, or establishment and spread of invasive or non-native species. This could slow the trend toward desired conditions or increase the risk of uncharacteristic fires in localized areas more so than in the other alternatives. Uncharacteristic fire could facilitate the spread or establishment of invasive or non-native species, which could then alter area hydrology, fire regime, and biodiversity.

All alternatives include guidance for management of research natural areas that would be beneficial for Pinyon Juniper Evergreen Shrub by allowing natural processes and natural conditions to prevail. This guidance would minimize recreational impacts by restricting camping, prohibiting recreation fires and limiting non-commercial group size (1987 Plan, page 196-1, SA-RNABotGeo-S-1, SA-RNABotGeo-G-6). In addition, access should be restricted as needed to maintain their natural, unmodified condition and commercial tours would be prohibited except in support of approved research (1987 Plan, page 196-2, SA-RNABotGeo-S-2). This guidance would reduce the potential for human-caused fires and maintain the natural conditions for which the RNA was designated, which include properly functioning soils and vegetation. This guidance would also mitigate soil compaction, soil loss, and vegetation damage from some recreational activities. Designated wilderness direction would prevail in the West Clear Creek RNA.

Alternative A

Using the analysis process described under the Species Viability section above, table 18 shows that under alternative A the vegetation quality of Pinyon Juniper Evergreen Shrub is classified as fair, which means it has a moderate departure from desired conditions and the number, size, and evenness of distribution of habitat areas across the landscape is somewhat reduced. Under the plan direction in alternative A, vegetation quality is expected to trend away from desired

conditions. Increasing tree density and canopy cover is predicted to continue with the negative effect of shading the understory and maintaining more small to medium-sized trees than desired. This would negatively affect the structure, composition, and function of the ERU and increase the risk of insect and disease outbreaks. In addition, there would be a higher potential for more of the ERU to burn at the high end of the range for mixed-severity fires. This could result in accelerated soil erosion and facilitate the establishment of invasive plant species, like cheatgrass, which can alter the fire regime and timing of fires.

Soil condition and productivity would remain fair with a trend away from desired conditions. About 43 percent of the ERU has satisfactory or satisfactory but inherently unstable soil conditions. In these areas, soil is functioning properly. Impaired soil conditions would remain in about 57 percent of the ERU, especially where there is higher canopy cover and loss of herbaceous understory. This is primarily due to lack of fire. In these areas, there is declined nutrient cycling, reduced ability to infiltrate water, and an inability of soil to resist erosion.

There is a low-moderate likelihood that Pinyon Juniper Evergreen Shrub could be a limiting factor to the viability of the associated species. This likelihood was derived by combining the value for habitat abundance with the value for vegetation quality. Vegetation quality was used instead of soil quality, because vegetation is assumed to respond faster than soil to treatments or disturbances, and thus, would better reflect differences between alternatives.

The management effect is a 3, because alternative A does not distinguish between the three pinyon juniper types that occur on the forest, which differ in composition, structure, and processes. Alternative A contributes less to the maintenance and sustainability of Pinyon Juniper Evergreen Shrub and the viability of the associated species than the other alternatives.

The 1987 Plan provides little explicit direction on desired conditions for this ERU. The different pinyon juniper types are combined into one broad category of Pinyon Juniper, which is divided into two management areas based on slope. Plan language emphasize the use of prescribed fire and mechanical treatments to achieve management objectives associated with range, watershed condition, and wildlife habitat (1987 Plan, pages 148 to 155; 162 to 165). There is an emphasis on prescribed burning and individual tree removal to achieve range improvements (1987 Plan, page 164) as well as mechanical treatment of vegetation, emphasizing sustained-yield for firewood and miscellaneous convertible products (1987 Plan, pages 148, 169).

Direction in the current Forest Plan is generally outdated. Different management objectives occur for slopes greater than 15 percent and slopes less than 15 percent. For example, old-growth, cover, and snags are generally provided on slopes greater than 15 percent, while mechanical treatment should be managed on slopes less than 15 percent (1987 Plan, page 148).

In alternative A, the Pinyon Juniper Evergreen Shrub ERU occurs in 23 management areas (MAs) However, about 61 percent of the ERU overlaps Pinyon Juniper Woodlands less than 40 percent slope (MA 7), Verde Valley (MA 11), and Grassland and Sparse Pinyon Juniper above the Rim (MA 10).

Management Area 7 direction promotes prescribed fire and seeding to be used to achieve resource objectives on the more gentle slopes (1987 Plan, page 148). However, no direction was provided on the appropriate seed mix, only stating that a mixture of warm and cool season grasses should be used. Non-native species could be included in the seed mix and these could disrupt the fire regime, hydrology, and compete with native species. Management Area 7 provides for portions of

the area to be managed as seral grasslands. Techniques discussed to maintain these areas include mechanical, chemical, and prescribed fire (1987 Plan, page 150). There are no records indicating that chemical or prescribed fire have been used to maintain seral grasslands in these areas. Mechanical treatments have occurred on a limited basis.

Stand diversity standards and guidelines in Management Area 7 provide for bear habitat and stands of old growth from 100 to 300 acres. These areas would be sufficient in size to provide habitat for species dependent on the forest interior for habitat (1987 Plan, page 151). However, according to the Vegetation and Fire section in Volume I of the FEIS, concentrating old growth in unnaturally large areas on steeper slopes rather than encouraging old-growth components in small areas throughout the ERU does not meet desired conditions. The development of old-growth components would be slower than could be otherwise achieved if mechanical treatment could occur throughout the ERU. Important habitat components such as alligator juniper and pine stringers would be managed for the benefit of wildlife (1987 Plan, page 154).

Management Area 10 is made up of the grasslands and pinyon juniper with less than 10 percent cover above the Mogollon Rim and a small portion of the transition zone (ecotone) between ponderosa pine and pinyon juniper, primarily on Anderson Mesa. The area includes a few stringers of ponderosa pine and ecotones between grass and pinyon juniper lands. The majority of the area is pinyon juniper that has been treated and is in the seral grassland stage. The area is important wildlife winter range, as well as year-round antelope range, and is used primarily as grazing land for both livestock and wildlife. Direction for Management Area 10 emphasizes the use of prescribed fire to achieve management objectives associated with range, watershed condition, and wildlife habitat; control of undesirable plant species; improvement of unsatisfactory range conditions; maintenance of seral grasslands where type conversions have occurred in the past except some wildlife corridors may be allowed to develop (1987 Plan, pages 162 to 165). Most of the language protects soil and vegetation except the emphasis on seral grasslands would not contribute to the maintenance or sustainability of Pinyon Juniper Evergreen Shrub.

The management emphasis for Management Area 11 is watershed condition, range management, wildlife habitat for upland game birds, and dispersed recreation (1987 Plan, page 166). Standards and guidelines allow for removal of undesirable plant species to maintain pronghorn habitat (1987 Plan, page 168). Plan language prioritizes improvement in watersheds in unsatisfactory condition, which could improve vegetation and soil conditions. Range management focuses on less than satisfactory range conditions, broadcast seeding following burning to increase production (for livestock), and forage improvement. The direction for soil in this alternative focuses on achieving range improvement by identifying areas suitable for soil scarification and seeding of early seral species to a “more productive state” and to evaluate soils to determine the best species to promote stabilization. This direction does not move this ERU toward the ecologically based desired conditions in alternative B (modified). Scarification would disturb the soil surface in the Verde Formation and other soil types and could lead to increased erosion. Alternative A specifies that the seed mix should be shade-tolerant and a mix of warm and cool season grasses, but does not specify that the seed mix should be native. Scarification and seeding of early seral species can introduce non-native species like Lehmann love grass (*Eragrostis lehmanniana*) that compete with native plants and facilitate fire spread. However, vegetative treatments to improve Pinyon Juniper Evergreen Shrub would be reviewed for soil potential for revegetation and erosion potential prior to treatment. The Verde Formation and other soils could

be avoided or mitigation measures could be employed to avoid severe impairment of soil productivity (1987 Plan, pages 166, 168, 169).

Although prescribed fire and wildfires managed for resource objectives may be used in Pinyon Juniper Evergreen Shrub ERU, there is no provision for using wildfires managed for resource objectives in the wildland-urban interface (1987 Plan, pages 92, 155, 165) and the language to manage wildfires for resource objectives in wilderness impedes the use of this tool (1987 Plan, pages 111, 112). This plan language limits the restoration of fire as a natural process in the wildland-urban interface and in wilderness, and canopy cover and tree density would be expected to increase in these areas.

There are 639 acres of Pinyon Juniper Evergreen Shrub in the proposed West Clear Creek Research Natural Area. The research natural area is located in the West Clear Creek Wilderness. Ongoing uses include recreation. Users seeking to escape the overcrowding in the Fossil Creek Area or a more remote experience may use this area. This research natural area was proposed in alternative A, but the designation was never completed and there is no known research occurring within it.

Alternative B (modified)

Using the analysis process described under the Species Viability section above, table 18 shows that under alternative B (modified) the vegetation quality of Pinyon Juniper Evergreen Shrub is classified as fair with a trend away from the desired conditions, the same as alternative A. A plan objective would have at least 3,750 acres treated over each 10-year period over the life of the plan with wildfires managed for resource objectives, within the natural fire regime (FW-TerrERU-PJ-O-3). As with alternative A, increasing tree density and canopy cover is predicted to continue and eventually would shade the understory and maintain a higher amount of small to medium-sized trees than desired. This would negatively affect the structure, composition, and function of the ERU. Consequences include increased risk of insect and disease outbreaks and higher potential for more of the ERU to burn at the high end of the range for mixed-severity fires. This could result in accelerated soil erosion and facilitate the establishment of invasive plant species, like cheatgrass, which can alter the fire regime and timing of fires.

Soil condition and productivity would be poor under alternative B (modified) and trend slowly toward desired conditions. As with alternative A, about 43 percent of the ERU has satisfactory or satisfactory but inherently unstable soil conditions. In these areas, soil is functioning properly. Impaired soil conditions would remain in about 57 percent of the ERU, especially where there is higher canopy cover and loss of herbaceous understory. This is primarily due to lack of fire. In these areas there is declined nutrient cycling, reduced ability to infiltrate water and an inability of soil to resist erosion. It is not known whether the treatment objective would target impaired soil conditions, because it is dependent on the location of ignitions, conditions at the time of ignition, and resources at risk.

Under alternative B (modified), Pinyon Juniper Evergreen Shrub has a low-moderate likelihood of being limiting to the associated species. This likelihood was derived by combining the value for habitat abundance with the value for vegetation quality. Vegetation quality was used instead of soil quality, because vegetation is assumed to respond faster than soil to treatments or disturbances, and thus, would better reflect differences between alternatives.

Management effect is a 2, which means that plan components in alternative B (modified) maintain or improve protection and management for most habitat occurrences in the plan area, and thus, contribute more to the maintenance and sustainability of Pinyon Juniper Evergreen Shrub and the viability of the associated species than alternative A.

Desired conditions in alternative B (modified) have greater potential to reduce ERU departure and move toward desired conditions than alternative A. Desired conditions promote: properly functioning ecosystems that are resilient to natural disturbances and climate change; the reduction of uncharacteristic disturbances; endemic levels of invertebrates (including pollinators) and disease with occasional outbreaks; and a balance of desirable non-native species and subspecies with properly functioning ecosystems (FW-Eco-DC-1 to 4). Desired conditions include a mosaic of vegetation conditions, densities, and structures and various scales that reflect natural disturbance regimes, resilience to disturbances, adaptions to climate variability, connections based on natural patterns, and allowances for inclusions, variability, and ecotones (FW-TerrERU-All-DC-1 to 4).

Unlike alternative A, this alternative updates pinyon juniper management by identifying three ERUs in the pinyon juniper forest type: Pinyon Juniper with Grass, Pinyon Juniper Evergreen Shrub, and Pinyon Juniper Woodland. ERU-specific plan components provide more explicit information for managers. A one-size-fits-all approach for pinyon juniper would not be appropriate because the pinyon juniper ERUs differ in terms of species composition, structure, and fire regime.

Implementation of desired conditions would result in structure and species composition that both reflect and support natural disturbance regimes. A mix of trees and shrubs would occur as a series of vegetation states that shift from herbaceous dominated to shrub dominated to tree dominated. Groups would be even-aged in structure with all ages represented across the landscape for an overall uneven-aged grouped appearance (FW-TerrERU-PJ-DC-6). Alternative B (modified) describes the fire regime more accurately than alternative A: mixed severity (Fire Regime III) although some evergreen shrub types would have occasional high-severity fires (Fire Regime IV) (FW-TerrERU-PJ-DC-8).

Plant composition would be similar to site potential at the landscape level yet could vary considerably at the fine and mid-scale in response to differing seral stages. The understory would be dominated by low to moderate density of shrubs, depending on seral stage. The interspaces would support native grasses and forbs (FW-TerrERU-PJ-DC-9). Mollisol soils would be managed toward grassland desired conditions, which would stay within the natural potential of the site and provide spatial heterogeneity and increased biodiversity within the ERU (FW-TerrERU-PJ-G-1)

Old-growth components and structure would occur throughout the landscape as individual components or as clumps. They would shift in time and space as a result of succession and tree growth and mortality. Habitat and food for wildlife and their prey would be provided by snags 8 inches and greater at diameter at root collar that would average three snags per acre and by snags 18 inches and greater that would average one snag per acre (FW-TerrERU-PJ-DC-5, 7). To further assure the distribution and sustainability of old-growth forest components, the development of old growth would be encouraged in areas where it is lacking (FW-TerrERU-PJ-G-5).

Coarse woody debris would average 2 to 4 tons per acre. Plan components promote the retention of slash piles across the landscape for several years instead of being immediately burned where coarse woody debris is deficient. This would provide cover for various species of wildlife; however, scenic integrity objectives, bark beetles, big game movements, and fire and fuel concerns would be factors when considering the number and distribution of slash piles or scattered slash to be retained (FW-TerrERU-PJ-G-4). Slash treatments would be used to improve herbaceous vegetation, watershed condition, and soil productivity in areas where there is little overstory; however, large accumulations of green material would be managed to reduce the risk of uncharacteristic bark beetle outbreaks (FW-TerrERU-PJ-G-2, 3). Coarse woody debris provides microsites for establishment of native vegetation, provides food and cover for a variety of wildlife species, is critical for soil productivity and nutrient cycling, and important for soil condition and preventing accelerated soil erosion.

Under this alternative, wildfires may be managed for resource objectives in more areas of the landscape than in alternative A (including wildland-urban interface and wilderness) allowing increased opportunities to reduce the risk of uncharacteristic fire and to restore fire-adapted ecosystems (FW-TerrERU-All-G-2, FW-WUI-DC-4).

Plan components direct managers to reduce fire hazard, intensity, and severity in order to protect human life and property (FW-WUI-DC-1, 2, FW-Fire-DC-1, 2). When wildland-urban interface intersects with a mixed- or high-severity fire regime like Pinyon Juniper Evergreen Shrub, characteristic ecosystem function would be modified to promote low-severity surface fires that rarely spread as crown fire; forests in the wildland-urban interface would be dominated by early seral, fire-adapted species growing in a more open condition than the general forest; and wildland-urban interface may have a higher frequency of disturbance from prescribed burning, wildfires managed for resource objectives, and/or vegetative treatments than the natural disturbance regime (FW-WUI-DC-3, 4, 7, 8). This proportion of the ERU would move away from desired conditions and may result in a different species composition and structure than what Pinyon Juniper Evergreen Shrub is adapted to. This departure could be mitigated by promoting wildland-urban interface conditions (fuel loading, basal area, logs, snags) at the lower end of the range given in the vegetation community desired conditions (FW-WUI-DC-5, 9). This departure could be mitigated by spatially arranging these structural components to reduce fire hazard and increase suppression success, and allowing fuel loading or tree densities at the higher end of the range where it provides for important fine-scale habitat structure or cover as long as it meets the overall intent of protecting wildland-urban interface values-at-risk (FW-WUI-DC-10; FW-WUI-G-1).

There are 723 acres of Pinyon Juniper Evergreen Shrub in Davey's recommended wilderness, which is bounded on one side by the existing Fossil Creek Wilderness. Recommended wilderness would reduce impacts from motorized use by promoting motorized vehicle use only for limited administrative and permitted activities (SA-RWild-DC-1, 2, 5; SA-RWild-G-1, 3, 5). Mechanized uses that maintain and do not detract from wilderness values would be allowable. However, new trails should be designed for non-motorized and non-mechanized activities that preserve wilderness character (SA-RWild-DC-6; SA-RWild-G-5). Implementation of these plan components would reduce disturbance to soil and vegetation from motorized or mechanized uses, which could be beneficial to associated species. If designated by Congress, the wilderness areas would be managed according to applicable laws, policy, and Forest Plan direction (SA-Wild-DC-1 to 11; SA-Wild-O-1, 2; SA-Wild-S-1 to 5; SA-Wild-G-1 to 11). However, limited access associated with recommended (and designated) wilderness could preclude restoration treatments

that require motorized equipment for treatments or safety, or make them harder to do logistically. Site-specific circumstances would also influence which or whether restoration treatments might be precluded. Delay or absence of restoration treatments could result in missed fire return intervals, increased and unnatural levels of fuels, increased density of shrubs and trees, or establishment and spread of invasive or non-native species. This could slow the trend toward desired conditions or increase the risk of uncharacteristic fires in localized areas more so than in the other alternatives. Uncharacteristic fire could facilitate the spread or establishment of invasive or non-native species, which could then alter area hydrology, fire regime, and biodiversity.

This ERU occurs within 7 proposed management areas (Pine Belt, Red Rock, Oak Creek Canyon, House Mountain-Lowlands, Sedona Neighborwoods, Verde Valley, and Long Valley). Approximately 77 percent is within Verde Valley (62 percent) and Red Rock (15 percent) management areas.

The area covered by the Verde Valley MA is different between alternatives. Under alternative B (modified), desired conditions in the Verde Valley MA would maintain or improve the sustainability of this ERU by managing watersheds to reduce the risk of uncharacteristic flooding and sedimentation, by emphasizing resource protection in areas used for dispersed recreation, and by preventing the introduction of diseases, invasive or undesirable species (MA-VerdeV-DC-1, 4; MA-VerdeV-G-1, 2).

The Red Rock MA is located on either side of Sedona and adjoins House Mountain-Lowlands, Pine Belt, Oak Creek Canyon, Sedona Neighborwoods, and Verde Valley Management Areas. It includes many of the scenic vistas that are famous throughout the region. This management area contains guidance for networks of motorized and non-motorized trails in the area, while protecting the fragile natural resources of the area (MA-RedRock-DC-3). Another beneficial desired condition would promote a balance between recreation experiences and natural resources (MA-RedRock-DC-2). As in the Verde Valley MA, this guidance may help protect resources by protecting sensitive soils and preventing the introduction of invasive or undesirable species. Commercial plant collecting would be prohibited in the management area (MA-RedRock–S-6). This continues guidance from the current plan (alternative A) and would reduce collection pressures in this area. This does not apply to other commercial forest products, which would be regulated by permit and would occur in designated locations only. This important distinction would allow consideration of vegetation treatments to achieve the desired conditions of the ERU. The prohibition of horse and pack stock, except for limited administrative use, could reduce vegetation and soil impacts from this recreational use. This prohibition applies to the Fay Canyon, Wilson Mountain, West Fork of Oak Creek, Devil’s Bridge, and Boynton Canyon Trails (MA-RedRock-S-9).

There are 915 acres of Pinyon Juniper Evergreen Shrub in the proposed West Clear Creek Research Natural Area, but the proposed research natural area is larger and in a different location than was proposed in alternative A. Under this alternative, the research natural area would be encompassed by the West Clear Wilderness. Although guidance for proposed research natural areas would apply, such as preservation of ecological features and biodiversity values of the area (SA-RNABotGeo-DC-1), providing a baseline for ecological changes (SA-RNABotGeo-DC-2), and allowing opportunities for study, while not modifying the conditions of the area (SA-RNABotGeo-DC-4), wilderness direction would prevail.

Alternative C

Alternative C has the same effects as alternative B (modified), except a total of 13 wildernesses are recommended instead of 3. In addition to the 47,893 acres of Pinyon Juniper Evergreen Shrub in designated wilderness, there are 50,164 acres in recommended wilderness. The recommended wilderness acres are distributed among nine recommended wildernesses: Black Mountain (5,552 acres), Cedar Bench (2,558 acres), Cimarron-Boulder (9,496 acres), Davey's (723 acres), Deadwood Draw (9,804 acres), Hackberry (15,890 acres), Railroad Draw (8 acres), Tin Can (2,652 acres), and Walker Mountain (3,480 acres). There would be about 37 percent of the ERU in either designated or recommended wilderness. Recommended wilderness would reduce impacts from motorized use by promoting motorized vehicle use only for limited administrative and permitted activities (SA-RWild-DC-1, 2, 5, 6; SA-RWild-G-1, 3, 5). Mechanized uses that maintain and do not detract from wilderness values would be allowable. However, new trails should be designed for non-motorized and non-mechanized activities that preserve wilderness character (SA-RWild-DC-6; SA-RWild-G-5). Implementation of these plan components would reduce disturbance to soil and vegetation from motorized or mechanized uses, which could be beneficial to associated species. If designated by Congress, the wilderness areas would be managed according to applicable laws, policy, and Forest Plan direction (SA-Wild-DC-1 to 11; SA-Wild-O-1, 2; SA-Wild-S-1 to 5; SA-Wild-G-1 to 11). However, limited access associated with recommended (and designated) wilderness could preclude restoration treatments that require motorized equipment for treatments or safety, or make them harder to do logistically. Site-specific circumstances would also influence which or whether restoration treatments might be precluded. Delay or absence of restoration treatments could result in missed fire return intervals, increased and unnatural levels of fuels, increased density of shrubs and trees, or establishment and spread of invasive or non-native species. This could slow the trend toward desired conditions or increase the risk of uncharacteristic fires in localized areas more so than in the other alternatives. Uncharacteristic fire could facilitate the spread or establishment of invasive or non-native species, which could then alter area hydrology, fire regime, and biodiversity.

Alternative D

Alternative D is the same as alternative B (modified), except there are no recommended wildernesses. In alternative D, the recommended wilderness areas of alternative B (modified) would be guided by applicable forestwide or management area plan direction rather than plan components relating to recommended wilderness.

Pinyon Juniper Woodland

Affected Environment

Amount

There are 77,186 acres of this ERU within the forest boundary. About 75,439 acres (4 percent) is managed by the Coconino NF, with most of the remaining 2 percent in private ownership.

Table 19 summarizes the information used to estimate the likelihood that Pinyon Juniper Woodland ERU would be a limiting factor to the viability for the associated species. The abundance is categorized as Occasional because, at 75,439 acres, it occupies a little over 4 percent of the forest. Habitats classified as Occasional generally cover 1 to 10 percent of the forest and are occasionally encountered.

Habitat Quality and Distribution

This ERU (also called Persistent Pinyon Juniper Woodland) generally occurs at elevations between 3,000 and 7,500 feet and covers approximately 75,439 acres (approximately 4 percent of the forest). Pinyon Juniper Woodland is characterized by high-severity fire that occurs every 35 to 200+ years.

It is located mainly in the northern and eastern portions of the forest on the lower slopes of mountains and upland rolling hills. This ERU ranges from sparse stands of scattered, small trees growing on poor substrates to relatively dense stands of large trees on more productive sites. However, tree density and cover may fluctuate in response to disturbance and climatic variability. Tree species include: pinyon pine and Utah and one-seed juniper (which are most common) and alligator juniper at higher elevations. Shrubs may include: Stansbury cliffrose, Gambel oak, saltbrush, big sagebrush, and limited areas of turbinella oak and manzanita. Understory species is mostly comprised of annual and perennial grasses including: blue grama, needle and thread grass, and western wheatgrass. Natural disturbances in Pinyon Juniper Woodland include endemic levels of insects and disease and wildfire.

There are 5,200 acres (about 7 percent of the ERU) within six designated wildernesses: mainly in Strawberry Crater Wilderness (3,515 acres), Munds Mountain Wilderness (350 acres), Red Rock-Secret Mountain (565 acres), West Clear Creek (444 acres), Sycamore Canyon (238 acres), and Fossil Springs (12 acres).

A small portion of this ERU is in the proposed West Clear Creek Research Natural Area: 85 acres under alternative A; 74 acres under alternatives B (modified), C, and D.

According to reference conditions, Pinyon Juniper Woodland was mostly open with a mosaic of small, medium, and large trees overtopping an herbaceous understory. Fires were more frequent and generally did not “thin from below” (i.e., they did not kill predominantly small trees), but rather tended to kill all or most of the trees, regardless of size, within the places that burned. In addition, invasive exotic species were not present.

Using the analysis process described under the Species Viability section above, table 19 shows that the vegetation quality of Pinyon Juniper Woodland is classified as good. This means it has a low departure and the number, size of habitat areas, or evenness in distribution across the landscape is similar to or only slightly reduced relative to reference conditions. The ERU’s trend from reference conditions varies. Areas that are overstocked with trees are expected to trend away and the remaining areas are expected to have a static trend. Currently, there is an overall shift toward small and medium-sized trees with loss of herbaceous understory and large trees with open canopy, mainly because of a history of fire suppression activities. This ERU is rated low for departure with respect to weeds.

Soil is in fair condition, probably due to fire suppression and loss of understory vegetation that would have carried fire. It is trending away from reference condition due to drought, continued fire suppression, and few vegetative treatments or natural disturbances. Some areas have greater than about 40 percent canopy cover contributing to impaired soil functions. Current surface litter and plant cover is low, species composition is poor, forage production is low, and visual sheet and rill erosion are common, especially in areas with high tree density or with impaired or unsatisfactory soil conditions.

Table 19 shows that there is a low likelihood that Pinyon Juniper Woodland habitat could be limiting to the associated species. The likelihood that habitat would be limiting to the associated species was derived by combining the value for habitat abundance with the value for vegetation quality. Vegetation quality was used instead of soil quality because vegetation is assumed to respond faster than soil to treatments or disturbances and thus would better reflect differences between alternatives.

Table 19 also compares management effect by alternative. Management effect categorizes the relative expected outcome of plan language in each alternative in terms of maintaining habitat quality and is the result of plan decisions, including plan objectives. Management effect category values are 1, 2, 3, and 4. The lower the management effects rating, the more effective the alternative is for maintaining the habitat. The effects of the alternatives are explained in greater detail in the discussions on the alternatives that follow.

Table 19. Summary of coarse filter analysis for Pinyon Juniper Woodland by alternative

<table>
<tr><th>Habitat</th><th>Existing</th><th>Alternative A</th><th>Alternatives B (modified), C, and D</th><th>Associated Species</th></tr>
<tr><td>Abundance</td><td>Occasional</td><td colspan="2">Occasional</td><td rowspan="5">Navajo Mogollon vole, pinyon jay, Arizona phlox, Arizona sunflower, Sunset Crater beardtongue</td></tr>
<tr><td>Quality-Vegetation</td><td>Good, static trend</td><td colspan="2">Good, static trend</td></tr>
<tr><td>Quality-Soil</td><td>Fair, trending away</td><td>Fair, trending away</td><td>Fair, trending slowly toward</td></tr>
<tr><td>Likelihood of Limitation</td><td>Low</td><td colspan="2">Low</td></tr>
<tr><td colspan="2">Management effect</td><td>3: Plan components maintain or improve protection and management for some habitat occurrences in the plan area.</td><td>2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.</td></tr>
</table>

Risk Factors

Fire exclusion has resulted in increased tree density and a substantial shift to small and medium sized trees as well as reduced understory species cover and diversity. Non-native or invasive plant species, such as annual grasses, can alter the natural fire return interval and fire regime.

Associated Species

Associated species are listed in table 19.

Environmental Consequences

Analysis related to the risks arising from non-native invasive plant species are addressed under the Non-native or Invasive Species topic in the Wildlife and Plant Issues and Topics section.

Common to All Alternatives

Plan components in all alternatives contribute to species viability by managing habitat to maintain viable and sustainable populations of wildlife and fish species and by improving and protecting habitat for threatened, endangered, and sensitive species (1987 Plan, pages 22-1, 23; FW-Eco-DC-1; FW-WFP-DC-1, 2, 3, 5, 6, 8; FW-WFP-G-3, 10). See At-risk Species in the Wildlife and Plant Issues and Topics section above for more information.

All alternatives address the threat of invasive plants. Invasive plants can increase as a consequence of ground disturbance and, once established, would compete with native species for water and nutrients or could alter the fire regime. All alternatives address the threat of invasive plants by pointing to the Final Environmental Impact Statement for the Treatment of Noxious or Invasive Weeds (USDA Forest Service 2005). This direction includes best management practices, among other guidance, which would help prevent, mitigate, and reduce the threat of invasive plants. All alternatives prioritize treatments, call for incorporating control measures in project planning and implementation, and emphasize coordination with partners (1987 Plan, pages 23, 69, 70, 182, 206-14, 206-76, 206-101, 201-116; FW-Invas-DC-1, 2; FW Invas-G-1, 2, -3; FW-Invas-MgtApp; FW-Graz-MgtApp; FW-RdsFac-G-8; FW-Rec-Dev-DC-9; FW-Rec-Dev-G-2). Additional information and analysis is discussed under the Non-native or Invasive Species topic in the Wildlife and Plant Topics and Issues section.

About 7 percent of the ERU is in designated wilderness. Designated wilderness areas would be managed according to applicable laws, policy, and Forest Plan direction to preserve wilderness resource values and wilderness quality, and to emphasize wilderness recreation (1987 Plan, pages 105 to 112; SA-Wild-DC-1 to 11; SA-Wild-S-1, 2; SA-Wild-G-1 to 7). Wilderness designation limits most active vegetation management because motorized and mechanized use is not allowed. Motorized and mechanized access can kill or damage plants, can degrade the habitat through soil compaction and soil loss, and can introduce non-native species that compete with native plants for resources. This can negatively affect the reproduction and survival of individual plants or populations. Ground-disturbing activities are primarily confined to main trails, trailheads, and key points of interest at which invasive species introduction and establishment, or accelerated erosion could occur, depending on the level of use. The lack of ground-disturbing activities elsewhere would be beneficial by reducing the risk of invasive plant introduction and dispersal by motorized or mechanized use. However, limited access associated with designated wilderness could preclude restoration treatments that require motorized equipment for treatments or safety, or make them harder to do logistically. Lack of restoration treatments could result in missed fire return intervals, increased and unnatural levels of fuels, increased density of shrubs and trees, or establishment and spread of invasive or non-native species. This could slow the trend toward desired conditions or increase the risk of uncharacteristic fires in localized areas more so than in the other alternatives. Uncharacteristic fire could facilitate the spread or establishment of invasive or non-native species, which could then alter area hydrology, fire regime, and biodiversity.

All alternatives include guidance for management of research natural areas that would be beneficial for Pinyon Juniper Woodland by allowing natural processes and natural conditions to prevail. This guidance would minimize recreational impacts by restricting camping, prohibiting recreation fires, and limiting non-commercial group size (1987 Plan, page 196-1, SA-RNABotGeo-S-1, SA-RNABotGeo-G-6). In addition, access should be restricted as needed to maintain their natural, unmodified condition, and commercial tours would be prohibited except in support of approved research (1987 Plan, page 196-2, SA-RNABotGeo-S-2). This guidance would reduce the potential for human-caused fires and maintain the natural conditions for which

the RNA was designated, which include properly functioning soils and vegetation. This guidance would also mitigate soil compaction, soil loss, and vegetation damage from some recreational activities. Designated wilderness direction would prevail in the West Clear Creek RNA.

Pinyon Juniper Woodland ERU occurs in three seasonal closure areas: the Ladders Bald Eagle Seasonal closure Area (127 acres), Rattlesnake (752 acres), and Woods (369 acres). These areas would be closed seasonally under all alternatives (1987 Plan, page 167 and Off-Road Driving Management Plan associated with 1987 Plan; MA-VerdeV-DC-7; MA-VerdeV-S-1; MA-PineBelt-DC-6, 7; MA-PineBelt-S-2, 3). The closures are designed to provide undisturbed habitat for the protection of nesting bald eagles and to minimize disturbance to big game winter habitat. This would reduce soil or vegetation impacts that could result from motorized used during the closure periods.

Alternative A

Using the analysis process described under the Species Viability section above, table 19 shows that under alternative A the vegetation quality of Pinyon Juniper Woodland is classified as good, which means it has a low departure and the number, size of habitat areas, or evenness in distribution across the landscape is similar to or only slightly reduced relative to reference conditions. Under the plan direction in alternative A, vegetation quality is expected to have a static trend relative to desired conditions. Increasing tree density and canopy cover is predicted to continue. This high tree density and cover would be expected to continue over extensive areas. This condition is appropriate for the ERU, and would support the historic fire regime of infrequent high-severity fires.

Soil condition and productivity would be fair with a trend away from desired conditions. About 40 percent of the ERU has satisfactory or satisfactory but inherently unstable soil conditions. In these areas, soil is functioning properly. Impaired soil conditions would remain in about 60 percent of the ERU, especially where there is higher canopy cover and loss of herbaceous understory. This is primarily due to lack of fire. In these areas there is declined nutrient cycling, reduced ability to infiltrate water, and an inability of soil to resist erosion.

There is a low likelihood that Pinyon Juniper Woodland could be a limiting factor to the viability of the associated species. This likelihood was derived by combining the value for habitat abundance with the value for vegetation quality. Vegetation quality was used instead of soil quality, because vegetation is assumed to respond faster than soil to treatments or disturbances, and thus, would better reflect differences between alternatives.

The management effect is a 3, because alternative A does not distinguish between the three pinyon juniper types that occur on the forest that differ in composition, structure, and processes. Alternative A contributes less to the maintenance and sustainability of Pinyon Juniper Woodland and the viability of the associated species than the other alternatives.

The 1987 Plan provides little explicit direction on desired conditions for this ERU. The different pinyon juniper types are combined into one broad category of Pinyon Juniper, which is divided into two management areas based on slope. Plan language emphasizes the use of prescribed fire and mechanical treatments to achieve management objectives associated with range, watershed condition, and wildlife habitat (1987 Plan, pages 148 to 155; 162 to 165). There is an emphasis on prescribed burning and individual tree removal to achieve range improvements (1987 Plan, page

164) as well as mechanical treatment of vegetation, emphasizing sustained-yield for firewood and miscellaneous convertible products (1987 Plan, pages 148, 169).

Direction in the current Forest Plan is generally outdated. Different management objectives occur for slopes greater than 15 percent and slopes less than 15 percent. For example, old growth, cover, and snags are generally provided on slopes greater than 15 percent, while mechanical treatment should be managed on slopes less than 15 percent (1987 Plan, page 148). This would not result in well-distributed habitat components.

Pinyon Juniper Woodland occurs in 24 different management areas (MAs) in this alternative, but primarily in MAs 7, 8, and 11. Thirteen percent falls within the Sedona/Oak Creek Ecosystem (10 individual management areas plus area-wide direction).

Management Area 7 includes slopes less than 40 percent. Plan direction promotes prescribed fire and seeding to be used to achieve resource objectives on the more gentle slopes (1987 Plan, page 148). However, no direction was provided on the appropriate seed mix, only stating that a mixture of warm and cool season grasses should be used. Non-native species could be included in the seed mix, and these could disrupt the fire regime, hydrology, and compete with native species.

Stand diversity standards and guidelines in Management Area 7 provide for stands of old growth from 100 to 300 acres. These areas are intended to provide habitat for species dependent on the forest interior for habitat (1987 Plan, pages 148, 151,152). According to the Vegetation and Fire section in Volume I of the FEIS, large old-growth stands would meet desired conditions for this ERU; however, concentrating old growth on steeper slopes and limiting mechanical treatments to slopes less than 15 percent would slow the development of old-growth components compared to allowing mechanical treatment throughout the ERU. Small mammals and birds would benefit with the retention of three unburned piles per acre on areas with piled slash. These piles would provide cover. Important habitat components such as alligator juniper and pine stringers would be managed for the benefit of wildlife (1987 Plan, page 154).

Management Area 8 includes the pinyon juniper woodlands on slopes over 40 percent. Steep canyons and volcanic slopes make the area unsuitable for many uses such as firewood cutting and some kinds of recreation. Most of the area is old growth because it has not been cut and fire has been excluded. The management emphasis is wildlife habitat, watershed condition, and dispersed recreation (1987 Plan, page 156). The area is not assigned any grazing capacity due to slopes and forest products are generally not removed. Prescribed fire using planned and unplanned ignitions is used to accomplish resource objectives, except there is no provision for unplanned ignitions in areas included in wildland-urban interface (1987 Plan, page 157).

The management emphasis for Management Area 11 is watershed condition, range management, wildlife habitat for upland game birds, and dispersed recreation (1987 Plan, page 166). Standards and guidelines allow for removal of undesirable plant species to maintain antelope habitat (1987 Plan, page 168). Plan language prioritizes improvement in watersheds in unsatisfactory condition which could improve vegetation and soil conditions. Range management focuses on less than satisfactory range conditions, broadcast seeding following burning to increase production (for livestock), and forage improvement. The direction for soil in this alternative focuses on achieving range improvement by identifying areas suitable for soil scarification and seeding of early seral species to a “more productive state” and to evaluate soils to determine the best species to promote stabilization. This direction does not move this ERU toward the ecologically based desired

conditions in alternative B (modified). Scarification would disturb the soil surface and could lead to increased erosion. Alternative A specifies that the seed mix should be shade-tolerant and a mix of warm and cool season grasses, but does not specify that the seed mix should be native. Scarification and seeding of early seral species can introduce non-native species like Lehmann love grass (*Eragrostis lehmanniana*) that compete with native plants and facilitate fire spread. However, vegetative treatments to improve Pinyon Juniper Woodland would be reviewed for soil potential for revegetation and erosion potential prior to treatment. Sensitive soils could be avoided or mitigation measures could be used to avoid severe impairment of soil productivity (1987 Plan, pages 166, 168, 169).

Sedona/Oak Creek ecosystem-wide plan direction contributes to the sustainability of Pinyon Juniper Woodland by including provisions to conserve or restore natural ecosystem disturbance patterns; promoting the natural ecological role of fire within the constraints of human health and safety; and managing the mosaic of vegetative conditions to reduce the occurrence of catastrophic fires (1987 Plan, page 206-9). There are goals to expand the use of prescribed fire and other mechanical methods to achieve area goals and to utilize fire management to reduce fuels, restore ecosystem function and protect resource values (1987 Plan, page 206-11). Guidelines restrict prescribed burning so prevailing winds do not inundate active peregrine falcon nests during the breeding season and restrict fuel reduction activities that use motorized equipment at least one quarter mile from active peregrine falcon nests to reduce activity and noise related impacts during the breeding season (1987 Plan, page 206-13). Depending on site-specific circumstances, these timing restrictions could slow or not affect progress toward desired conditions.

Although prescribed fire and wildfires managed for resource objectives may be used in Pinyon Juniper Woodland ERU, there is no provision for using wildfires managed for resource objectives in the wildland-urban interface (1987 Plan, pages 92, 155, 165), and the language to manage wildfires for resource objectives in wilderness impedes the use of this tool (1987 Plan, pages 111, 112). This plan language limits the restoration of fire as a natural process in the wildland-urban interface and in wilderness, and canopy cover and tree density would be expected to increase in these areas, which could increase vulnerability to uncharacteristic outbreaks of insects or disease.

There are 85 acres of Pinyon Juniper Woodland in the proposed West Clear Creek Research Natural Area. The proposed RNA is within the West Clear Creek Wilderness. Ongoing uses include recreation. Users seeking to escape the overcrowding in the Fossil Creek Area or a more remote experience may use this area. This RNA was proposed in alternative A, but the designation was never completed and there is no known research occurring within it.

Alternative B (modified)

Under alternative B (modified), Pinyon Juniper Woodland has a low likelihood of being limiting to the associated species, based on vegetation quality and a high likelihood based on soil quality (table 19). The vegetation condition of this ERU is expected to maintain a low departure with a static trend relative to the desired condition. Fire return interval departure would remain low, but trending away from the desired conditions. Conditions may further improve by managing wildfires to meet resource objectives (FW-TerrERU-All-G-2; FW-Fire-G-2), an option that is not available within wildland-urban interface under alternative A.

Using the analysis process described under the Species Viability section above, table 19 shows that under alternative B (modified) the vegetation quality of Pinyon Juniper Woodland is classified as good with a static trend relative to desired conditions, the same as alternative A.

Increasing tree density and canopy cover is predicted to continue. This high tree density and cover would be expected to continue over extensive areas. This condition is appropriate for the ERU, and would support the historic fire regime of infrequent high-severity fires. There could be increased vulnerability to insect and disease outbreaks and continued shading of understory species at the landscape scale, although understory could be more abundant at finer scales.

Soil condition and productivity would be fair under alternative B (modified) with a trend slowly toward desired conditions. This is because any activities that would occur in Pinyon Juniper Woodland would follow updated desired conditions and wildfires may be managed for resource objectives in more areas of the landscape than in alternative A. Consequently, soil productivity and function would improve, protective vegetative ground cover could increase, and soils could better withstand accelerated soil erosion in these treated areas.

Under alternative B (modified), Pinyon Juniper Woodland has a low likelihood of being limiting to the associated species. This likelihood was derived by combining the value for habitat abundance with the value for vegetation quality. Vegetation quality was used instead of soil quality, because vegetation is assumed to respond faster than soil to treatments or disturbances, and thus, would better reflect differences between alternatives.

Management effect is a 2, which means that plan components in alternative B (modified) maintain or improve protection and management for most habitat occurrences in the plan area, and thus, contribute more to the maintenance and sustainability of Pinyon Juniper Woodland and the viability of the associated species than alternative A.

Desired conditions in alternative B (modified) have greater potential to reduce ERU departure and move toward desired conditions than alternative A. Desired conditions promote: properly functioning ecosystems that are resilient to natural disturbances and climate change; the reduction of uncharacteristic disturbances; endemic levels of invertebrates (including pollinators) and disease with occasional outbreaks; and a balance of desirable non-native species and subspecies with properly functioning ecosystems (FW-Eco-DC-1 to 4). Desired conditions include a mosaic of vegetation conditions, densities, and structures and various scales that reflect natural disturbance regimes, resilience to disturbances, adaptions to climate variability, connections based on natural patterns, and allowances for inclusions, variability, and ecotones (FW-TerrERU-All-DC-1 to 4). A guideline for pinyon juniper addresses the management of large accumulations of green material (e.g., slash and wind-thrown trees) to reduce the risk of uncharacteristic bark beetle outbreaks (FW-TerrERU-PJ-G-3).

Unlike alternative A, this alternative updates pinyon juniper management by identifying three ERUs in the pinyon juniper forest type: Pinyon Juniper with Grass, Pinyon Juniper Evergreen Shrub, and Pinyon Juniper Woodland. ERU-specific plan components provide more explicit information for managers. A one-size-fits-all approach for pinyon juniper would not be appropriate, because the pinyon juniper ERUs differ in terms of species composition, structure, and fire regime.

Implementation of desired conditions would result in structure and species composition that both reflect and support natural disturbance regimes. A mix of trees and shrubs would occur as a series of vegetation states that shift from herbaceous dominated to shrub dominated to tree dominated. Even-aged patches of pinyons and junipers would form multi-aged woodlands (FW-TerrERU-PJ-

DC-10). Alternative B (modified) describes the fire regime more accurately than alternative A: mixed to high severity (Fire Regime III, IV, and V) (FW-TerrERU-PJ-DC-13).

Plant composition would be similar to site potential at the landscape level, yet could vary considerably at the fine and mid-scale in response to differing seral stages. Ground cover would consist of shrubs, perennial grasses, and forbs, with some sites being capable of carrying surface fire (FW-TerrERU-PJ-DC-14). Mollisol soils would be managed toward grassland desired conditions, which would stay within the natural potential of the site and provide spatial heterogeneity and increased biodiversity within the ERU (FW-TerrERU-PJ-G-1).

Old-growth components and structure would occur throughout the landscape as individual components or as clumps. They would shift in time and space as a result of succession and tree growth and mortality. Habitat and food for wildlife and their prey would be provided by snags 8 inches and greater at diameter at root collar that would average three snags per acre and by snags 18 inches and greater that would average one snag per acre (FW-TerrERU-PJ-DC-10, 11, 12). These would be distributed throughout the landscape rather than mainly on slopes greater than 15 percent as in alternative A.

Coarse woody debris would average 2 to 5 tons per acre (FW-TerrERU-PJ-DC-12). Plan components promote the retention of slash piles across the landscape for several years instead of being immediately burned where coarse woody debris is deficient. This would provide cover for various species of wildlife; however, scenic integrity objectives, bark beetles, big game movements, and fire and fuel concerns would be factors when considering the number and distribution of slash piles or scattered slash to be retained (FW-TerrERU-PJ-G-4). Slash treatments would be used to improve herbaceous vegetation, watershed condition, and soil productivity in areas where there is little overstory; however, large accumulation of green material would be managed to reduce the risk of uncharacteristic bark beetle outbreaks (FW-TerrERU-PJ-G-2, 3). Coarse woody debris provides microsites for establishment of native vegetation, provides food and cover for a variety of wildlife species, is critical for soil productivity and nutrient cycling, and important for soil condition and preventing accelerated soil erosion.

Under this alternative, wildfires may be managed for resource objectives in more areas of the landscape than in alternative A (including wildland-urban interface and wilderness) allowing increased opportunities to reduce the risk of uncharacteristic fire and to restore fire-adapted ecosystems (FW-TerrERU-All-G-2, FW-WUI-DC-4).

Plan components direct managers to reduce fire hazard, intensity, and severity in order to protect human life and property (FW-WUI-DC-1, 2; FW-Fire-DC-1, 3). When wildland-urban interface intersects with a mixed- or high-severity fire regime like Pinyon Juniper Woodland, characteristic ecosystem function would be modified to promote low-severity surface fires that rarely spread as crown fire; forests in the wildland-urban interface would be dominated by early seral, fire-adapted species growing in a more open condition than the general forest; and wildland-urban interface may have a higher frequency of disturbance from prescribed burning, wildfires managed for resource objectives, and/or vegetative treatments than the natural disturbance regime (FW-WUI-DC-3, 4, 7, 8). This proportion of the ERU would move away from desired conditions, and may result in a different species composition and structure than what Pinyon Juniper Woodland is adapted to. This departure could be mitigated by promoting wildland-urban interface conditions (fuel loading, basal area, logs, snags) at the lower end of the range given in the vegetation

community desired conditions (FW-WUI-DC-5, 9). This departure could be mitigated by spatially arranging these structural components to reduce fire hazard and increase suppression success, and allowing fuel loading or tree densities at the higher end of the range, where it provides for important fine-scale habitat structure or cover as long as it meets the overall intent of protecting wildland-urban interface values-at-risk (FW-WUI-DC-10; FW-WUI-G-1).

In addition to the 5,200 acres of Pinyon Juniper Woodland in designated wilderness, there are 1,467 acres in two recommended wildernesses: Strawberry Crater (605 acres) and Davey's (863 acres). Together, this represents about 9 percent of the total ERU. Recommended wilderness would reduce impacts from motorized use by promoting motorized vehicle use only for limited administrative and permitted activities (SA-RWild-DC-1, 2, 5; SA-RWild-G-1, 3, 5). Mechanized uses that maintain and do not detract from wilderness values would be allowable. However, new trails should be designed for non-motorized and non-mechanized activities that preserve wilderness character (SA-RWild-DC-6; SA-RWild-G-5). Implementation of these plan components would reduce disturbance to soil and vegetation from motorized or mechanized uses, which could be beneficial to associated species and could reduce the potential for invasive species establishment. If designated by Congress, the wilderness areas would be managed according to applicable laws, policy, and Forest Plan direction (SA-Wild-DC-1 to 11; SA-Wild-O-1, 2; SA-Wild-S-1 to 5; SA-Wild-G-1 to 11). However, limited access associated with recommended (and designated) wilderness could preclude restoration treatments that require motorized equipment for treatments or safety, or make them harder to do logistically. Site-specific circumstances would also influence which or whether restoration treatments might be precluded. Delay or absence of restoration treatments could result in missed fire return intervals, increased and unnatural levels of fuels, increased density of shrubs and trees, or establishment and spread of invasive or non-native species. This could slow the trend toward desired conditions or increase the risk of uncharacteristic fires in localized areas more so than in the other alternatives. Uncharacteristic fire could facilitate the spread or establishment of invasive or non-native species, which could then alter area hydrology, fire regime, and biodiversity.

This ERU occurs within 14 proposed management areas. Approximately 70 percent is within the Verde Valley (40 percent) and Anderson Mesa (30 percent) management areas. The area covered by the Verde Valley MA is different between alternatives. Under alternative B (modified), desired conditions in the Verde Valley MA would maintain or improve the sustainability of this ERU by managing watersheds to reduce the risk of uncharacteristic flooding and sedimentation, emphasizing resource protection in areas used for dispersed recreation, and preventing the introduction of diseases and invasive or undesirable species (MA-VerdeV-DC-1, 4; MA-VerdeV-G-1, 2).

A desired condition in the Anderson Mesa MA would minimize roads and trails (MA-AMesa-DC-1). This could reduce soil or vegetation impacts from the use of roads and trails in localized areas.

There are 74 acres of Pinyon Juniper Woodland in the proposed West Clear Creek Research Natural Area, but the proposed RNA is in a different location than was proposed in alternative A. Under this alternative, the RNA would be encompassed by the West Clear Creek Wilderness. Although guidance for proposed research natural areas would apply, such as preserving ecological features and biodiversity values of the area (SA-RNABotGeo-DC-1), providing a baseline for ecological changes (SA-RNABotGeo-DC-2), and allowing opportunities for study while not modifying the conditions of the area (SA-RNABotGeo-DC-4), wilderness direction would prevail.

Alternative C

Alternative C has the same effects as alternative B (modified) except a total of 13 wildernesses are recommended instead of 3. In addition to the 5,200 acres of Pinyon Juniper Woodland in designated wilderness, there are 13,600 acres in recommended wilderness. The recommended wilderness acres are distributed among nine recommended wildernesses: Black Mountain (947 acres), Cedar Bench (1,053 acres), Cimarron-Boulder (3,432 acres), Davey's (863 acres), Deadwood Draw (922 acres), East Clear Creek (487 acres), Hackberry (4,200 acres), Strawberry Crater (605 acres), Tin Can (427 acres), and Walker Mountain (665 acres). There would be about 25 percent of the ERU in either designated or recommended wilderness. Recommended wilderness would reduce impacts from motorized use by promoting motorized vehicle use only for limited administrative and permitted activities (SA-RWild-DC-1, 2, 5, 6; SA-RWild-G-1, 3, 5). Mechanized uses that maintain and do not detract from wilderness values would be allowable. However, new trails should be designed for non-motorized and non-mechanized activities that preserve wilderness character (SA-RWild-DC-6; SA-RWild-G-5). Implementation of these plan components would reduce disturbance to soil and vegetation from motorized or mechanized uses which could be beneficial to associated species. If designated by Congress, the wilderness areas would be managed according to applicable laws, policy, and Forest Plan direction (SA-Wild-DC-1 to 11; SA-Wild-O-1, 2; SA-Wild-S-1 to 5; SA-Wild-G-1 to 11). However, limited access associated with recommended (and designated) wilderness could preclude restoration treatments that require motorized equipment for treatments or safety, or make them harder to do logistically. Site-specific circumstances would also influence which or whether restoration treatments might be precluded. Delay or absence of restoration treatments could result in missed fire return intervals, increased and unnatural levels of fuels, increased density of shrubs and trees, or establishment and spread of invasive or non-native species. This could slow the trend toward desired conditions or increase the risk of uncharacteristic fires in localized areas more so than in the other alternatives. Uncharacteristic fire could facilitate the spread or establishment of invasive or non-native species, which could then alter area hydrology, fire regime, and biodiversity.

Alternative D

Alternative D would have the same effects as alternative B (modified), except alternative D contains no recommended wildernesses. In alternative D, the recommended wilderness areas of alternative B (modified) would be guided by applicable forestwide or management area plan direction rather than plan components relating to recommended wilderness.

Aspen

Aspen occurs in Ponderosa Pine, Mixed Conifer with Frequent Fire, Mixed Conifer with Infrequent Fire, and Spruce-Fir ERUs, and in other moist cool locations. Aspen provides habitat for wildlife as well as scenic beauty for humans, and is a vital part of several plant communities. It is an early seral species with the ability to pioneer disturbances, but it is replaced later by slower growing tree species (Perala 2009). It is a shade-intolerant species that occurs as groups or clones. A single clone may cover a number of acres. Its distribution can vary in space and time and is influenced by soil type, soil moisture, low temperatures, and disturbances (primarily wildfires, but occasionally flooding) that stimulate root sprouting and colonization. Aspen sites may or may not have a significant conifer component, depending on successional status.

Affected Environment

Amount

Due to low commercial value and past fire suppression, the total number of acres covered and recruitment of new stands were thought to have been reduced compared to historical coverage. An accelerated aspen decline on the Coconino NF was documented between 2003 and 2007, due to a combination of a significant frost event, long-term drought, and bouts of defoliation from western tent caterpillars (Lynch et al. 2007, Fairweather et al. 2007). This reduced spatial coverage and numbers of plants on the forest. This was more pronounced on low-elevation dry sites than wetter high-elevation sites. Regeneration from sprouting is occurring following wildfires as is recruitment of aspen stems into taller size classes. The existing plan estimates 4,487 acres on the forest (1987 Plan, page 142). The abundance of aspen is categorized as rare, because it occurs on less than 1 percent of the forest.

Habitat Quality and Distribution

Widespread death of mature aspen trees, chronic browsing by ungulates (Fairweather et al. 2007), and advanced conifer reproduction could result in loss of vigor or further loss of aspen. The vegetation quality is classified as poor and trending away from desired conditions due to the widespread mortality.

Using the analysis process described under the Species Viability section above, table 20 shows that the vegetation quality of aspen is classified as poor. This means it has a high departure from desired conditions and the number, size, and evenness of distribution of habitat areas across the landscape is greatly reduced. Aspen is trending away from reference conditions.

Soil quality is good in the four primary ERUs for which aspen is an early seral stage component.

Table 20 shows that there is a high likelihood that aspen habitat could be limiting to the associated species. The likelihood that habitat would be limiting to the associated species was derived by combining the value for habitat abundance with the value for vegetation quality. Vegetation quality was used instead of soil quality, because vegetation is assumed to respond faster than soil to treatments or disturbances, and thus, would better reflect differences between alternatives.

Table 20 also compares management effect by alternative. Management effect categorizes the relative expected outcome of plan language in each alternative in terms of maintaining habitat quality and is the result of plan decisions, including plan objectives. Management effect category values are 1, 2, 3, and 4. The lower the management effects rating, the more effective the alternative is for maintaining the habitat. The effects of the alternatives are explained in greater detail in the discussions on the alternatives that follow.

Table 20. Summary of coarse filter analysis for aspen

Habitat	Existing	Alternative A	Alternatives B (modified), C, and D	Associated Species
Abundance	Rare	Rare	Rare	Rusby's milkvetch, evening grosbeak, Alberta arctic
Quality-vegetation	Poor, trending away	Poor, trending away	Poor, trending away	
Quality-soil	Good, static	Good, static: MCFF, MCIF, SF, and PP low objective Good, slowly toward: PP high objective	Good, static: PP low objective Good, toward: PP high objective toward. Good, slowly toward: MCFF, MCIF Good, static: SF	
Likelihood of Limitation	High			
Management effect		3: Plan components maintain or improve protection and management for some habitat occurrences in the plan area.	2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.	

Risk Factors

Primary threats to aspen are ungulate herbivory and fire exclusion. Monitoring of permanent plots in the Schultz Fire have shown that ungulate browse damage has likely contributed to the decrease in regeneration density (USDA Forest Service 2015a).

Associated Species

Associated species are listed in table 20.

Environmental Consequences

Because aspen is an early seral species in four ERUs and not itself an ERU, additional environmental consequences for aspen can be found in the environmental consequences section for the applicable ERUs.

Common to All Alternatives

Plan components in all alternatives contribute to species viability by managing habitat to maintain viable and sustainable populations of wildlife and fish species and by improving and protecting habitat for threatened, endangered, and sensitive species (1987 Plan, pages 22-1, 23; FW-Eco-DC-1; FW-WFP-DC-1, 2, 3, 5, 6, 8; FW-WFP-G-3, 10). See At-risk Species in the Wildlife and Plant Issues and Topics section above for more information.

All alternatives provide guidance for the management of aspen, which is an early seral species in Ponderosa Pine, Mixed Conifer Frequent Fire, Mixed Conifer Infrequent Fire, and Spruce-Fir ERUs. The intent of the guidance for all alternatives is similar (1987 Plan, pages 141 to 144; FW-TerrERU-AspMpl-DC-1 to 3; FW-TerrERU-AspMpl-G-1). Aspen regeneration would be protected from herbivory by fencing, by modifying grazing capacity, and by piping water to areas

outside the stand. Stand diversity would provide suitable habitat for wildlife, while maintaining or enhancing firewood production, age class distribution, and sustained-yield of firewood. Snags greater than 12 inches d.b.h. and nest trees would be retained. Harvesting would generally occur from August 15 to May 15 to maximize sprouting. Roads, spur trails, landings, and fuel treatments would be located or implemented to have the least impact on the site (1987 Plan, pages 142 to 144). Alternatives B (modified), C, and D also emphasize regeneration, protection from herbivory, and age class diversity. Although firewood is not explicitly mentioned in alternatives B (modified), C, or D, fuelwooding could be a tool to meet the objective to restore at least 1,000 acres of aspen and maple during each 10-year period over the life of the plan (FW-TerrERU-AspMpl-O-1).

Alternative A

Using the analysis process described under the Species Viability section above, table 20 shows that under alternative A, the vegetation quality of aspen would be poor and trend toward desired conditions. This means that overall there is a high departure from desired conditions and the number, size, and evenness of distribution of habitat areas across the landscape would be reduced compared to desired conditions.

Soil condition and productivity would continue to be in good condition with a static trend relative to desired conditions in Mixed Conifer with Frequent Fire, Mixed Conifer with Infrequent Fire, Spruce-Fir, and Ponderosa Pine under the low treatment objective. The trend would slowly move toward desired conditions under the high treatment objective in Ponderosa Pine because more acres are being treated.

There is a high likelihood that aspen would be a limiting factor to the viability of the associated species. Vegetation quality was used instead of soil quality, because vegetation is assumed to respond faster than soil to treatments or disturbances, and thus, would better reflect differences between alternatives.

The management effect for aspen is a 3 under alternative A, which means the plan components maintain or improve protection and management for some habitat occurrences in the plan area. However, alternative A contributes less to the maintenance and sustainability of aspen and the viability of the associated species than the other alternatives.

Alternative A provides guidance for the management of aspen (1987 Plan, pages 141 to 144). The intent of the guidance is that aspen regeneration should be promoted, protected from excessive herbivory from livestock or wildlife; and a variety of tools can be used including clear cutting, prescribed fire, wildfire (except in the wildland-urban interface), and fuelwooding to manage aspen. Aspen that is treated and protected through fencing or other means would be maintained and expected to regenerate successfully. Aspen that is not treated and/or not protected would eventually decline due to excessive herbivory or being naturally shaded out by conifers. Some aspen stands have been subject to drought, insect defoliators, excessive browsing, and altered fire regimes that have exceeded the capacity of the root reserves to maintain stand vigor. Alternative A also has guidance to retain snags greater than 12 inches d.b.h. and nest trees and to follow the snag standards and guidelines in Management Area 3, Ponderosa Pine and Mixed Conifer less than 40 percent slope (1987 Plan, page 131). Some plan components in alternative A support the maintenance and improvement of aspen through a regulated, sustained-yield approach to enhance firewood production and wildlife habitat, a conversion of 254 acres per decade from mixed conifer or pine to aspen (1987 Plan, pages 118, 130).

Alternative A lacks plan components in Spruce-fir that would contribute to the maintenance or sustainability of aspen as it shifts in time and space. Spruce-fir occurs in the Kachina Peaks Wilderness and although wildfire would be allowed to play its natural role within the wilderness (1987 Plan, page 112), limitations in alternative A would limit the acreage of fires implemented in this ERU. Wildfires managed for resource objectives in wilderness are difficult to implement; however, they are not explicitly prohibited under alternative A. No wildfires have been managed to meet resource objectives in wilderness areas on the forest since the existing Plan was signed in 1987. Therefore, few open areas that support aspen regeneration would be expected.

Prescribed fire and wildfires managed for resource objectives may be used in the ERUs that support aspen, but there is no provision for using wildfires managed for resource objectives in the wildland-urban interface (1987 Plan, pages 92, 155, 165) and the language to manage wildfires for resource objectives in wilderness impedes the use of this tool (1987 Plan, pages 111, 112). This plan language limits the restoration of fire as a natural process in the wildland-urban interface and in wilderness, and canopy cover and shrub density would be expected to increase in these areas, shading out aspen. There would also be increased potential for uncharacteristic fire in the wildland-urban interface and wilderness portions of this ERU, which could be beneficial for aspen.

Although language in the 1987 Plan supports aspen, a portion of mixed conifer and ponderosa pine would be managed to maintain habitat for Mexican spotted owls, a species that requires cool microsites, late seral vegetation, and high canopy cover in much of its habitat. The portions of ponderosa pine, mixed conifer, and spruce-fir in designated wilderness would be managed to maintain wilderness characteristics and the use of motorized or mechanized equipment is prohibited. No vegetative treatments or only light treatments would be expected in these areas resulting in late seral stages, higher canopy closure, and less favorable conditions for early seral species like aspen, and decreased likelihood of restoring the historic fire regime and vegetation structure depending on site-specific conditions.

Alternative B (modified)

Using the analysis process described under the Species Viability section above, table 20 shows that alternative B (modified) has the same vegetation quality as alternative A. Soil quality would be good and static for Spruce-Fir and Ponderosa Pine under the low treatment objective; good and toward desired conditions for Ponderosa Pine under the high treatment objective; and good and slowly toward desired conditions for both mixed conifer types.

There would continue to be a high likelihood that aspen would be a limiting factor to the viability of the associated species. The management effect for alternative B (modified) is a 2, which means that plan components in alternative B (modified) maintain or improve protection and management for most habitat occurrences in the plan area. This alternative contributes more to the viability of the associated species than alternative A.

Outdated plan components for the ERUs that support aspen have been removed, and updated plan components better reflect current science. Alternative B (modified) emphasizes ecological conditions and composition, structure, and function of the ERUs using current science, in contrast to alternative A and emphasizes characteristic fire as a key disturbance mechanism that shapes the fire-adapted ERUs.

Alternative B (modified) removes the plan language limitations that restrict the use of wildfire managed for resource benefits in designated wilderness, allowing wildfire to play its natural role in wilderness where it is feasible to do so (SA-Wild-DC-4). In contrast to alternative A, alternative B (modified) removes the restrictions that prohibit the use of wildfires managed for resource benefits in the wildland-urban interface. This could facilitate the use of fire for restoration or fuels reduction and would help maintain openings, improve conditions for aspen, improve resilience, and reduce vulnerability to uncharacteristic fire in these areas. Motorized and mechanized use would still be prohibited as per wilderness law and policy.

Alternative B (modified) is similar to alternative A in that it provides guidance for the management of aspen (FW-TerrERU-AspMpl-DC 1 to 3 and FW-TerrERU-AspMpl-G-1). The intent of the guidance is that aspen regeneration should be promoted and protected from excessive herbivory from livestock or wildlife. Alternative B (modified) emphasizes that aspen extent and location may shift over time, depending on human and natural disturbances more so than alternative A (FW-TerrERU-AspMpl-DC-2).

Alternative B (modified) has a desired condition that describes characteristics of older aspen as including old trees, snags, coarse woody debris, and logs, and that the amounts of these characteristics and tree density vary depending on microsite, time since disturbance, and age of the stand (FW-TerrERU-AspMpl-DC-3). This desired condition also specifies that aspen snags greater than 12 inches d.b.h. are a well-distributed component.

Unlike alternative A, alternative B (modified) has desired conditions for Spruce-fir ERU that promote natural levels of disturbances, multiple species (including aspen), and a mosaic of seral stages from young to old (FW-TerrERU-SF-DC-1, 5, 6, and 8). This would promote regeneration of aspen.

In contrast to alternative A, alternative B (modified) has desired conditions for two mixed conifer types recognizing that the natural disturbances and distribution of these types vary and result in distinct composition and structures. Plan components support fire regimes that would maintain and support aspen in Mixed Conifer Frequent Fire and allows for even-aged forest structure in small patches (often characteristic of aspen) (FW-TerrERU-MC-MCFF-DC-5). Plan objectives would enhance aspen regeneration through prescribed cutting in Mixed Conifer Frequent Fire over 2,900 to 15,000 acres during each 10-year period over the life of the plan and through prescribed fire (8,000 acres) and naturally ignited fires (at least 7,500 acres) within the natural fire regime during each 10-year period over the life of the plan (FW-TerrERU-MC-MCFF-O-1, 2, 3). Plan components for Mixed Conifer Infrequent Fire also promote natural disturbances and fire regimes that encourage the regeneration of aspen (FW-TerrERU-MC-MCIF-DC-4, 5).

Desired conditions for aspen and maple would promote all age classes in groups or patches that shift across the landscape as a result of natural levels of disturbance and mechanical treatments and is reproducing successfully. A plan objective would restore 1,000 acres of aspen and maple during each 10-year period over the life of the plan and where needed, regeneration and recruitment should be protected from excessive herbivory (FW-TerrERU-AspMpl-DC-1 through 3, O-1, and G-1).

Alternative C

Alternative C is the same as alternative B (modified).

Alternative D

Alternative D is the same as alternative B (modified).

Ponderosa Pine

Affected Environment

Amount

Ponderosa Pine is the largest ERU on the forest, covering approximately 797,171 acres (or approximately 43 percent) of the forest. There are 860,099 acres of this ERU within the forest boundary and the Coconino NF manages about 93 percent (797,171 acres) of that, with the remaining 7 percent in mixed ownership (State, private, Navajo Army Depot, city, and county).

Table 21 summarizes the information used to estimate the likelihood that Ponderosa Pine ERU would be a limiting factor to the viability of the associated species. The abundance is categorized as Common because, at 797,171 acres, it occupies 43 percent of the forest. Habitats classified as Common generally cover more than 10 percent of the forest and are abundant and frequently encountered.

Habitat Quality and Distribution

According to reference conditions, Ponderosa Pine primarily occurred as open, all-aged forests, with a widespread herbaceous understory. In addition to the dominant overstory species (ponderosa pine), other trees include: Gambel oak; Douglas-fir; pinyon pine; Utah Rocky Mountain and alligator juniper; and aspen in small, localized areas. Snags (or dead standing trees) are also present. Understory vegetation includes a mixture of shrubs and grasses including: manzanita, Fendler’s ceanothus, Arizona fescue, mountain muhly, screw leaf muhly, and blue grama. In some areas, Ponderosa Pine occurs as savannah with extensive grasslands interspersed between widely spaced clumps or individual trees (USDA Forest Service 2009a). Its composition and structure was maintained by frequent, low-intensity fires and endemic levels of insects and disease. Ponderosa Pine is characterized by low-severity fire that occurs every 0 to 35 years. Early reports indicate that bark beetle activity was less frequent, extensive, and damaging in the Southwest than other western regions (USDA Forest Service 2009a). This includes periodic outbreaks, especially with droughts, or in the absence of controlling disturbance agents. There were widespread bark beetle outbreaks on the forest in the mid-1920s, late 1930s, mid-1960s, late 1970s through the early 1980s, and late 1990s through the mid-2000s (Lynch et al. 2007). Dwarf mistletoe abundance is probably greater today than in the 1800s, mostly because there are more trees now.

Using the analysis process described under the Species Viability section above, table 21 summarizes vegetation and soil quality. The vegetation quality of Ponderosa Pine is classified as poor, which means there is a high departure relative to reference conditions and that the number, size, and evenness of distribution of the habitat areas is greatly reduced. This ERU is trending away from reference conditions because canopy cover is higher, trees are denser and more continuous, fuel loads are higher, and there are more even-aged stands of trees because fire has been excluded. Consequently, Ponderosa Pine is generally less resilient to drought and less sustainable over time. Trees are under competitive stress and more susceptible to uncharacteristic wildfire, uncharacteristic insect and disease outbreaks, and invasive species. Understory abundance, distribution, and diversity is reduced because higher canopy cover levels reduce the

amount of sunlight reaching the forest floor and buildups of dense mats of pine needle litter suppress vegetation.

Soil is considered in good condition with a static trend relative to reference conditions. In most areas, surface organic matter and litter are similar to reference conditions due to high amounts of protective litter cover protecting the soil from accelerated erosion. Nutrient cycling is nearly impaired where there is closed canopy (about 70 percent of the ERU). Closed canopy areas have reduced solar radiation and produce high amounts of litter or duff, which can prohibit germination and establishment of herbaceous vegetation that holds soil in place and carries fire. Areas with closed canopies and high densities of trees, however, do not affect the ability of the soil to produce tree biomass. There is a reduction in understory and forage and possibly coarse-woody material (greater than 3 inches diameter), but not enough to affect long-term soil productivity.

Ponderosa Pine occurs in several soil types. Several of the plants associated with Ponderosa Pine are also specific to rocks and soil derived from dolomitic limestone (the endemic Flagstaff pennyroyal), basalt soils associated with the San Francisco Peaks volcanic field (Rusby's milkvetch), and cinder soils associated in the Sunset Crater Volcanic Field (Sunset Crater beardtongue, Diamond Valley suncup, Serrate phacelia). Soil condition in these soil types are assumed to be the same as in the rest of the ERU.

Table 21 shows that there is a moderate likelihood that Ponderosa Pine habitat could be limiting to the associated species. The likelihood that habitat would be limiting to the associated species was derived by combining the value for habitat abundance with the value for vegetation quality. Vegetation quality was used instead of soil quality, because vegetation is assumed to respond faster than soil to treatments or disturbances, and thus, would better reflect differences between alternatives.

Table 21 also compares management effect by alternative. Management effect categorizes the relative expected outcome of plan language in each alternative in terms of maintaining habitat quality and is the result of plan decisions, including plan objectives. Management effect category values are 1, 2, 3, and 4. The lower the management effects rating, the more effective the alternative is for maintaining the habitat. The effects of the alternatives are explained in greater detail in the discussions on the alternatives that follow.

About 31,087 acres (about 4 percent of the ERU) of Ponderosa Pine occur in nine designated wildernesses. These wildernesses are Fossil Springs Wilderness (4,589 acres, less than 1 percent of ERU), Kachina Peaks Wilderness (114 acres, less than 1 percent of ERU), Kendrick Mountain Wilderness (83 acres, less than 1 percent of ERU), Munds Mountain Wilderness (328 acres, less than 1 percent of ERU), Red Rock-Secret Mountain Wilderness (12,341 acres, almost 2 percent of ERU), Strawberry Crater Wilderness (2,515 acres, less than 1 percent of ERU), Sycamore Canyon Wilderness (5,580 acres, less than 1 percent of ERU), West Clear Creek Wilderness (5,479 acres, less than 1 percent of ERU), and Wet Beaver Wilderness (59 acres, less than 1 percent of ERU).

About 49 acres of Ponderosa Pine occur within the Red Mountain Geological Area and 1,027 acres occur within the Oak Creek Research Natural Area.

About 1,441 acres occur with three environmental study areas: Elden (488 acres), Griffith (298 acres), and Old Caves (655 acres).

Table 21. Summary of coarse filter analysis for Ponderosa Pine ERU

Habitat	Existing	Alternative A	Alternatives B (modified), C, and D	Associated Species
Abundance	Common	Common	Common	Mexican spotted owl, bald eagle, northern goshawk, Allen's lappet-browed bat, Navajo Mogollon vole, western red bat, Arizona phlox, Arizona sneezeweed, Flagstaff beardtongue, Flagstaff pennyroyal, hairy clematis (Arizona leatherflower), Mt. Dellenbaugh sandwort, Rusby's milkvetch, Sunset Crater beardtongue, golden eagle, southwestern myotis, black dropseed, creeping milkvetch, Diamond Valley suncup, Flagstaff cinquefoil, James rubberweed, Jones' wild buckwheat, MacDougal's aletes, Oak Creek triteleia, serrate phacelia, western mousetail
Quality-Vegetation	Poor, away	Low objective: Poor at short term then Fair at long term/trending toward High objective: Fair/trending toward	Low objective: Poor at short term then Fair at long term/trending toward High objective: Fair/trending toward	
Quality-Soil	Good, static	Good, static (low treatment objective. Good, toward desired conditions (high treatment objective)	Good, static (low treatment objective. Good, toward desired conditions (high treatment objective)	
Likelihood of Limitation	Moderate	Low objective: Moderate at short term then Low-Moderate at long term High objective: Low-Moderate	Low objective: Moderate at short term then Low-Moderate at long term High objective: Low-Moderate	
Management effect		3: Plan components maintain or improve protection and management for some habitat occurrences in the plan area.	2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.	

Risk Factors

Primary threats to Ponderosa Pine ERU are: uncharacteristic wildfire; invasive, exotic species; and insects and disease.

Associated Species

Associated species are listed in table 21.

Environmental Consequences

Analysis related to the risks arising from non-native invasive plant species are addressed under the Non-native or Invasive Species topic in the Wildlife and Plant Issues and Topics section.

Common to All Alternatives

Plan components in all alternatives contribute to species viability by managing habitat to maintain viable and sustainable populations of wildlife and fish species and by improving and protecting habitat for threatened, endangered, and sensitive species (1987 Plan, pages 22-1, 23; FW-Eco-

DC-1; FW-WFP-DC-1, 2, 3, 5, 6, 8; FW-WFP-G-3, 10). See At-risk Species in the Wildlife and Plant Issues and Topics section for more information.

All alternatives address the threat of invasive plants. Invasive plants can increase as a consequence of ground disturbance and, once established, would compete with native species for water and nutrients or could alter the fire regime. All alternatives address the threat of invasive plants by pointing to the Final Environmental Impact Statement for the Treatment of Noxious or Invasive Weeds (USDA Forest Service 2005). This direction includes best management practices, among other guidance, which would help prevent, mitigate, and reduce the threat of invasive plants. All alternatives prioritize treatments, call for incorporating control measures in project planning and implementation, and emphasize coordination with partners (1987 Plan, pages 23, 69, 70, 182, 206-14, 206-76, 206-101, 201-116; FW-Invas-DC-1, 2; FW-Invas-G-1, 2, 3; FW-Invas-MgtApp; FW-Graz-MgtApp; FW-RdsFac-G-8; FW-Rec-Dev-DC-9; FW-Rec-Dev-G-2). Additional information and analysis is discussed under the Non-native or Invasive Species topic in the Wildlife and Plant Topics and Issues section.

Plan language under all alternatives directs implementing site-specific best management practices for ground-disturbing projects (1987 Plan, page 71; FW-Soil-G-1, 2, 3). Implementation of this direction would avoid or limit ground-disturbing activities that could cause loss of protective vegetative ground cover. This direction would also avoid or limit detrimental impacts to soil condition and productivity, including to soils with high burn severity, sensitive soils with moderate or severe erosion hazard, and calcareous soils that have high wind erodibility when exposed. Where such disturbances cannot be avoided, project-specific best management practices should be developed. Finally, specific project design features would be required on projects occurring on slopes greater than 40 percent grade where soils with moderate or severe erosion hazard ratings occur or where soils are sensitive to degradation when disturbed. This would help maintain good soil condition in this ERU.

Designated wilderness areas would be managed according to applicable laws, policy and Forest Plan direction to preserve wilderness resource values and wilderness quality, and to emphasize wilderness recreation (1987 Plan, pages 105 to 112; SA-Wild-DC-1 to 11; SA-Wild-DC-S-1, 2; SA-Wild-DC-G-1 to 7). Wilderness designation limits most active vegetation management because motorized and mechanized use is not allowed. Motorized and mechanized access can kill or damage plants, can degrade the habitat through soil compaction and soil loss, and can introduce non-native species that compete with native plants for resources. This can negatively affect the reproduction and survival of individual plants or populations. Ground-disturbing activities are primarily confined to main trails, trailheads, and key points of interest at which invasive species introduction and establishment, or accelerated erosion could occur depending on the level of use. The lack of ground-disturbing activities elsewhere would be beneficial by reducing the risk of invasive plant introduction and dispersal by motorized or mechanized use. However, limited access associated with designated wilderness could preclude restoration treatments that require motorized equipment for treatments or for safety or make them harder to do logistically. Lack of restoration treatments could result in missed fire return intervals, an unnatural increase in fuels, increased density of shrubs and trees, or establishment and spread of invasive or non-native species. This could slow the trend toward desired conditions or increase the risk of uncharacteristic fires in localized areas more so than in the other alternatives. Uncharacteristic fire could facilitate the spread or establishment of invasive or non-native species, which could then alter area hydrology, fire regime, and biodiversity. Kendrick Mountain Wilderness is managed under the Kaibab National Forest Plan.

All alternatives include the already designated Oak Creek Research Natural Area and the proposed Rocky Gulch Research Natural Area, which has 925 acres of Ponderosa Pine. All alternatives include guidance for management of research natural areas that would be beneficial for Ponderosa Pine by allowing natural processes and natural conditions to prevail. This guidance would minimize recreational impacts by restricting camping, prohibiting recreation fires, and limiting non-commercial group size (1987 Plan, page 196-1; SA-RNABotGeo-S-1; SA-RNABotGeo-G-6). In addition, access should be restricted as needed to maintain their natural, unmodified condition, and commercial tours would be prohibited except in support of approved research (1987 Plan, page 196-2; SA-RNABotGeo-S-2). This guidance would reduce the potential for human-caused fires and maintain the natural conditions for which the RNA was designated, which include properly functioning soils and vegetation. This guidance would also mitigate soil compaction, soil loss, and vegetation damage from some recreational activities. Designated wilderness direction would prevail in the Oak Creek RNA, which occurs in the Red Rock-Secret Mountain Wilderness.

Alternative A

Using the analysis process described under the Species Viability section above, table 21 shows that under the low treatment level in alternative A, the vegetation quality of Ponderosa Pine would be poor and trend toward desired conditions, while under the high treatment level, the vegetation quality would improve to fair with a trend toward desired conditions. This means that under the low treatment level, Ponderosa Pine would have a high departure from desired conditions in the short term, and the number, size, and evenness of distribution of habitat areas across the landscape would be reduced compared to desired conditions. However, this would improve to a moderate departure in the long term. Under the high treatment level, the vegetation quality of Ponderosa Pine would be fair in both the short and long term with a trend toward desired conditions. This means that Ponderosa Pine would improve faster with more treatment and would have a moderate departure from desired conditions and the number, size, and evenness of distribution of habitat areas across the landscape would be somewhat reduced compared to desired conditions.

Soil condition and productivity would continue to be in good condition with a static trend relative to desired conditions. The duff layer is sufficient to protect against accelerated soil erosion and loss of soil productivity. In treated or open areas, the nutrient cycling function, water infiltration, and herbaceous understory would improve. In untreated or high canopy closure areas, these factors would not improve.

There is a low-moderate likelihood that Ponderosa Pine could be a limiting factor to the viability of the associated species under the high treatment level. Under the low treatment level, there is a moderate likelihood in the short term, improving to a low-moderate in the long term. This likelihood was derived by combining the value for habitat abundance with the value for vegetation quality. Vegetation quality was used instead of soil quality, because vegetation is assumed to respond faster than soil to treatments or disturbances, and thus, would better reflect differences between alternatives.

The management effect for alternative A is a 3, which means that plan components in alternative A maintain or improve protection and management for some habitat occurrences in the plan area. This alternative contributes less to the viability of the associated species than the other alternatives. The plan components that contribute to this management effect are discussed below.

The 1987 Plan emphasizes timber production, other forest products, livestock grazing, recreation, and wildlife habitat (1987 Plan, pages 117 to 118). It does not emphasize restoration and lacks descriptions of structure, patterns, and function at various spatial scales. Alternative A describes two Ponderosa Pine subtypes: pure pine and pine with Gambel oak. It also recognizes aspen as distinct seral stage in some areas (1987 Plan, pages 116, 141). All of Ponderosa Pine is recognized as being part of a fire-dependent ecosystem.

While Ponderosa Pine does not have specific treatment objectives under alternative A, it is expected that a substantial portion of the Ponderosa Pine ERU would receive treatment through the actions associated with an ongoing project, the Four-Forest Restoration Initiative. The treatments are the same as plan objectives for alternatives B (modified), C, and D (FW-TerrERU-PP-O-1, 2, 3). The objectives are:

- Use prescribed cutting to treat 50,000 to 260,500 acres of Ponderosa Pine during each 10-year period over the life of the plan.
- Use prescribed fire to underburn 150,000 to 200,000 acres of Ponderosa Pine within the natural fire regime during each 10-year period over the life of the plan.
- Use naturally ignited wildfires (i.e., lightning-caused fires that are managed for resource objectives) to treat 135,000 acres of Ponderosa Pine within the natural fire regime during each 10-year period over the life of the plan.

For the low treatment objective, open stands would represent about 28 percent of the ERU in the short term, 35 percent in the long term, and closed-canopy conditions would represent the majority of the ERU. For the high treatment objective, this would be about 40 percent of the ERU in the short term and 47 percent in the long term. The percent of open stands represents the sum of the following states: grass, forb, brush/shrub, open seedling and sapling, open medium trees, and open very large trees (both single and multistory). The amount of open canopy under the low treatment objective in the short term is not an improvement over existing conditions but conditions would improve in the long term. Conditions would improve under the high treatment objective as well in both the long and short term. The abundance, distribution, and vigor of understory vegetation would improve in open areas and would provide food and cover for a variety of wildlife species. Treatments would improve conditions for Gambel oak, which grow better in more open conditions, and aspen, an early seral species. Improved resilience to drought, insects and disease, and uncharacteristic disturbances are expected where more open stand conditions are created.

Larger tree classes are projected to increase over existing conditions in the short and long term under both low and high treatment objectives. Progress toward uneven-aged conditions (multi-storied states) is also projected to increase over existing conditions in the short and long term under both low and high treatment objectives.

Management direction in alternative A is uneven, i.e., part of it is updated and better reflects current science and part of it is outdated. For example, some plan components promote management based on 10,000-acre (10K) blocks that were established across the forest in the 1980s (1987 Plan, page 70) in which vegetation is managed to achieve various resource objectives such as snags, old growth, and wildlife cover (1987 Plan, pages 123, 124 to 127). Management using10K blocks assured that various habitat elements were distributed equitably across the landscape, but the 10K block concept is no longer used and has been replaced with analysis areas driven by other purposes. These purposes could include reducing fire risk around

specific communities, landscape-level restoration, or the need to improve management in specific watersheds.

Additional direction for basal area and growing stock level density is provided for wildlife hiding and thermal cover required on 30 percent of each 10K block, but it is designed for even-aged ponderosa pine and mixed conifer (1987 Plan, pages 124, 124-1, 125) rather than the uneven-aged conditions promoted in desired conditions.

The 1987 Plan provides direction in mixed conifer and pine-oak forests that allows for a variety of stand conditions across the landscape (1987 Plan, page 65-3), while mimicking natural disturbance patterns that result in irregular tree groups and canopy gaps (1987 Plan, page 65-4). This direction does not apply to pure pine. Uneven-aged management is emphasized and standard prescription guidelines are provided for ponderosa pine under various scenarios (1987 Plan, pages 65-7, 65-10, 130 to 135).

Portions of the 1987 Plan manage Gambel oak for firewood and wildlife habitat with detailed silvicultural prescriptions. The emphasis on firewood is not be beneficial for Gambel oak because the use of the forest has increased substantially since the plan was written, oak firewood is harder to find, and signs of fuelwood theft are common in certain areas of the forest. Beneficial guidelines include snag retention and rotation age of 240 to 360 years (for large oaks) (1987 Plan, page 131). Gambel oak would be maintained for vegetation diversity and/or mast production in management areas 6 (Unproductive timber land) and 7 (Pinyon-Juniper Woodland, less than 40 percent slope) (1987 Plan, pages 147, 152).

Under alternative A, ponderosa pine that is not classified as Mexican spotted owl habitat or wilderness is managed for northern goshawk habitat, which provides guidance for structural diversity. Plan direction emphasizes uneven-aged structure, retention of snags, and minimum levels for logs and woody debris for various habitat categories (1987 Plan, pages 65-9 to 65-11). General direction is provided to manage for old age trees such that as much old forest structure as possible is sustained over time across the landscape and to sustain a mosaic of vegetation densities (overstory and understory), age classes and species composition across the landscape (1987 Plan, pages 65-7, 70-1, and 70-2). Specific direction is provided in terms of canopy cover provided by different vegetation structural stages (VSS) (1987 Plan, pages 65-9 to 65-11). However, the forest no longer uses VSS. For the purposes of this forest plan analysis, VSS are represented by vegetation states. A crosswalk between VSS and vegetation states can be found in appendix C.

Some of the plan language in alternative A would manage old growth as 100- to 300-acre stands over no less than 20 percent of each forested ecosystem management area (1987 Plan, pages 70-1, 129). Consequences of this plan direction are described in detail in the Vegetation and Fire section in Volume I of the FEIS. This strategy would provide less ability than alternative B (modified) to promote vertical structure and age class diversity; would tend to maintain a more continuous canopy than alternative B (modified) that would be more conducive to crown fires; and would result in more even-aged conditions. This structure and age class diversity is not reflective of frequent low-severity fires characteristic of this ERU. During wildfires, there is likely to be more area in mixed-severity condition with 25 to 75 percent loss of dominant overstory, compared to loss of 25 percent or less, which is characteristic of low-severity fires. Old-growth stands would be less resilient to endemic levels of disturbances. There would be fewer openings and less understory. The 1987 Plan also contains more updated plan language for

old-growth. Alternative A would manage old growth in patterns that provide for a flow of functions and interactions at multiple scales through time across the landscape, and would allocate old growth as landscape percentages rather than specific acres, based on site capability, risks, and disturbance regime. A table that displayed the minimum criteria for structural attributes would be used for a forested site to be considered old growth (1987 Plan, pages 70-1, 70-2).

Prescribed fire and wildfires managed for resource objectives may be used in Ponderosa Pine, but there is no provision for using wildfires managed for resource objectives in the wildland-urban interface (1987 Plan, pages 92, 155, 165) and the language to manage wildfires for resource objectives in wilderness impedes the use of this tool (1987 Plan, pages 111, 112). This plan language limits the restoration of fire as a natural process in the wildland-urban interface and in wilderness, and canopy cover and shrub density would be expected to increase in these areas. There would also be increased potential for uncharacteristic fire in the wildland-urban interface and wilderness portions of this ERU. This is particularly problematic where the landownership pattern is intermixed with different ownerships. This is a negative impact on the composition and age class distribution of Ponderosa Pine, which is a fire-dependent ecosystem.

About 13 percent of Ponderosa Pine occurs in designated wilderness and Mexican spotted owl protected activity centers (PACs). Ten percent of restricted Mexican spotted owl habitat would be managed for replacement nesting and roosting habitat in which the basal area threshold is set to a minimum 150 square feet per acre (1987 Plan, page 65-4), which is higher than the 110 square feet per acre minimum threshold identified under the current recovery plan (USDI Fish and Wildlife Service 2012b).

Wilderness areas and PACs are managed for wilderness characteristics and Mexican spotted owl habitat and have different objectives and goals than areas outside of these areas. Management sideboards associated with these two categories would result in fewer or no treatments or more conservative silvicultural prescriptions than non-wilderness, non-PAC, and non-replacement nesting and roosting habitat areas. Light to no treatment may occur in Mexican spotted owl PACs under this alternative. The existing plan contains direction from the now-revised 1995 Mexican Spotted Owl Recovery Plan. This direction only allows treatments for fuelwood and fire risk abatement in PACs; only allows harvesting of conifers less than 9 inches d.b.h. in PACs selected for treatment; and allows treatments only outside of 100-acre no-treatment areas around known nest areas (1987 Plan, page 65-2). This outdated guidance does not reflect the 2012 revised recovery plan (USDI Fish and Wildlife Service 2012b), and the 9-inch diameter cap may restrict treatment needed to meet the stated objective of fire risk abatement.

As a result, no treatment areas, light treatment areas, and dense locations in designated wilderness areas would generally have a greater risk in the long term of uncharacteristic fire effects, higher than desired fire severity, and decreased likelihood of restoring the historic fire regime and vegetation structure, depending on site-specific conditions. There are about 31,087 acres of Ponderosa Pine in designated wilderness and 75,805 acres of PACs outside of designated wilderness in this ERU, for a total of 13 percent of the Ponderosa Pine ERU. These areas would not favor early seral species like aspen or the development of large oak, even though emphasis is placed on retaining relatively high densities and retaining and promoting large oaks (1987 Plan, pages 65 to 65-4).

An objective in Roads and Facilities would “decommission between 200 to 800 miles of a combination of unauthorized roads and system roads not identified on the motor vehicle use map

during the 10 years following approval." The motor vehicle use map is developed through a separate process established under the Travel Management Rule. Road decommissioning may be done in coordination with other management activities, such as the Four-Forest Restoration Initiative (4FRI) (FW-RdsFac-O-1). This analysis assumes that the majority of decommissioning would occur in Ponderosa Pine, because that is where most of the 4FRI-related activities are currently planned and that decommissioning effectively closes the road. This analysis also assumes that the average width of the footprint associated with a road identified for decommissioning would be 18 feet, which includes a 12-foot-wide road plus about 3 feet of drainage ditches or other disturbance on each side. Road decommissioning could be accomplished using a variety of techniques such as adding signs; placing boulders to obstruct access; ripping and re-contouring roadbeds; or re-establishing former drainage patterns, contours, slopes, and vegetation. A positive effect would be re-establishment of vegetation over a former roadbed. One mile of decommissioning equals 2.18 acres (5,280 feet in a mile multiplied by 18 feet per 43,560 square feet in an acre). Therefore, this plan objective could result in a gain of between 436 to 1,744 acres of habitat during the 10 years following plan approval.

Snag and log abundance within Ponderosa Pine could be affected by road decommissioning. Several authors have documented a direct correlation between snag availability and road access. Wisdom and Bates (2008) reported that snags were nearly three times more abundant in stands away from roads as they were in stands with roads and snags were less abundant in stands closer to towns or in flatter topography. Likewise, Chambers 2002, and Ganey et al. 2014 reported a similar relationship between human access and decreased snag and log availability in northern Arizona pine-oak habitat. Fuelwooding is one of the activities that could impact snag and log abundance. Current fuelwood regulations have limits on the locations and timing where fuelwood can be gathered and the size of snags that can be removed, and the snag sizes are based on forest plan direction.

There are about 50 acres of Ponderosa Pine in the Red Mountain Geological Area. Plan components in alternative A are generally protective of the features and the composition, structure, and function of the different vegetation types within geological areas. For example, existing conditions and natural processes would be maintained; natural events would not be rehabilitated; and off-road driving would be prohibited (1987 Plan, page 194). Visitors should be limited in some areas, depending on carrying capacity, and the uniqueness and ecological condition of these areas should be protected and maintained, including in allotment management plans. In addition, timber harvest and firewood cutting is prohibited (1987 Plan, page 195). Other protective measures include: Special-use authorizations that would or could adversely affect the areas would not be allowed; adjacent roads would be managed to prevent vehicular intrusion, and road access would be blocked and obliterated. Fire suppression tactics would minimize damage to character of the areas and prescribed fire with planned ignitions may be used as a management tool, provided it is a compatible use (1987 Plan, page 196). Collectively, these standards and guidelines mitigate the soil disturbance and plant damage that can result from these activities and maintain the conditions and characteristics for which this geological area was established.

Mechanized use in geological and botanical areas is not explicitly addressed in alternative A, resulting in vague direction to managers. It is unclear as to whether mechanized use is prohibited, is allowed only on trails, or is allowed on and off trail in these areas. Consequently, mechanized use could damage vegetation or contribute to accelerated soil erosion within localized areas in this ERU.

There are 1,441 acres of Ponderosa Pine in environmental study areas (Management Area 18). This is less than 1 percent of the ERU. Plan direction for these areas is generally protective and would maintain or improve the resilience of this ERU. Plan components would reduce the risk of uncharacteristic fire, improve watershed health, restore bare soil areas, reduce soil compaction, close areas to motorized vehicles, and protect unique features using fencing or other means. These areas are not currently open to livestock grazing. Special-use authorizations (new or amendments) that would or could adversely affect the areas would not be allowed. See 1987 Plan, pages 197, 198, and 199.

Alternative B (modified)

Using the analysis process described under the Species Viability section above, table 21 shows that alternative B (modified) has the same vegetation and soil quality as alternative A; i.e., vegetation quality would be in poor condition in the short term, then would improve to fair condition with a trend toward desired conditions under the low treatment objective. Under the high treatment objective, vegetation quality would be in fair condition and trend toward desired conditions. Soil quality would be good with a static trend relative to desired conditions. Consequently, there is a low-moderate likelihood that Ponderosa Pine could be a limiting factor to the viability of the associated species under the high treatment level. Under the low treatment level, there is a moderate likelihood in the short term improving to a low-moderate likelihood in the long term, also like alternative A. As described under alternative A, this is because the expected treatment levels in these two alternatives are the same.

The big difference between these alternatives is plan components. Outdated plan components have been removed. Updated plan components better reflect current science. The management effect for alternative B (modified) is a 2, which means that plan components in alternative B (modified) maintain or improve protection and management for most habitat occurrences in the plan area. This alternative contributes more to the viability of the associated species than alternative A. The plan components that contribute to this management effect are discussed below.

Alternative B (modified) emphasizes ecological conditions and composition, structure, and function of this ERU using current science, in contrast to alternative A (Reynolds et al. 2013) and emphasizes characteristic fire as a key disturbance mechanism that shapes Ponderosa Pine (FW-TerrERU-PP-DC-3, 6, 8, 9).

Alternative B (modified) updates plan language for Ponderosa Pine, provides desired conditions that acknowledge the unique composition and fire regimes in Ponderosa Pine types, and provide managers with more specific guidance to manage these sub-types where needed. This would be particularly beneficial for the wildlife species that prefer one type over another.

Vegetation structural stages are represented by seral states in alternative B (modified) (see Appendix C in Volume III of the FEIS) and vegetation structure is described at a variety of scales. For example, at the landscape scale, this alternative promotes a mosaic of age classes, variable structure (live and dead), and understory vegetation across the landscape that is resilient to disturbances and climate variability, and facilitates natural disturbances (FW-TerrERU-PP-DC-1 to 7). Desired conditions at the mid-scale account for variability across the landscape and describe characteristics of tree groups, openness, tree density, distribution of age classes, predominantly uneven-aged conditions, and conditions in northern goshawk habitat (FW-TerrERU-PP-8 to 12). Fine scale desired conditions describe conditions within and between tree

groups and the value of witch's brooms (FW-TerrERU-PP-DC-13, 14, 15). Witch's brooms are a deformity in a tree branch where a dense mass of shoots grow from a single point. This forms a broom or birds nest-like structure that is used by a variety of wildlife species for food or shelter. Witch's brooms may be caused by dwarf mistletoe or other organisms. Guidelines provide sideboards that would promote or sustain old-growth forest attributes like large trees, old trees, snags, large logs, uneven-aged conditions, pre-settlement trees, and occupancy of small wildlife species, and would reduce the risk of uncharacteristic bark beetle outbreaks (FW-TerrERU-PP-G-1 to 7). References to 100- to 300-acre stands for old-growth have been removed. Alternative B (modified) also removes language that requires the use of 10,000-acre blocks and vegetation structural stages for planning.

Plan language in alternative B (modified) promotes a variety of structural conditions across the landscape that reflect natural disturbance patterns that result in irregular tree groups and canopy gaps. However, this plan language allows for variability in group size and openness where needed for species-specific habitat requirements (FW-TerrERU-PP-DC-1, 2, 3, 4, 8, 9, 13). Similar language in alternative A was mainly associated with Mexican spotted owl restricted habitat (ponderosa pine Gambel oak), which, by definition, excluded pure pine.

There is improved guidance for Gambel oak in this alternative, compared to alternative A. Desired conditions in Ponderosa Pine ERU emphasize Gambel oak as well distributed and provide for sustainability by promoting all sizes and ages of oak trees in natural patterns of abundance and density. Other desired conditions provide for medium and large oak snags as a well-distributed habitat component where they naturally occur (FW-TerrERU-PP-DC-5, 7). Moderate to large live oak trees with dead limbs, hollow boles, and cavities will provide shelter and habitat for a variety of wildlife species. Another beneficial guideline would manage for Gambel oak trees and snags to be sustained over time (FW-TerrERU-PP-G-4). The alternative A emphasis on Gambel oak as firewood or non-industrial wood has been removed.

Alternative B (modified) removes the plan language limitations that restrict the use of wildfire managed for resource benefits in designated wilderness allowing wildfire to play its natural role in wilderness where it is feasible to do so (SA-Wild-DC-4). In contrast to alternative A, alternative B (modified) removes the restrictions that prohibit the use of wildfires managed for resource benefits in the wildland-urban interface. This could facilitate the use of fire for restoration or fuels reduction and would help maintain openings, improve resilience, and reduce vulnerability to uncharacteristic fire in these areas. Motorized and mechanized use would still be prohibited as per wilderness law and policy.

In addition to the 31,087 acres of designated wilderness, there are 97 acres of recommended wilderness: Abineau (68 acres of pine) and Strawberry Crater (29 acres of pine). Desired conditions emphasize undeveloped characteristics, ecological characteristics, native species, and little evidence of human presence or occupation, yet still allow for limited administrative use (SA-RWild-DC-1, 2, 3, 5). This could improve soil condition due to limited human use and reduce the effect of illegal fuelwooding due to reduced motorized access. However, it could increase the vulnerability of these areas to uncharacteristic fires in areas where thinning would be required prior to the use of fire. Due to the small area, recommended wilderness is likely to have little effect on the composition, structure, or function of Ponderosa Pine.

About 50 acres of Ponderosa Pine occur within the Red Mountain Geological Area. Under alternative B (modified), mechanized travel is not suitable in geological areas except on

designated trails (see Chapter 4 of the Revised Plan, Recreation and Transportation Suitability). Subsequent environmental analysis would need to be done for this direction to take effect. This suitability recommendation is considered to be protective of vegetation and soil because potential impacts would be limited to the trail prism. Damage to vegetation and accelerated erosion would be evaluated during the environmental analysis.

About 1,441 acres of Ponderosa Pine occur within three environmental study areas: Elden (488 acres), Griffith (298 acres), and Old Caves (655 acres). The plan direction for these areas is generally protective. For example, management activities and new special uses (and amendments) would be designed to retain and promote the character of these areas and to promote educational opportunities (MA-FlagN-G-1; MA-MtElden-G-4, 5). New transmission corridors would avoid environmental study areas to protect the settings and educational resources (MA-FlagN-G-2; MA-MtElden-G-6) and educational opportunities would be consistent with resource desired conditions, as well (MA-FlagN-DC-7; MA-MtElden-DC-7). This management direction would not affect the overall quality of this ERU because the percentage of the ERU that overlaps the environmental study area is less than 1 percent.

Alternative C

Alternative C has the same effects as alternative B (modified), except 13 wildernesses are recommended instead of 3. In addition to the 31,087 acres of Ponderosa Pine in designated wilderness, there are 4,462 acres in recommended wilderness (less than 1 percent of the ERU). The recommended wilderness acres are distributed among seven recommended wildernesses: Abineau (68 acres), Strawberry Crater (29 acres), Barbershop (849 acres), Deadwood Draw (245 acres), East Clear Creek (1,240 acres), Railroad Draw (1,205 acres), and Tin Can (826 acres). There would be about 4 percent of the ERU in either designated or recommended wilderness. Recommended wilderness would reduce impacts from motorized use by promoting motorized vehicle use only for limited administrative and permitted activities (SA-RWild-DC-1, 2, 5, 6; SA-RWild-G-1, 3, 5). Mechanized uses that maintain and do not detract from wilderness values would be allowable. However, new trails should be designed for non-motorized and non-mechanized activities that preserve wilderness character (SA-RWild-DC-6; SA-RWild-G-5). Implementation of these plan components would reduce disturbance to soil and vegetation from motorized or mechanized uses, which could be beneficial to associated species. If designated by Congress, the wilderness areas would be managed according to applicable laws, policy, and Forest Plan direction (SA-Wild-DC-1 to 11; SA-Wild-O-1, 2; SA-Wild-S-1 to 5; SA-Wild-G-1 to 11). However, limited access associated with recommended (and designated) wilderness could preclude restoration treatments that require motorized equipment for treatments or safety, or make them harder to do logistically. Site-specific circumstances would also influence which or whether restoration treatments might be precluded. Delay or absence of restoration treatments could result in missed fire return intervals, increased and unnatural levels of fuels, increased density of shrubs and trees, or establishment and spread of invasive or non-native species. This could slow the trend toward desired conditions or increase the risk of uncharacteristic fires in localized areas more so than in the other alternatives. Uncharacteristic fire could facilitate the spread or establishment of invasive or non-native species, which could then alter area hydrology, fire regime, and biodiversity.

Alternative D

Alternative D is the same as alternative B (modified) except there are no recommended wilderness areas. In alternative D, the recommended wilderness areas of alternative B (modified)

would be guided by applicable forestwide or management area plan direction rather than plan components relating to recommended wilderness.

Mixed Conifer All

Mixed Conifer with Frequent Fire

Affected Environment

Amount

On the Coconino NF, 49,826 acres of Mixed Conifer with Frequent Fire ERU are within the administrative boundary of the Coconino NF. The forest manages 49,595 acres, which is nearly 98 percent of the ERU. The remaining acres are in private ownership.

Table 22 summarizes the information used to estimate the likelihood that Mixed Conifer with Frequent Fire ERU would be a limiting factor to the viability of the associated species. The abundance is categorized as Occasional because, at 49,595 acres, it occupies about 2.7 percent of the forest. Habitats classified as Occasional generally cover 1 to 10 percent of the forest and are occasionally encountered.

Habitat Quality and Distribution

Mixed Conifer with Frequent Fire ERU primarily occurs on mountain slopes, canyons, and north-facing slopes. It occupies the warmer and drier sites of the mixed conifer life zone and is characterized by a relatively open structure and a historic fire regime of frequent, low-severity fires and infrequent, mixed-severity fires. These conifer forests are dominated by mainly shade-intolerant trees such as: ponderosa pine, southwestern white pine, limber pine, and Gambel oak, with a lesser presence of New Mexican locust. Shade-tolerant species such as Douglas-fir and white fir tend to increase when lack of fire or other disturbances facilitate development in older stages of succession. Aspen may occur as small groups in north-facing slopes, drainages, and other microsites where cooler, moister conditions prevail. Maple species may be found in swales and canyons. This ERU typically occurs with an understory of graminoids, forbs, and shrubs. The understory is similar to Ponderosa Pine ERU, but it generally occurs in cooler, moister, and often higher sites and has more sedges, mosses, and liverworts. Primary natural disturbances in this ERU are wildfire and endemic levels of insects and disease.

Douglas-fir dwarf mistletoe is thought to be currently more widespread and continuous in distribution than under reference conditions because of fire exclusion and the greater amount of dense multi-layered stands. The abundance of southwestern dwarf mistletoe is also likely higher (USDA Forest Service 2016c). Compared to reference conditions, current levels of insects and disease are outside the historic range of variability. The possible introduction of white pine blister rust, which was recently discovered for the first time in eastern Arizona, could further elevate mortality levels. White pine blister rust is one of the most damaging tree diseases in North America, affecting trees of all sizes, but has not been detected yet on the Coconino NF. Mixed Conifer with Frequent Fire has few weed species (USDA Forest Service 2009a).

Using the analysis process described under the Species Viability section above, table 22 shows that vegetation is classified in fair condition and trending away from reference conditions due to a lack of fire. This means that there is a moderate departure relative to reference conditions and that

the number, size, and evenness of distribution of the habitat areas is somewhat reduced. As a result of fire exclusion, shade-tolerant species, such as white fir, are increasing in the understory. Tree density is high in most places and conditions for early succession species like aspen are not being maintained or created. Aspen populations are declining in this ERU because of insect defoliators, drought, fire exclusion, and heavy ungulate browsing.

Soil is considered in good condition with a static trend relative to reference conditions. In most areas, surface organic matter and litter are similar to reference conditions due to high amounts of protective litter cover protecting the soil from accelerated erosion. The majority of soils are in satisfactory condition. Rusby's milkvetch is associated with Mixed Conifer with Frequent Fire where it overlaps the basalt soils associated with the volcanic field created by the eruption of the San Francisco Peaks on the north and west side of the San Francisco Peaks. Soil condition in this soil type is assumed to be the same as in the rest of the ERU.

Table 22 shows that there is a moderate likelihood that Mixed Conifer with Frequent Fire habitat could be limiting to the associated species. The likelihood that habitat would be limiting to the associated species was derived by combining the value for habitat abundance with the value for vegetation quality. Vegetation quality was used instead of soil quality, because vegetation is assumed to respond faster than soil to treatments or disturbances, and thus, would better reflect differences between alternatives.

Table 22 also compares management effect by alternative. Management effect categorizes the relative expected outcome of plan language in each alternative in terms of maintaining habitat quality and is the result of plan decisions, including plan objectives. Management effect category values are 1, 2, 3, and 4. The lower the management effects rating, the more effective the alternative is for maintaining the habitat. The effects of the alternatives are explained in greater detail in the discussions on the alternatives that follow.

About 778 acres (almost 2 percent of the ERU) of Mixed Conifer with Frequent Fire occur in two designated wildernesses: Red Rock-Secret Mountain (598 acres) and Sycamore Canyon Wilderness (180 acres).

About 299 acres of Mixed Conifer with Frequent Fire occur in the Mogollon Rim Botanical Area. The Mogollon Rim Botanical Area preserves a representative portion of a white fir/bigtooth maple community. This community represents a unique vegetation community in Arizona and is found only at a few locations along the Mogollon Rim.

Table 22. Summary of coarse filter analysis for Mixed Conifer with Frequent Fire ERU

Habitat	Existing	Alternative A	Alternatives B (modified), C, and D	Associated Species
Abundance	Occasional	Occasional		Mexican spotted owl, northern goshawk, Allen's lappet-browed bat, Navajo Mogollon vole, western red bat, Rusby's milkvetch, evening grosbeak, golden-crowned kinglet, MacGillivray's warbler, three-toed woodpecker
Quality-Vegetation	Fair, trending away	Fair, trending toward short term then static trend long term	Low objective: Fair, toward at short term then Fair, static at long term High objective: Good, toward at short term then Good, static at long term	
Quality-Soil	Good, static	Good, trending slowly toward	Low objective: Good, trending slowly toward High objective: Good, trending slowly toward	
Likelihood of Limitation	Moderate	Moderate	Low objective: Moderate High objective: Low	
Management effect		3: Plan components maintain or improve protection and management for some habitat occurrences in the plan area.	2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.	

Risk Factors

The primary threat to Mixed Conifer with Frequent Fire is fire exclusion.

Associated Species

Associated species are listed in table 22.

Environmental Consequences

Common to All Alternatives

Plan components in all alternatives contribute to species viability by managing habitat to maintain viable and sustainable populations of wildlife and fish species and by improving and protecting habitat for threatened, endangered, and sensitive species (1987 Plan, pages 22-1, 23; FW-Eco-DC-1; FW-WFP-DC-1, 2, 3, 5, 6). See At-risk Species in the Wildlife and Plant Issues and Topics section above for more information.

Designated wilderness areas would be managed according to applicable laws, policy, and Forest Plan direction to preserve wilderness resource values and wilderness quality, and to emphasize wilderness recreation (1987 Plan, pages 105 to 112; SA-Wild-DC-1 to 11; SA-Wild-S-1, 2; SA-Wild-G-1 to 7). Wilderness designation limits most active vegetation management because motorized and mechanized use is not allowed. Motorized and mechanized access can kill or damage plants, can degrade the habitat through soil compaction and soil loss, and can introduce non-native species that compete with native plants for resources. This can negatively affect the reproduction and survival of individual plants or populations. Ground-disturbing activities are primarily confined to main trails, trailheads, and key points of interest at which invasive species introduction and establishment, or accelerated erosion could occur, depending on the level of use.

The lack of ground-disturbing activities elsewhere would be beneficial by reducing the risk of invasive plant introduction and dispersal by motorized or mechanized use. However, limited access associated with designated wilderness could preclude restoration treatments that require motorized equipment for treatments or safety, or make them harder to do logistically. Lack of restoration treatments could result in missed fire return intervals, increased and unnatural levels of fuels, increased density of shrubs and trees, or establishment and spread of invasive or non-native species. This could slow the trend toward desired conditions or increase the risk of uncharacteristic fires in localized areas more so than in the other alternatives. Uncharacteristic fire could facilitate the spread or establishment of invasive or non-native species, which could then alter area hydrology, fire regime, and biodiversity. This would have a small effect to Mixed Conifer with Frequent Fire due to the small proportion of the ERU in wilderness.

All alternatives provide guidance for the management of aspen, which is an early successional species in this ERU (1987 Plan, pages 141 to 144; FW-TerrERU-AspMpl-DC 1 to 3; FW-TerrERU-AspMpl-G-1). The guidance would enhance or maintain aspen through plan objectives and protect aspen regeneration from livestock grazing or wildlife where necessary through fencing or other means. All alternatives would retain snags greater than 12 inches d.b.h. to provide nesting and feeding habitat for wildlife. See 1987 Plan, pages 130, 131, 142; and FW-TerrERU-AspMpl-DC-1, 3; FW-TerrERU-AspMpl-O-1, FW-TerrERU-AspMpl-G-1. Once snags fall, the resulting downed logs would provide important contributions to nutrient cycling, soil productivity, and cover and microsites for various species, including young mixed conifer tree species.

Alternative A

Using the analysis process described under the Species Viability section above, table 22 shows that under alternative A, the vegetation quality of Mixed Conifer with Frequent Fire is classified as fair, which means it has a moderate departure from desired conditions and the number, size, and evenness of distribution of habitat areas across the landscape is somewhat reduced. It would be trending toward desired conditions in the short term, but the trend would become static in the long term.

Soil condition and productivity would continue to be in good condition with a static trend relative to desired conditions. The duff layer is sufficient to protect against accelerated soil erosion and loss of soil productivity.

There is a moderate likelihood that Mixed Conifer with Frequent Fire could be a limiting factor to the viability of the associated species. This likelihood was derived by combining the value for habitat abundance with the value for vegetation quality. Vegetation quality was used instead of soil quality, because vegetation is assumed to respond faster than soil to treatments or disturbances, and thus, would better reflect differences between alternatives.

The management effect for alternative A is a 3, which means that plan components in alternative A maintain or improve protection and management for some habitat occurrences in the plan area. This alternative contributes less to the maintenance and sustainability of the habitat and to the viability of the associated species than the other alternatives. The plan components that contribute to this management effect are discussed below.

The majority of Mixed Conifer with Frequent Fire is within three management areas under the 1987 Plan; most (89 percent) occurs in Management Area 3- Ponderosa Pine and Mixed Conifer less than 40 percent slope, Management Area 4- Ponderosa Pine and Mixed Conifer greater than

40 percent slope, and Management Area 19- Mogollon Rim. The 1987 Forest Plan provides little direction on desired conditions for this ERU, as it is lumped into the broad vegetation category of Mixed Conifer, which is combined with ponderosa pine on slopes less than 40 percent or on slopes greater than 40 percent. There is vague direction with regard to the mixed conifer category as a whole, and it is particularly ambiguous with respect to how structure, patterns, and function vary at different spatial scales (1987 Plan, pages 117, 125, 133, 138).

Management direction in alternative A is uneven, i.e., part of it is updated and better reflects current science and part of it is outdated. For example, some plan components promote management based on 10,000-acre (10K) blocks that were established across the forest in the 1980s (1987 Plan, page 70) in which vegetation is managed to achieve various resource objectives such as snags, old growth, and wildlife cover (1987 Plan, pages 123, 124 to 127). Management using10K blocks assured that various habitat elements were distributed equitably across the landscape, but the 10K block concept is no longer used and has been replaced with analysis areas driven by other purposes. These purposes could include reducing fire risk around specific communities, landscape-level restoration, or the need to improve management in specific watersheds.

Some of the plan language in alternative A would manage old growth as 100- to 300-acre stands over no less than 20 percent of each forested ecosystem management area (1987 Plan, pages 70-1, 129). Consequences of this plan direction are described in detail in the Vegetation and Fire section in volume I of the FEIS. This strategy would provide less ability than alternative B (modified) to promote vertical structure and age class diversity; would tend to maintain a more continuous canopy than B (modified) that would be more conducive to crown fires; and would result in more even-aged conditions. This structure and age class diversity is not reflective of frequent low-severity fires characteristic of this ERU. During wildfires, there is likely to be more area in mixed severity condition with 25 to 75 percent loss of dominant overstory, compared to loss of 25 percent or less, which is characteristic of low-severity fires. Old-growth stands would be less resilient to endemic levels of disturbances. There would be fewer openings and less understory. The 1987 Plan also contains more updated plan language for old growth. Alternative A would manage old growth in patterns that provide for a flow of functions and interactions at multiple scales through time across the landscape, and would allocate old growth as landscape percentages rather than specific acres, based on site capability, risks, and disturbance regime. A table that displayed the minimum criteria for structural attributes would be used for a forested site to be considered old growth (1987 Plan, pages 70-1, 70-2).

Prescribed fire and wildfires managed for resource objectives may be used in Mixed Conifer with Frequent Fire, but there is no provision for using wildfires managed for resource objectives in the wildland-urban interface (1987 Plan, pages 92, 155, 165) and the language to manage wildfires for resource objectives in wilderness impedes the use of this tool (1987 Plan, pages 111, 112). This plan language limits the restoration of fire as a natural process in the wildland-urban interface and in wilderness, and canopy cover and shrub density would be expected to increase in these areas. There would also be increased potential for uncharacteristic fire in the wildland-urban interface and wilderness portions of this ERU. This is particularly problematic where the landownership pattern is intermixed with different ownerships. This is a negative impact on the composition and age class distribution of Mixed Conifer with Frequent Fire, which is a fire-dependent ecosystem.

The expected treatment levels are the same as the low level of treatment in alternative B (modified). They are:

- Use prescribed cutting to treat 2,900 acres of Mixed Conifer with Frequent Fire during each 10-year period over the life of the plan.
- Use prescribed fire on at least 8,000 acres of Mixed Conifer with Frequent Fire within the natural fire regime during each 10-year period over the life of the plan.
- Use naturally ignited wildfires (i.e., lightning-caused fires managed for resource objectives) to treat at least 7,500 acres of Mixed Conifer with Frequent Fire within the natural fire regime, during each 10-year period over the life of the plan.

As more Mixed Conifer with Frequent Fire is made of uneven-aged states, it would become more structurally diverse. The amount of open canopy in the ERU would be expected to increase in the long term, resulting in increased abundance and diversity of grasses, forbs, and shrubs. Tree density would be expected to decrease in the areas where it exceeds desired conditions. However, the treatment levels in alternative A are too low to offset excess regeneration, and small tree growth and canopy cover would remain predominantly closed across the landscape, which would suppress tree growth.

Within this ERU, in areas where higher tree density is maintained, such as within MSO protected activity centers (about 7,621 acres in this ERU), or on steep slopes, the risk of uncharacteristic fire is still higher than elsewhere. Early seral species, such as aspen, may continue to decline where late seral species or closed canopy conditions are emphasized. Outside of these areas, the ERU would generally be managed as MSO restricted habitat with an emphasis on large trees, large hardwoods, large snags, and large downed woody debris (1987 Plan, pages 65 to 65-6, 65-9 to 65-11). Restricted habitat is an outdated term and is no longer used.

Currently, under alternative A, language from an earlier version of the Recovery Plan is incorporated into the 1987 Plan. This plan direction conflicts with the most current recovery plan recommendations, does not reflect current science, and could be in conflict with future recovery plan revisions. As a result of this plan direction, light to no treatment may occur in Mexican spotted owl PACs under this alternative. The existing plan contains direction from the now-revised 1995 Mexican Spotted Owl Recovery Plan. This direction only allows treatments for fuelwood and fire risk abatement in PACs; only allows harvesting of conifers less than 9 inches d.b.h. in PACs selected for treatment; and only allows treatments outside of 100-acre no treatment areas around known nest areas (1987 Plan, page 65-2). This outdated guidance does not reflect the 2012 revised recovery plan (USDI Fish and Wildlife Service 2012b) and the 9-inch diameter cap may restrict treatment needed to meet the stated objective of fire risk abatement.

Mixed Conifer with Frequent Fire occurs within the Mogollon Rim Botanical Area. Plan components in alternative A are generally protective of the composition, structure, and function of the different vegetation types within botanical areas. For example, existing conditions and natural processes would be maintained; natural events would not be rehabilitated; and off-road driving would be prohibited (1987 Plan, page 194). Visitors should be limited in some areas, depending on carrying capacity, and the uniqueness and ecological condition of these areas should be protected and maintained, including in allotment management plans. In addition, timber harvest and firewood cutting is prohibited (1987 Plan, page 195). Other protective measures include: Special-use authorizations that would or could adversely affect the areas would not be allowed;

adjacent roads would be managed to prevent vehicular intrusion; and road access would be blocked and obliterated. Fire suppression tactics would minimize damage to character of the areas and prescribed fire with planned ignitions may be used as a management tool provided it is a compatible use (1987 Plan, page 196). Collectively, these standards and guidelines mitigate the soil disturbance and plant damage that can result from these activities and maintain the conditions and characteristics for which this botanical area was established.

Mechanized use in botanical areas is not explicitly addressed in alternative A, resulting in vague direction to managers. It is unclear as to whether mechanized use is prohibited, is allowed only on trails, or is allowed on and off trail in these areas. Consequently, mechanized use could damage vegetation or contribute to accelerated soil erosion within localized areas in this ERU.

Alternative B (modified)

Using the analysis process described under the Species Viability section above, table 22 shows that under the low treatment objective, vegetation quality in alternative B (modified) would be in fair condition (a moderate departure from desired conditions). Under the high treatment objective, vegetation quality would be in good condition. The trend under both objectives would be toward desired conditions in the short term and static relative to desired conditions in the long term. Soil quality would be good with a static trend relative to desired conditions.

Under the low treatment objective, there is a moderate likelihood that Mixed Conifer with Frequent Fire could be a limiting factor to the viability of the associated species. Under the high treatment objective, the likelihood would be low that this ERU would be limiting to the viability of the associated species. These likelihoods were derived by combining the value for habitat abundance with the value for vegetation quality. Vegetation quality was used instead of soil quality because vegetation is assumed to respond faster than soil to treatments or disturbances and thus would better reflect differences between alternatives.

The management effect would be a 2, which means that plan components in alternative B (modified) maintain or improve protection and management for most habitat occurrences in the plan area, and thus, contribute more to the maintenance and sustainability of Mixed Conifer with Frequent Fire and the viability of the associated species than alternative A.

Desired conditions in the proposed revised plan have greater potential to reduce ERU departure and move toward desired conditions than alternative A. Desired conditions promote: properly functioning ecosystems that are resilient to natural disturbances and climate change; the reduction of uncharacteristic disturbances; endemic levels of invertebrates (including pollinators) and disease with occasional outbreaks; and a balance of desirable non-native species and subspecies with properly functioning ecosystems (FW-Eco-DC-1, 2, 3, 4). Desired conditions include a mosaic of vegetation conditions, densities, and structures, and various scales that reflect natural disturbance regimes, resilience to disturbances, adaptions to climate variability, connections based on natural patterns, and allowances for inclusions, variability, and ecotones (FW-TerrERU-All-DC-1 to 4).

Alternative B (modified) clearly distinguishes between different Mixed Conifer types on the forest and provides desired conditions, objectives, and guidance that are specific to each type. Alternative B (modified) promotes characteristic disturbances as mechanisms that shape mixed conifer (FW-TerrERU-MC-All-DC-1; FW-TerrERU-MC-MCFF-DC-4, 5, 7, 8).

The outdated vegetation structural stages concept in alternative A is represented by seral states in alternative B (modified) (see Appendix C in Volume III of the FEIS) and vegetation structure is described at a variety of scales. For example, at the landscape scale, this alternative promotes a mosaic of age classes, variable structure (live and dead), and understory vegetation across the landscape that is resilient to disturbances and climate variability and facilitates natural disturbances (FW-TerrERU-MC-All-DC-1, 2; FW-TerrERU-MC-MCFF-DC-1 to 5). Desired conditions at the mid-scale account for variability across the landscape and describe characteristics of tree groups, openness, tree density, distribution of age classes, predominantly uneven-aged conditions, and conditions in northern goshawk habitat (FW-TerrERU-MC-MCFF-6 to 9). Fine scale desired conditions describe conditions within and between tree groups and the value of witch's brooms (FW-TerrERU-MC-MCFF-DC-10, 11, 12). Witch's brooms are a deformity in a tree branch where a dense mass of shoots grow from a single point. This forms a broom or birds nest-like structure that is used by a variety of wildlife species for food or shelter. Witch's brooms may be caused by dwarf mistletoe or other organisms. Guidelines provide sideboards that would promote or sustain old-growth forest attributes like large trees, old trees, snags, large logs, and occupancy of small wildlife species, and would reduce the risk of uncharacteristic bark beetle outbreaks (FW-TerrERU-MC-All-G-1, 2, 3). References to 100- to 300-acre stands for old growth have been removed. Alternative B (modified) also removes language that requires the use of 10,000-acre blocks and vegetation structural stages for planning.

Alternative B (modified) removes the plan language limitations that restrict the use of wildfire managed for resource benefits in designated wilderness allowing wildfire to play its natural role in wilderness where it is feasible to do so (SA-Wild-DC-4). In contrast to alternative A, alternative B (modified) removes the restrictions that prohibit the use of wildfires managed for resource benefits in the wildland-urban interface. This could facilitate the use of fire for restoration or fuels reduction, and would help maintain openings, improve resilience, and reduce vulnerability to uncharacteristic fire in these areas.

About 79 percent of Mixed Conifer with Frequent Fire occurs in the C.C. Cragin Watersheds and East Clear Creek Management Areas. The C.C. Cragin Watersheds Management Area is characterized by the C.C. Cragin Reservoir, which supplies water to the Town of Payson and by Forest Road 300 along the Mogollon Rim. The East Clear Creek Management Area is remote and characterized by East Clear Creek and Leonard Canyon drainages and their tributaries. Desired conditions envision a low risk of substantial damage from uncharacteristic fire and recreation and more primitive non-motorized recreation in canyons (MA-CCCrg-DC-1, 2; MA-EastClr-DC-1, 2). Guidelines require the C. C. Cragin Watersheds Management Area be managed to reduce the threat of uncharacteristic disturbances such as wildfires, flooding, and sedimentation, and require that roads and trails in the management area be maintained to prevent erosion and sedimentation (MA-CCCrg-G-1, 2). Implementation of these components would contribute to and improve vegetation and soil quality and contribute to the maintenance and sustainability of this ERU.

Mixed Conifer with Frequent Fire also occurs in the Pine Belt, San Francisco Peaks, and Long Valley Management Areas. Plan language for the Pine Belt Management Area does not focus on Mixed Conifer with Frequent Fire or terrestrial ERUs. Plan language for the San Francisco Peaks Management Area does not focus on Mixed Conifer with Frequent Fire, but rather broadly addresses recreation, the cultural significance of the San Francisco Peaks, and limitations on horse and pack stock and recreational livestock in higher elevations, which do not impact this ERU. Most of the direction in the Long Valley Management Area focuses on recreation opportunities and riparian habitat, except one desired condition promotes more primitive non-

motorized recreation along ridges and canyons. This would lower the potential for recreational disturbance in this management area (MA-LongV-DC-5).

There are no acres of Mixed Conifer with Frequent Fire ERU in recommended wilderness.

Mixed Conifer with Frequent Fire occurs within the Mogollon Rim Botanical Area. Plan language in alternative B (modified) promotes protection and maintenance of the unique characteristics of botanical areas and sustainability of their inherent physical and biological processes that are not negatively impacted from human activities or permitted uses (SA-RNABotGeo-DC-5, SA-RNABotGeo-G-1, 5). Fires and allotment management plans would be protective of the resources for which these areas were designated (SA-RNABotGeo-G-3, 4). In contrast to alternative A, mechanized travel is not suitable in botanical areas, except on designated trails (see Chapter 4 of the Revised Plan, Recreation and Transportation Suitability). Subsequent environmental analysis would need to be done for this direction to take effect. This suitability recommendation is considered to be protective of vegetation and soil because potential impacts would be limited to the trail prism. Damage to vegetation and accelerated erosion would be evaluated during the environmental analysis.

Alternative C

Alternative C has the same effects as alternative B (modified), except 13 wildernesses are recommended instead of 3. In addition to the 778 acres of Mixed Conifer with Frequent Fire in designated wilderness, there are 283 acres in the Barbershop Canyon recommended wilderness. There would be 2 percent of the ERU in either designated or recommended wilderness. Recommended wilderness would reduce impacts from motorized use by promoting motorized vehicle use only for limited administrative and permitted activities (SA-RWild-DC-1, 2, 5; SA-RWild-G-1, 3, 5). Mechanized uses that maintain and do not detract from wilderness values would be allowable. However, new trails should be designed for non-motorized and non-mechanized activities that preserve wilderness character (SA-RWild-DC-6, SA-RWild-G-5). Implementation of these plan components would reduce disturbance to soil and vegetation from motorized or mechanized uses, which could be beneficial to associated species. If designated by Congress, the wilderness areas would be managed according to applicable laws, policy, and Forest Plan direction (SA-Wild-DC-1 to 11; SA-Wild-O-1, 2; SA-Wild-S-1 to 5; SA-Wild-G-1 to 11). However, limited access associated with recommended (and designated) wilderness could preclude restoration treatments that require motorized equipment for treatments or safety, or make them harder to do logistically. Site-specific circumstances would also influence which or whether restoration treatments might be precluded. Delay or absence of restoration treatments could result in missed fire return intervals, increased and unnatural levels of fuels, increased density of shrubs and trees, or establishment and spread of invasive or non-native species. This could slow the trend toward desired conditions or increase the risk of uncharacteristic fires in localized areas more so than in the other alternatives. Uncharacteristic fire could facilitate the spread or establishment of invasive or non-native species, which could then alter area hydrology, fire regime, and biodiversity. This would have little effect to Mixed Conifer with Frequent Fire because of the small proportion of the ERU affected.

Alternative D

Alternative D is the same as alternative B (modified).

Mixed Conifer with Infrequent Fire

Affected Environment

Amount

On the Coconino NF, 38,321 acres of Mixed Conifer with Infrequent Fire ERU are within the administrative boundary of the Coconino NF. The forest manages 37,143 (97 percent) of those acres, which represents about 97 percent of the ERU. The remaining acres of Mixed Conifer with Infrequent Fire are in private or State ownership.

Table 23 summarizes the information used to estimate the likelihood that Mixed Conifer with Infrequent Fire would be a limiting factor to the viability of the associated species. The abundance is categorized as Occasional because, at 38,321 acres, it occupies about 2 percent of the forest. Habitats classified as Occasional generally cover 1 to 10 percent of the forest and are occasionally encountered.

Habitat Quality and Distribution

Mixed Conifer with Infrequent Fire ERU occurs on mountain slopes such as the San Francisco Peaks and may also occur in canyons and north-facing slopes such as on Hutch Mountain and Mormon Mountain. Dominant and codominant species include Douglas-fir, southwestern white pine, and limber pine, and late seral species such as maple, white fir, and blue spruce. The diverse understory consists of native herbaceous and shrub species and it generally has more forbs, sedges, mosses, and liverworts than Mixed Conifer with Frequent Fire and more leaf litter because there are more deciduous species. Disturbances typically occur at two temporal and spatial scales: large-scale infrequent disturbances (mostly mixed-severity fires at 35- to 200-year intervals) and small-scale, frequent disturbances (e.g., fire, insect, disease, wind).

Using the analysis process described under the Species Viability section above, table 23 shows that the vegetation quality of Mixed Conifer with Infrequent Fire is fair, i.e., moderately departed, in the short term and trending away from reference conditions. In the long term, vegetation quality would degrade to poor, i.e., highly departed from reference conditions, and trend away from reference conditions.

There is a high proportion of dense, closed canopy conditions and much of the ERU is in a late successional state due to fire exclusion. This is a higher proportion than in reference conditions. As a result, shade-tolerant species, such as white fir, are increasing and early successional, more fire-tolerant species like aspen are decreasing. Aspen populations are declining in this ERU because of insect defoliators, drought, fire exclusion, and heavy ungulate browsing. The current fire frequency is far outside the historic range of variability.

The risk of uncharacteristically large and severe fires is higher than reference conditions. Mortality due to insects and disease is likely to continue. There was an increase in mortality of subalpine/corkbark fir from western balsam bark beetle in 2013, compared to 2012, increasing the extent of the area with standing dead and downed trees (USDA Forest Service 2015a). White pine blister rust is also a potential threat. It is known from eastern Arizona, but has not been detected here yet. It is one of the most damaging tree diseases and affects white pines of all size classes.

Soil is in good condition and has a static trend relative to reference conditions. In most areas, surface organic matter and litter are similar to reference conditions due to high amounts of

protective litter cover protecting the soil from accelerated erosion. The majority of soils are in satisfactory condition.

Table 23 shows that there is a moderate likelihood that Mixed Conifer with Infrequent Fire habitat could be limiting to the associated species. The likelihood that habitat would be limiting to the associated species was derived by combining the value for habitat abundance with the value for vegetation quality. Vegetation quality was used instead of soil quality, because vegetation is assumed to respond faster than soil to treatments or disturbances, and thus, would better reflect differences between alternatives.

Table 23 also compares management effect by alternative. Management effect categorizes the relative expected outcome of plan language in each alternative in terms of maintaining habitat quality and is the result of plan decisions, including plan objectives. Management effect category values are 1, 2, 3, and 4. The lower the management effects rating, the more effective the alternative is for maintaining the habitat. The effects of the alternatives are explained in greater detail in the discussions on the alternatives that follow.

About 8,193 acres (22 percent of the ERU) occur within designated wilderness. Of this, 6,052 acres (16 percent) lie within the Kachina Peaks Wilderness and 2,141 acres (6 percent) lie within the Kendrick Mountain Wilderness. The Kachina Peaks Wilderness is managed by Coconino National Forest. Kendrick Mountain Wilderness is managed by the adjacent Kaibab National Forest.

Table 23. Summary of coarse filter analysis for Mixed Conifer with Infrequent Fire ERU

Habitat	Existing	Alternative A	Alternatives B (modified), C, and D	Associated Species
Abundance	Occasional	Occasional		Mexican spotted owl, northern goshawk, Allen's lappet-browed bat, Rusby's milkvetch, evening grosbeak, golden-crowned kinglet, MacGillivray's warbler, Swainson's thrush, three-toed-woodpecker, Alberta arctic, Colorado blue columbine, Hall's milkweed
Quality-Vegetation	Fair, trending away	Fair, trending away from desired conditions then poor with a trend away from desired conditions	Fair, static	
Quality-Soil	Good, static	Good, static	Good, trending slowly toward	
Likelihood of Limitation	Moderate	Moderate, then High	Moderate	
Management effect		3: Plan components maintain or improve protection and management for some habitat occurrences in the plan area.	2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.	

Risk Factors

Primary risk factors are uncharacteristic fire and fire exclusion.

Associated Species

Associated species are listed in table 23.

Environmental Consequences

Common to All Alternatives

Plan components in all alternatives contribute to species viability by managing habitat to maintain viable and sustainable populations of wildlife and fish species and by improving and protecting habitat for threatened, endangered, and sensitive species (1987 Plan, pages 22-1, 23; FW-Eco-DC-1; FW-WFP-DC-1, 2, 3, 5, 6, 8; FW-WFP-G-3, 10). See At-risk Species in the Wildlife and Plant Issues and Topics section above for more information.

Designated wilderness areas would be managed according to applicable laws, policy, and Forest Plan direction to preserve wilderness resource values and wilderness quality, and to emphasize wilderness recreation (1987 Plan, pages 105 to 112, SA-Wild-DC-1 to 11; SA-Wild-S-1, 2; SA-Wild-G-1 to 7). Wilderness designation limits most active vegetation management because motorized use and mechanized use is not allowed. Motorized and mechanized access can kill or damage plants, can degrade the habitat through soil compaction and soil loss, and can introduce non-native species that compete with native plants for resources. This can negatively affect the reproduction and survival of individual plants or populations. Ground-disturbing activities are primarily confined to main trails, trailheads, and key points of interest at which invasive species introduction and establishment, or accelerated erosion could occur, depending on the level of use. The lack of ground-disturbing activities elsewhere would be beneficial by reducing the risk of invasive plant introduction and dispersal by motorized or mechanized use. However, limited access associated with designated wilderness could preclude restoration treatments that require motorized equipment for treatments or safety, or make them harder to do logistically. Lack of restoration treatments could result in missed fire return intervals, increased and unnatural levels of fuels, increased density of shrubs and trees, or establishment and spread of invasive or non-native species. This could slow the trend toward desired conditions or increase the risk of uncharacteristic fires in localized areas more so than in the other alternatives. Uncharacteristic fire could facilitate the spread or establishment of invasive or non-native species, which could then alter area hydrology, fire regime, and biodiversity.

All alternatives address the threat of invasive plants by pointing to the Final Environmental Impact Statement for the Treatment of Noxious or Invasive Weeds (USDA Forest Service 2005). This direction includes best management practices, among other guidance, which would help prevent, mitigate, and reduce the threat of invasive plants. All alternatives prioritize treatments, call for incorporating control measures in project planning and implementation, and emphasize coordination with partners (1987 Plan, pages 23, 69, 70, 182, 206-14, 206-76, 206-101, 201-116; FW-Invas-DC-1, 2, 3; FW Invas-G-1, 2, 3: FW-Invas-MgtApp: FW-WFP-DC-10: FW-Graz-MgtApp: FW-RdsFac-G-8; FW-Rec-Dev-DC-9; FW-Rec-Dev-G-2; FW-TerrERU-Grass-DC-2). A management approach in Invasive Species of alternatives B (modified), C, and D reminds managers to prioritize areas such as wilderness areas, research natural areas, botanical areas, wild and scenic river areas, and riparian areas for invasive species control to maintain and restore the

integrity of native species and ecosystems. Additional information and analysis is discussed under the Non-native of Invasive Species topic in the Wildlife and Plant Topics and Issues section.

All alternatives provide guidance for the management of aspen, which is an early successional species in this ERU (1987 Plan, pages 141 to 144; FW-TerrERU-AspMpl-DC-1 to 3; FW-TerrERU-AspMpl-G-1). The guidance would enhance or maintain aspen through plan objectives and protect aspen regeneration from livestock grazing or wildlife where necessary through fencing or other means. All alternatives would retain snags greater than 12 inches d.b.h. to provide nesting and feeding habitat for wildlife. See 1987 Plan, pages 130, 131, 142; FW-TerrERU-AspMpl-DC-1, 3. Once snags fall, the resulting downed logs would provide important contributions to nutrient cycling, soil productivity, and cover and microsites for various species, including young mixed conifer tree species.

Alternative A

Using the analysis process described under the Species Viability section above, table 23 shows that under alternative A the vegetation quality of Mixed Conifer with Infrequent Fire would initially be classified as fair, which means it has a moderate departure from desired conditions and the number, size, and evenness of distribution of habitat areas across the landscape is somewhat reduced. In the long term vegetation quality would trend away from desired conditions and eventually transition to poor condition, which means it would have a high departure and the number, size, and evenness of distribution of habitat areas across the landscape would be greatly reduced, compared to desired conditions. There would be a continued trend away from desired conditions. Under alternative A, management of this ERU is not expected to change over current levels, leading to a continued loss in age class diversity, increased canopy cover, loss of early successional species, and a reduction in herbaceous understory.

Fire return interval is expected to remain moderately departed and begin to trend away from the desired conditions due to a lack of fire treatment (prescribed and wildfires managed for resource objectives) objectives or anticipated fire treatments. While the ERU is adapted to mixed-severity fires, the existing composition and structure puts it at greater risk of severe fires over an uncharacteristically large extent that would be the case under conditions when the fire return interval was at a low departure. Soil quality would remain good with a static trend relative to desired conditions.

Initially, there would be a moderate likelihood that Mixed Conifer with Infrequent Fire would be a limiting factor to the viability of associated species, but this would transition to a high likelihood as vegetative conditions in the ERU became poor. These likelihoods were derived by combining the value for habitat abundance with the value for vegetation quality. Vegetation quality was used instead of soil quality, because vegetation is assumed to respond faster than soil to treatments or disturbances, and thus, would better reflect differences between alternatives.

The management effect is a 3. This means plan components maintain or improve protection and management for some habitat occurrences in the plan area. Alternative A contributes less to the maintenance and sustainability of Mixed Conifer with Infrequent Fire and the viability of the associated species than the other alternatives.

The majority of Mixed Conifer with Infrequent Fire is within four management areas under the 1987 Plan. Most of this ERU (85 percent) occurs in Management Area 3- Ponderosa Pine and Mixed Conifer less than 40 percent slope, Management Area 36-Schultz, Management Area 1-

Wilderness, and Management Area 4- Ponderosa Pine and Mixed Conifer greater than 40 percent slope. The 1987 Forest Plan provides little direction on desired conditions for this ERU, as it is lumped into the broad vegetation category of Mixed Conifer, which is combined with ponderosa pine on slopes less than 40 percent or on slopes greater than 40 percent. There is vague direction with regard to the mixed conifer category as a whole and is particularly ambiguous with respect to how structure, patterns, and function vary at different spatial scales (1987 Plan, pages 117, 125, 133, 138). Wilderness area direction is evaluated under All Alternatives above. Plan components in the Schultz Management Area promote the re-introduction of fire’s natural role as much as possible, the balance of recreation demands with soil and vegetation protection, the maintenance of large tracts of unfragmented habitat for disturbance sensitive species, and the reduced potential for catastrophic fire (1987 Plan, pages 206-103, 105). Implementation of these plan components would reduce the threats to and contribute to the sustainability of Mixed Conifer with Infrequent Fire in the Schultz Management Area.

Prescribed fire and wildfires managed for resource objectives may be used in Mixed Conifer Infrequent Fire, but there is no provision for using wildfires managed for resource objectives in the wildland-urban interface (1987 Plan, pages 92, 155, 165) and the language to manage wildfires for resource objectives in wilderness impedes the use of this tool (1987 Plan, pages 111, 112). This plan language limits the restoration of fire as a natural process in the wildland-urban interface and in wilderness, and canopy cover and tree density would be expected to increase in these areas. There would also be increased potential for uncharacteristic fire in the wildland-urban interface and wilderness portions of this ERU.

Management direction in alternative A is uneven, i.e., part of it is updated and better reflects current science and part of it is outdated. For example, some plan components promote management based on 10,000-acre (10K) blocks that were established across the forest in the 1980s (1987 Plan, page 70) in which vegetation is managed to achieve various resource objectives such as snags, old growth, and wildlife cover (1987 Plan, pages 123, 124 to 127). Management using10K blocks assured that various habitat elements were distributed equitably across the landscape, but the 10K block concept is no longer used and has been replaced with analysis areas driven by other purposes. These purposes could include reducing fire risk around specific communities, landscape-level restoration, or the need to improve management in specific watersheds.

Alternative A contains language that would allocate old growth as 100- to 300-acre stands over no less than 20 percent of each forested ecosystem management area (1987 Plan, page 129). This structure and age class diversity reflects the characteristics that would be expected in infrequent fire ecosystems like Mixed Conifer with Infrequent Fire ERU. Other plan language would have allocations consisting of landscape percentages meeting old-growth conditions and not specific acres and managing old-growth in patterns that provide for a flow of functions and interactions at multiple scales over time (1987 Plan, page 70-1). Though not specifically acknowledging structure and spatial patterns that reflect different fire regimes, this plan language has the flexibility to allow managers to allocate in an ecologically sound manner.

There are a little over 13,000 acres of Mexican spotted owl protected activity centers in Mixed Conifer with Infrequent Fire ERU. Alternative A contains plan components from an outdated version of the Mexican Spotted Owl Recovery Plan. These plan components only allow trees smaller than 9 inches d.b.h. to be removed from protected activity centers and from steep slopes (mixed conifer and pine-oak forests outside protected activity centers with slopes greater than

40 percent that have not been logged within the past 20 years) only to abate fire risk (1987 Plan, pages 65-2, 65-3). Besides not reflecting the most current science for this threatened species, this plan language does not allow treatments that could restore owl habitat nor is a 9-inch diameter limit sufficient to abate fire risk in most cases.

Alternative B (modified)

Using the analysis process described under the Species Viability section above, table 23 shows that under alternative B (modified) the vegetation quality of Mixed Conifer with Infrequent Fire would be fair with a static trend relative to desired conditions. This means it has a moderate departure from desired conditions and the number, size, and evenness of distribution of habitat areas across the landscape is somewhat reduced. Under alternative B (modified), few treatments are anticipated because management of this ERU is not expected to change over current levels, leading to a continued loss in age class diversity, increased canopy cover, loss of early successional species, and a reduction in herbaceous understory.

The fire return interval is expected to remain moderately departed and begin trending away from the desired conditions. As in alternative A, while the ERU is adapted to mixed-severity fires, the existing composition and structure puts it at greater risk of severe fires over an uncharacteristically larger extent than would be the case under conditions when the fire return interval was at a low departure. Soil quality would remain good with a static trend relative to desired conditions.

There would be a moderate likelihood that Mixed Conifer with Infrequent Fire would be a limiting factor to the viability of associated species. This likelihood was derived by combining the value for habitat abundance with the value for vegetation quality. Vegetation quality was used instead of soil quality, because vegetation is assumed to respond faster than soil to treatments or disturbances, and thus, would better reflect differences between alternatives.

The management effect for alternative B (modified) is a 2, which indicates plan components under this alternative maintain or improve protection and management for most habitat occurrences in the plan area, and thus, contribute more to the maintenance and sustainability of Mixed Conifer with Infrequent Fire and the viability of the associated species than alternative A.

Desired conditions in alternative B (modified) have greater potential to reduce ERU departure and move toward desired conditions than alternative A. Desired conditions promote: properly functioning ecosystems that are resilient to natural disturbances and climate change; the reduction of uncharacteristic disturbances; endemic levels of invertebrates (including pollinators) and disease with occasional outbreaks; and a balance of desirable non-native species and subspecies with properly functioning ecosystems (FW-Eco-DC-1, 2, 3, 4). Desired conditions include a mosaic of vegetation conditions, densities and structures and various scales that reflect natural disturbance regimes, resilience to disturbances, adaptions to climate variability, connections based on natural patterns, and allowances for inclusions, variability, and ecotones (FW-TerrERU-All-DC-1 to 4).

Alternative B (modified) clearly distinguishes between different Mixed Conifer types on the forest and provides desired conditions, objectives, and guidance that are specific to each type. Alternative B (modified) promotes characteristic disturbances as mechanisms that shape mixed conifer (FW-TerrERU-MC-All-DC-1; FW-TerrERU-MC-MCIF-DC-1, 2, 4, 5, 6, 7, 10).

The outdated vegetation structural stages concept in alternative A is represented by seral states in alternative B (modified) (see Appendix C in Volume III of the FEIS) and vegetation structure is described at a variety of scales. For example, at the landscape scale, this alternative promotes a mosaic of age classes, variable structure (live and dead), and understory vegetation across the landscape that is resilient to disturbances and climate variability, and facilitates natural disturbances (FW-TerrERU-MC-All-DC-1, 2; FW-TerrERU-MC-MCIF-DC-1, 2, 3, 4). Desired conditions at the mid-scale account for variability across the landscape and describe characteristics of tree groups, openness, tree density, distribution of age classes, predominantly even-aged groups and patches, fire regimes and behavior, and conditions in northern goshawk habitat (FW-TerrERU-MC-MCIF-5, 6, 7, 8). Fine scale desired conditions describe conditions within and between tree groups as well as openings (FW-TerrERU-MC-MCIF-DC-9, 10). Guidelines provide sideboards that would promote or sustain old-growth forest attributes like large trees, old trees, snags, large logs, and occupancy of small wildlife species, and would reduce the risk of uncharacteristic bark beetle outbreaks (FW-TerrERU-MC-All-G-1, 2, 3). References to 100- to 300-acre stands for old growth in alternative A have been removed and replaced with a desired condition that describes old-growth structure as stands or patches over large areas where old-growth components are concentrated (FW-TerrERU-MC-MCIF-DC-2). This better reflects the natural fire regime in this ERU. Alternative B (modified) also removes language that requires the use of 10,000-acre blocks and vegetation structural stages for planning.

Alternative B (modified) removes the plan language limitations that restrict the use of wildfire managed for resource benefits in designated wilderness, allowing wildfire to play its natural role in wilderness where it is feasible to do so (SA-Wild-DC-4). In contrast to alternative A, alternative B (modified) removes the restrictions that prohibit the use of wildfires managed for resource benefits in the wildland-urban interface. This could facilitate the use of fire for restoration or fuels reduction and would help maintain openings, improve resilience, and reduce vulnerability to uncharacteristic fire in these areas.

Under alternative B (modified), Mixed Conifer with Infrequent Fire occurs in seven management areas: Pine Belt, San Francisco Peaks, Inner Basin, Mount Elden, Anderson Mesa, Lake Mary Watersheds, and Long Valley. Most of this ERU (88 percent) occurs within San Francisco Peaks (53 percent), Mt. Elden (16 percent), and Pine Belt (19 percent) Management Areas. Plan language for the Pine Belt and Mount Elden Management Areas does not focus on Mixed Conifer with Infrequent Fire or terrestrial ERUs. Plan language for the San Francisco Peaks Management Area broadly addresses recreation, the cultural significance of the San Francisco Peaks, and limitations on horse and pack stock on the Humphrey's Trail and Weatherford Trail above Doyle Saddle. This has little impact on this ERU. However, a standard that would prohibit recreational livestock use in the watersheds draining into the Inner Basin could prevent ground and vegetation impacts to localized portions of Mixed Conifer with Infrequent Fire (MA-Peaks-S-3).

Plan components direct managers to reduce fire hazard, intensity, and severity in order to protect human life and property (FW-WUI-DC-1). When wildland-urban interface intersects with a mixed-severity fire regime like Mixed Conifer with Infrequent Fire, characteristic ecosystem function would be modified to promote low-severity surface fires that rarely spread as crown fire; forests in the wildland-urban interface would be dominated by early seral, fire-adapted species growing in a more open condition than the general forest; and wildland-urban interface may have a higher frequency of disturbance from prescribed burning, wildfires managed for resource objectives, and/or vegetative treatments than the natural disturbance regime (FW-WUI-DC-3, 4, 7, 8). Treated portions of the ERU in the wildland-urban interface would move away from desired

conditions and may result in a different species composition and structure than what Mixed Conifer with Infrequent Fire is adapted to. This departure could be mitigated by promoting wildland-urban interface conditions (fuel loading, basal area, logs, snags) at the lower end of the range give in vegetation community desired conditions (FW-WUI-DC-5, 9). This departure could also be mitigated by spatially arranging these structural components to reduce fire hazard and increase suppression success, and allowing fuel loading or tree densities at the higher end of the range where it provides for important fine-scale habitat structure or cover, as long as it meets the overall intent of protecting wildland-urban interface values-at-risk (FW-WUI-DC-10; FW-WUI-G-1).

The plan language that refers to outdated direction from the 1995 Mexican Spotted Owl Recovery Plan has been removed. A guideline in the Wildlife, Fish, and Plant section requires managers to apply habitat management objectives and species protection measures from approved recovery plans to activities that occur within federally listed species habitat (FW-WFP-G-1). As with all alternatives, treatments that occur within Mixed Conifer with Infrequent Fire and other habitats would follow approved recovery plans and would undergo consultation with the U.S. Fish and Wildlife Service.

About 347 acres of this ERU would fall within the Abineau recommended wilderness area. Recommended wilderness would reduce impacts from motorized use by promoting motorized vehicle use only for limited administrative and permitted activities (SA-RWild-DC-1, 5; SA-RWild-G-1, 3, 5). Mechanized uses that maintain and do not detract from wilderness values would be allowable. However, new trails should be designed for non-motorized and non-mechanized activities that preserve wilderness character (SA-RWild-DC-6; SA-RWild-G-5). Implementation of these plan components would reduce disturbance to soil and vegetation from motorized or mechanized uses, which could be beneficial to associated species. If designated by Congress, the wilderness areas would be managed according to applicable laws, policy, and Forest Plan direction (SA-Wild-DC-1 to 11; SA-Wild-O-1, 2; SA-Wild-S-1 to 5; SA-Wild-G-1 to 11). However, limited access associated with recommended (and designated) wilderness could preclude restoration treatments that require motorized equipment for treatments or safety, or make them harder to do logistically. Site-specific circumstances would also influence which or whether restoration treatments might be precluded. Delay or absence of restoration treatments could result in missed fire return intervals, increased and unnatural levels of fuels, increased density of shrubs and trees, or establishment and spread of invasive or non-native species. This could slow the trend toward desired conditions or increase the risk of uncharacteristic fires in localized areas more so than in the other alternatives. Uncharacteristic fire could facilitate the spread or establishment of invasive or non-native species, which could then alter area hydrology, fire regime, and biodiversity. This would have little impact because this is less than 1 percent of the ERU.

Alternative C

Alternative C is the same as alternative B (modified). Only the Abineau recommended wilderness includes Mixed Conifer with Infrequent Fire, the same as alternative B (modified).

Alternative D

Alternative D is the same as alternative B (modified) except there is no recommended wilderness.

Spruce-Fir

Affected Environment

Amount

On the Coconino NF, 13,946 acres of Spruce-Fir ERU lie within the administrative boundary. The forest manages 100 percent of the acres.

Table 24 summarizes the information used to estimate the likelihood that Spruce-Fir ERU would be a limiting factor to the viability of the associated species. The abundance is categorized as Rare because, at 13,946 acres, it occupies less than 1 percent of the forest. By definition, habitats classified as rare generally cover less than 1 percent of the forest and are rarely encountered.

Habitat Quality and Distribution

The Spruce-Fir ERU occurs in some of the coldest, wettest, and highest elevation sites on the forest. Spruce-Fir is often dominated by Engelmann spruce, but contains other species, depending on elevation. The understory commonly includes currants, maples, honeysuckle, common juniper, alpine clover, and sedges. It can be subdivided into lower elevation (Spruce-Fir Mix) and upper elevation (Subalpine Spruce-Fir), each with differing fire regimes and subdominant species composition.

The upper elevation subtype is bounded by Alpine Tundra ERU above about 11,500 feet. The lower elevation subtype resembles Mixed Conifer with Infrequent Fire except with a different composition of tree species, due to colder and wetter conditions, and it is a transition zone between Mixed Conifer with Infrequent Fire and the upper elevation Spruce-Fir Mix. In the lower elevation subtype, the common tree species are aspen, Douglas-fir, white fir, and southwestern white/limber pine. The climax forest is dominated by Engelmann spruce, white fir, and occasionally blue spruce. Subdominant species may include corkbark/subalpine fir, white fir, and bristlecone pine. In the upper elevation subtype, the dominant tree species are Engelmann spruce and cork bark fir (subalpine fir). Patches of aspen are occasionally present, but are usually absent. Natural disturbances in these subtypes typically occur at two temporal and spatial scales; large-scale, infrequent disturbances (mostly fire) and small-scale, frequent disturbances (e.g., fire, insects, disease, and wind). This ERU is characterized by infrequent, high-severity fire (fire return interval of over 200 years and over 75 percent overstory replacement).

Using the analysis process described under the Species Viability section above, table 24 shows that the vegetation quality of the Spruce-Fir ERU is fair, or moderately departed from reference conditions. It is expected to trend toward desired conditions as trees in the young to mid-aged seral stage grow into mature stages. Other expected changes are increases in tree density, shifts in species composition to more shade-tolerant species, and increases in fuel loading and continuity. Soil is similar to reference conditions and has a static trend relative to reference conditions. Spruce-Fir ERU has a high likelihood of being a limiting factor to the viability of the associated species considering vegetation quality. This likelihood was derived by combining the value for habitat abundance with the value for vegetation quality. Vegetation quality was used instead of soil quality, because vegetation is assumed to respond faster than soil to treatments or disturbances, and thus, would better reflect differences between alternatives.

Spruce-Fir has a moderately departed fire return interval with a static trend relative to reference conditions. There was a shift in age class distribution within the Spruce-Fir ERU, as a result of a

series of large wildfires in the early 1900s. These fires removed a substantial portion of the mature forest and reinitiated the stands. There is currently a substantial surplus of young to mid-aged trees. Sources of more frequent disturbance (e.g., small fires, insects, disease, and wind throw) have been less common recently, resulting is a deficit of early seral stages such as herbaceous openings, seedlings, and young aspen.

In 2007, there were an estimated 340 acres affected by spruce beetle. Spruce beetle outbreaks are typically associated with warm temperatures during the growing season and disturbance events such as sudden increases in woody debris from wind throw and logging slash. Outbreaks of spruce beetle tend occur infrequently because the beetle prefers areas dominated by dense stands of large-diameter spruce. When outbreaks do occur, their impacts convert Spruce-Fir forests to fir-dominated forests. There are an unknown number of acres affected by true fir beetles. This is considered to be within the historic range of variability, because only a small number of acres are affected, and native insects and disease are thought to be at endemic levels for the ERU (USDA Forest Service 2009a). An exotic spruce aphid (*Elatobium abietinum*) became established in the late 1990s, and may pose a risk to spruce species if populations expand (Lynch et al. 2007 and USDA Forest Service 2009a). Five invasive weed species (dalmatian toadflax, cheatgrass, bull thistle, musk thistle, and houndstongue) are present, but their populations are few in number and acreage, so are not considered a threat to this ERU.

Warmer and drier weather resulting from climate change may increase stress levels on the major tree species within this ERU, leading to high levels of mortality in these components, dramatic shifts in the structure and function, and possible disappearance of the ERU on the forest. Under the scenario of warming and drying conditions, this high-elevation ERU cannot migrate upward to higher elevations to escape climate change (USDA Forest Service 2016a).

Soils in Spruce-Fir have a low departure and a static trend.

Table 24 shows that there is a high likelihood that Spruce-Fir habitat could be limiting to the associated species. The likelihood that habitat would be limiting to the associated species was derived by combining the value for habitat abundance with the value for vegetation quality. Vegetation quality was used instead of soil quality, because vegetation is assumed to respond faster than soil to treatments or disturbances, and thus, would better reflect differences between alternatives.

Table 24 also compares management effect by alternative. Management effect categorizes the relative expected outcome of plan language in each alternative in terms of maintaining habitat quality and is the result of plan decisions, including plan objectives. Management effect category values are 1, 2, 3, and 4. The lower the management effects rating, the more effective the alternative is for maintaining the habitat. The effects of the alternatives are explained in greater detail in the discussions on the alternatives that follow.

Table 24. Summary of coarse filter analysis for Spruce-Fir ERU

Habitat	Existing	Alternative A	Alternatives B (modified), C, and D	Associated Species
Abundance	Rare	Rare		San Francisco Peaks ragwort, evening grosbeak, golden-crowned kinglet, MacGillivray's warbler, Swainson's thrush, three-toed woodpecker, bristlecone pine, Colorado blue columbine, common moonwort, corkbark (subalpine) fir, graceful buttercup, reflected moonwort
Quality-Vegetation	Fair, trending toward	Fair, trending toward desired conditions		
Quality-Soil	Good, static	Good, static		
Likelihood of Limitation	High	High		
Management effect		4: Decline in habitat quality as a result of management or lack of management that result from plan components. Plan components may not exist or may be few.	2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.	

About 81 percent of this ERU is in designated wilderness, mainly within the Kachina Peaks Wilderness, with about 225 acres in the Kendrick Mountain Wilderness. The Kendrick Mountain Wilderness is managed under the Kaibab National Forest land management plan. The remainder of this ERU is within the permit area for the Snowbowl Ski Area and the Inner Basin of the San Francisco Peaks. About 970 acres are within the Inner Basin Management Area, which is one of the water sources for Flagstaff. It contains several deep water wells, springs, and is closed to motor vehicle traffic except that necessary to maintain the infrastructure of the water system. About 1,730 acres occur within the San Francisco Peaks Management Area.

The Spruce-Fir Forest contains the San Francisco Peaks Research Natural Area. The existing San Francisco Peaks Research Natural Area was established in 1931, and is an example of a bristlecone pine/tundra/old-growth spruce-fir community. The RNA preserves the characteristics of the transition zone between Mixed Conifer and Alpine Tundra with populations of bristlecone pine, and occurs completely within the Kachina Peaks Wilderness. Currently, the research natural area is 1,010 acres in size, but is proposed to be expanded in alternative A. The proposed expansion includes Spruce-Fir.

Risk Factors

Primary threats to Spruce-Fir ERU are spruce beetles and an exotic spruce aphid (*Elatobium abietinum*). Climate change could also impact this ERU although it is beyond the control of the Forest Service. Extended drought, reduced snowpack, early melting of snowpack, or elevated temperatures as a consequence of climate change could significantly alter species composition and vegetation structure. Vulnerability to insect and disease could increase. Under these conditions, tree mortality in all seral stages and age classes could increase. Some species may be able to migrate or establish in suitable habitat at different elevations or aspects if they are genetically adapted to do so within the time frame that changes due to climate occur. If damage

from the exotic spruce aphid increases, the relative proportion of Engelmann spruce in spruce-fir could decrease dramatically.

Associated Species

Associated species are listed in table 24.

Environmental Consequences

Common to All Alternatives

Plan components in all alternatives contribute to species viability by managing habitat to maintain viable and sustainable populations of wildlife and fish species and by improving and protecting habitat for threatened, endangered, and sensitive species (1987 Plan, pages 22-1, 23; FW-Eco-DC-1; FW-WFP-DC-1, 2, 3, 5, 6, 8; FW-WFP-G-3, 10). See At-risk Species in the Wildlife and Plant Issues and Topics section above for more information.

All alternatives address the threat of invasive plants. Invasive plants can increase as a consequence of ground disturbance, and once established, would compete with native species for water and nutrients or could alter the fire regime. All alternatives address the threat of invasive plants by pointing to the Final Environmental Impact Statement for the Treatment of Noxious or Invasive Weeds (USDA Forest Service 2005). This direction includes best management practices, among other guidance, which would help prevent, mitigate, and reduce the threat of invasive plants. All alternatives prioritize treatments, call for incorporating control measures in project planning and implementation, and emphasize coordination with partners (1987 Plan, pages 23, 69, 70, 182, 206-14, 206-76, 206-101, 201-116; FW-Invas-DC-1, 2; FW Invas-G-1, 2, 3; FW-Invas-MgtApp; FW-Graz-MgtApp; FW-RdsFac-G-8; FW-Rec-Dev-DC-9; FW-Rec-Dev-G-2). Additional information and analysis is discussed under the Non-native or Invasive Species topic in the Wildlife and Plant Topics and Issues section. Although no significant weed issues have been identified in Spruce-Fir, this guidance would be useful if weed issues occur in the future.

A portion of Spruce-Fir ERU occurs within the Kachina Peaks Wilderness. All alternatives recognize wilderness and incorporate appropriate direction (1987 Plan, pages 105 to 112; SA-Wild-DC-1 to 8; SA-Wild-S-1, 2; SA-Wild-G-1 to 7). Wilderness direction provides an added layer of protection for the Spruce Fir ERU, such as prohibiting motorized and mechanized travel, which would reduce accelerated erosion. Management would emphasize wilderness recreation and watershed condition, while maintaining wilderness resource values. Livestock grazing would be managed under Congressional guidelines for grazing in wilderness (1987 Plan, page 105; FSM 2323.22), and therefore, could still occur if approved under site-specific environmental analysis. Corrective measures would be taken if overuse causes unacceptable resource damage and the Kachina Peaks Wilderness would be closely monitored to determine whether corrective measures are needed (1987 Plan, page 105; SA-Wild-DC-1; SA-Wild-G-1, 2).

Although natural processes, such as fire, are encouraged in wilderness areas (1987 Plan, page 112; SA-Wild-DC-4), applicable laws and policies may decrease opportunities to manage wildfire for resource benefits or use prescribed fire. This is because mechanical treatments, tools, and motorized vehicles are prohibited; therefore, crews could not use vehicles to enter or exit a wilderness, nor could they use chainsaws, an essential tool in fire management. Consequently there is a greater potential for the fire to escape containment and the safety risk to firefighters is higher because there would be a reduced ability to evacuate the area in the event of an unexpected change in fire behavior (USDA Forest Service 2016c). High-severity fire would move this ERU

toward desired conditions, should it occur, and early seral or shade-intolerant species such as aspen would establish or be maintained within the burned areas. Lack of fire would move this ERU away from desired conditions; however, because the fire return interval is 200 + years, and tree growth is relatively slow at high elevations, it may be years before the impacts to vegetation structure, composition, and function are noticeable. While the vegetation is departed from reference conditions, it is within the historic range of variability because this ERU experiences infrequent high-severity fires. There have been few large high-severity fires in this ERU since the 1900s, but the historic fire return interval is over 200 years, so this is within the expected range (USDA Forest Service 2009a).

The Spruce-Fir ERU occurs within the Inner Basin Management Area for all alternatives. Soil and vegetation conditions would be maintained or improved through the following plan direction: Recreation in the Inner Basin is restricted to day use (1987 Plan page 192; MA-InBsn-G-7); grazing is not allowed and the area is not part of any grazing allotment (1987 Plan, page 192; Chapter 4 of Revised Plan, Grazing Suitability, table 12); and the use of recreational livestock is prohibited above Doyle Saddle and above the watershed cabin (1987 Plan, page 192; MA-Peaks-S-1; MA-InBsn-S-1).

Alternative A

Using the analysis process described under the Species Viability section above, table 24 shows that under alternative A, the vegetation quality of Spruce-Fir is classified as Fair, which means it has a moderate departure from desired conditions and the number, size, and evenness of distribution of habitat areas across the landscape is somewhat reduced. It would trend toward desired conditions. Under alternative A, management of Spruce-Fir is not expected to change over current levels. Vegetation condition is expected to remain moderately departed, but trending toward the desired conditions. Specifically, the current departed condition related to underrepresented early successional species, excessive density, poor age class diversity, and deficit herbaceous vegetation is expected to persist. However, in the absence of large-scale disturbance, the mid-aged seral stage would develop into mature trees and small-scale disturbances would replenish the early seral community components. Fire return interval is expected to remain highly departed, but maintain a static trend relative to the desired conditions.

Soil quality would remain good with a static trend relative to desired conditions.

There is a high likelihood that Spruce-Fir could be a limiting factor to the viability of the associated species. This likelihood was derived by combining the value for habitat abundance with the value for vegetation quality. Vegetation quality was used instead of soil quality, because vegetation is assumed to respond faster than soil to treatments or disturbances, and thus, would better reflect differences between alternatives.

The management effect is a 4. This means there could be a decline in habitat quality as a result of management or lack of management that result from plan components. Plan components may not exist or may be few. Alternative A contributes less to the maintenance and sustainability of Spruce-Fir and the viability of the associated species than the other alternatives.

Alternative A provides little to no explicit desired conditions for Spruce-Fir ERU, but rather it is accounted for under management direction for wilderness. The small portion of the ERU that is not in MA 1 (Wilderness) or MA 16 (Inner Basin) is within MA 4 (Ponderosa Pine and Mixed Conifer Above 40 Percent Slopes).

The San Francisco Peaks Research Natural Area includes about 932 acres of Spruce-Fir and has a dual designation with the Kachina Peaks Wilderness (1987 Plan page 193), and would be managed according to that direction. This alternative also has two additions to the San Francisco Peaks Research Natural Area, which includes about 138 acres of Spruce-Fir. The additions are also within the Kachina Peaks Wilderness boundary. The effects are the same as described under wilderness in the Common to All Alternatives section above.

Prescribed fire and wildfires managed for resource objectives may be used in Spruce-Fir, but there is no provision for using wildfires managed for resource objectives in the wildland-urban interface (such as near Arizona Snow Bowl) (1987 Plan, pages 92, 155, and 165) and the language to manage wildfires for resource objectives in wilderness impedes the use of this tool (1987 Plan, pages 111, 112). This plan language limits the restoration of fire as a natural process in the wildland-urban interface and in wilderness, and canopy cover and tree density would be expected to increase in these areas. There would also be increased potential for uncharacteristic fire in the wildland-urban interface and wilderness portions of this ERU.

For fire management in the Kachina Peaks Wilderness, the objective is to hold fires to 10 acres or less, while choosing the suppression tactics that minimize damage to soil and water resources (1987 Plan, page 112). This is repeated for the Inner Basin MA (1987 Plan, page 192). This guidance does not acknowledge the reference condition within the Spruce-Fir ERU where infrequent, high-severity stand-replacing fire was within the historic range of variability. The acreage limits would be difficult to obtain, especially with the presence of wilderness that limits suppression options, departed conditions, and dense stand structure.

Alternative A does not address climate change.

Alternative B (modified)

Using the analysis process described under the Species Viability section above, table 24 shows that under alternative B (modified) the vegetation quality of Spruce-fir would be fair with a trend toward desired conditions. This means it has a moderate departure from desired conditions and the number, size, and evenness of distribution of habitat areas across the landscape is somewhat reduced. Under alternative B (modified), the departed condition related to underrepresented early successional species, excessive density, poor age class diversity, and deficit understory vegetation is expected to persist; however, in the absence of large-scale disturbance, the mid-aged would develop into mature trees and small-scale disturbances would replenish the early seral community components.

Soil quality would remain good with a static trend relative to desired conditions.

There would be a high likelihood that Spruce-Fir would be a limiting factor to the viability of associated species. This likelihood was derived by combining the value for habitat abundance with the value for vegetation quality. Vegetation quality was used instead of soil quality, because vegetation is assumed to respond faster than soil to treatments or disturbances, and thus, would better reflect differences between alternatives.

The management effect for alternative B (modified) is a 2, which indicates plan components under this alternative maintain or improve protection and management for most habitat occurrences in the plan area, and thus, contribute more to the maintenance and sustainability of Spruce-Fir and the viability of the associated species than alternative A.

Alternative B (modified) provides direction to promote properly functioning ecosystems that are resilient to natural disturbances and climate change (FW-TerrERU-SF-DC-4). The desired conditions for Spruce-Fir promote a functioning ecosystem that contains all of the components, processes, and natural levels of disturbance historically maintained in the vegetation community, while providing a mosaic of structural and seral stages (FW-TerrERU-SF-DC-1) and old-growth components (FW-TerrERU-SF-DC-2), which are important for wildlife and provide structural diversity within the ERU. This ERU is dominated by vigorous trees, while containing declining trees, snags, and woody debris (FW-TerrERU-SF-DC-3). These components provide direction for the associated tree species including aspen, bristlecone pine, and corkbark (subalpine fir).

Implementation of desired conditions in Spruce-Fir would result in structure and species composition that both reflect and support natural disturbance regimes. A mosaic of structural and seral stages would range in age from young to old and consist of multiple species. Canopies are more closed than in adjacent mixed conifer. These conditions would support infrequent mixed-severity fires in the lower-elevation subtype and very infrequent high-severity fires in the upper-elevation subtype. Frequent small disturbances would result in groups and patches of tens of acres or less (FW-TerrERU-SF-DC-1, 5 6). Plant composition would be similar to site potential at the landscape level, yet could vary considerably at the fine and mid-scale in response to differing seral stages (FW-TerrERU-SF-DC-4).

Old-growth components and structure would occur over large areas as stands or patches where old-growth components are concentrated. They would shift in time and space as a result of succession, and tree growth and mortality (FW-TerrERU-SF-DC-2). Habitat and food for wildlife and their prey would be provided by snags, downed logs, and coarse woody debris that vary in density by size class and seral stage. Snags would range in size from greater than 8 inches to greater than 18 inches (FW-TerrERU-SF-DC-3, 7).

Overarching management direction would promote properly functioning ecosystems that are resilient to natural disturbances and climate change; promote characteristic disturbances and reduce the threat of uncharacteristic disturbances; and promote balance between desirable non-native species and subspecies and properly functioning ecosystems, thereby, furthering sustainability and adaptability (FW-Eco-DC-1 to 4, FW-TerrERU-All-DC-2).

Desired conditions promote an understory that reflects the cooler moister conditions of the ERU: native grasses, forbs, sedges, mosses, liverworts, and/or shrubs (FW-TerrERU-SF-DC-1, 4). Vegetative ground cover and herbaceous vegetation would provide protection from accelerated soil erosion, promote water infiltration, and contribute to soil nutrient cycling, ecosystem function and species diversity (FW-TerrERU-SF-DC-1, 4, 9). These provide guidance for common and rare plant species in the ERU, including San Francisco Peaks ragwort, Colorado blue columbine, and graceful buttercup.

Under this alternative, wildfires may be managed for resource objectives in more areas of the landscape than in alternative A (including wildland-urban interface and wilderness), allowing increased opportunities to reduce the risk of uncharacteristic fire and restore fire-adapted ecosystems (FW-TerrERU-All-G-2; FW-WUI-DC-4).

Plan components direct managers to reduce fire hazard, intensity, and severity in order to protect human life and property (FW-WUI-DC-2). When wildland-urban interface intersects with a high-severity fire regime like Spruce-Fir, characteristic ecosystem function would be modified to promote low-severity surface fires that rarely spread as crown fire; forests in the wildland-urban

interface would be dominated by early seral, fire-adapted species growing in a more open condition than the general forest; and wildland-urban interface may have a higher frequency of disturbance from prescribed burning, wildfires managed for resource objectives, and/or vegetative treatments than the natural disturbance regime (FW-WUI-DC-3, 4, 7, and 8). This proportion of the ERU would move away from desired conditions and may result in a different species composition and structure than what Spruce-Fir is adapted to. This departure could be mitigated by promoting wildland-urban interface conditions (fuel loading, basal area, logs, snags) at the lower end of the range given in vegetation community desired conditions (FW-WUI-DC-5, 9). This departure could also be mitigated by spatially arranging these structural components to reduce fire hazard and increase suppression success, and allowing fuel loading or tree densities at the higher end of the range where it provides for important fine-scale habitat structure or cover as long as it meets the overall intent of protecting wildland-urban interface values-at-risk (FW-WUI-DC-5, 9, 10; FW-WUI-G-1). This is intended to mitigate the risks to the wildland-urban interface and associated infrastructure.

Plan language in the Inner Basin Management Area and San Francisco Peaks Management Area would promote properly functioning ecosystems and watersheds, and would reduce human-caused disturbance to soil, vegetation, and water in the Spruce-Fir ERU. There are goals for properly functioning watersheds that are resilient to natural and human disturbances; for functioning vegetation, soil, and riparian areas that facilitate precipitation infiltration and groundwater recharge; for water quality that meets or exceeds Arizona water quality standards; and for low risk of substantial damage from uncharacteristic fire and recreation to water quality and supply, visual quality, and cultural integrity (MA-InBsn-DC-1, 2, 3, 4). Erosion and sedimentation would be reduced and watersheds would be protected through maintenance of roads and trails (MA-InBsn-G-4), restriction of motorized access to authorized vehicles necessary for area administration on Forest Roads 146, 6437, and a portion of 553 (MA-InBsn-G-5; MA-Peaks-G-1), and limitation of dispersed recreation to day-use only (MA-InBsn-G-7).

Like alternative A, this alternative includes the eastside expansion of the San Francisco Peaks Research Natural Area in the Kachina Peaks Wilderness. Although wilderness direction would prevail, the desired conditions for research natural areas are to provide excellent examples of the ecological features for which they were designated (SA-RNABotGeo-DC-1), to function as reference areas to study natural processes, and to serve as baseline areas for measuring long-term ecological change where natural conditions and processes are preserved and maintained (SA-RNABotGeo-DC-2). San Francisco Peaks RNA and other RNAs on the forest provide opportunities for research, study, observation, monitoring and for educational opportunities that do not modify the conditions for which they were established (SA-RNABotGeo-DC-4), while preserving and maintaining genetic diversity (SA-RNABotGeo-DC-3). The expansion includes portions of this ERU, as well as a portion of Alpine Tundra ERU, and would include some of the occurrences of San Francisco Peaks ragwort.

There are no treatment objectives under this alternative. Furthermore, the vast majority of this ERU is located within wilderness and treatment is not expected to increase over current levels. Underrepresented early successional species, high density, poor age class diversity, and deficit understory vegetation is expected to persist; however, in the absence of large-scale disturbance, the mid-aged would develop into mature trees and small-scale disturbances would replenish the early seral community components.

Alternative C

Alternative C is the same as alternative B (modified).

Alternative D

Alternative D is the same as alternative B (modified).

Alpine Tundra

Affected Environment

Amount

On the Coconino NF, 939 acres of Alpine Tundra ERU lie within the administrative boundary and the forest manages 100 percent of the ERU.

Table 25 summarizes the information used to estimate the likelihood that the Alpine Tundra ERU would be a limiting factor to the associated species. The abundance is categorized as rare because, at 939 acres, it occupies about 0.1 percent of the forest. Habitats classified as rare generally cover less than 1 percent of the forest. Alpine Tundra is rarely encountered because it only occurs on the San Francisco Peaks.

Habitat Quality and Distribution

The Alpine Tundra ERU is found at the highest elevations on the forest on the San Francisco Peaks. This is the only area of Alpine Tundra located on National Forest System lands in Arizona; it is also one of the southernmost extents of Alpine Tundra in the continental U.S.

Alpine Tundra ERU typically has sparse vegetation including grasses, forbs, lichens, and low shrubs. Low vegetative cover and high rock content (80 percent) is typical of TES soil unit 850, which is the primary soil unit in the ERU (USDA Forest Service 1995c). Alpine Tundra consists of three main habitat associations: boulder fields, talus slopes, and alpine tundra meadows. Krummholz (i.e., areas of dwarfed, wind-twisted trees) occurs near tree line where trees transition to Alpine Tundra vegetation.

Primary natural disturbances in Alpine Tundra are climate-related. Vegetation is controlled by temperature and the presence of soil, wind, snow accumulation, slope, and aspect. The dynamics of freeze-thaw cycles and wind give rise to unusual shapes of trees and characteristic plant forms such as cushion plants. Episodic weather-related factors are the major natural disturbance processes and include extreme temperatures, solar radiation, high winds, avalanches, and moisture. Alpine Tundra is not a fire-adapted ERU, and it is highly unlikely that fire would occur there. Wildland fires and invasive or noxious weeds have had little to no effect on this habitat. However, year-round off-trail recreation can trample plants and damage habitat by causing soil compaction, and moving rocks, which can provide microsites for Alpine Tundra vegetation except when it is not protected by snow.

Using the analysis process described under the Species Viability section above, table 25 shows that the vegetation quality and soil quality of Alpine Tundra are classified as good. This means the ERU has a low departure from reference conditions and the number, size of habitat areas, or evenness in distribution across the landscape are similar to reference conditions. Vegetation quality is trending away from reference conditions due to climate change and weather patterns that have favored a transition into more meadow subtypes.

Soil condition has a static trend relative to reference conditions.

There is a moderate likelihood that Alpine Tundra habitat could be limiting to the associated species. The likelihood that habitat would be limiting to the associated species was derived by combining the value for habitat abundance with the value for vegetation quality. Vegetation quality was used instead of soil quality, because vegetation is assumed to respond faster than soil to treatments or disturbances, and thus, would better reflect differences between alternatives.

Table 25. Summary of coarse filter analysis for Alpine Tundra ERU

Habitat	Existing	Alternatives A, B (modified), C, and D	Associated Species
Abundance	Rare	Rare	San Francisco Peaks ragwort, crenulate moonwort, bearded gentian, blackroot sedge, common moonwort, Dane's dwarf gentian, different-nerve sedge, graceful buttercup, reflected moonwort, spider saxifrage
Quality-vegetation	Good, trending away due to climate change	Good, trending away but may become Fair, trending away due to climate change	
Quality-Soil	Good, static	Good, static	
Likelihood of Limitation	Moderate	Moderate	
Management effect		2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.	

Table 25 also compares management effect by alternative. Management effect categorizes the relative expected outcome of plan language in each alternative in terms of maintaining habitat quality and is the result of plan decisions, including plan objectives. Management effect category values are 1, 2, 3, and 4. The lower the management effects rating the more effective the alternative is for maintaining the habitat. The effects of the alternatives are explained in greater detail in the discussions on the alternatives that follow.

About 898 acres (96 percent of the ERU) occur within the Kachina Peaks Wilderness. The remainder is within the Arizona Snowbowl ski permit area. About 77 acres of the San Francisco Peaks Research Natural Area occur in Alpine Tundra.

Risk Factors

The main risk factor for this ERU is climate change, which is outside the control of the Forest Service. The trend of the ERU could be negatively impacted by the predicted effects of climate change, which could result in the treeline moving upward in elevation, resulting in decreased abundance of Alpine Tundra. The other habitat threat is off-trail hiking. Off-trail hiking has the potential to reduce the vigor, maintenance, and survival of rare plants in localized areas in this ERU.

Associated Species

Associated species are listed in table 25.

Environmental Consequences

Common to All Alternatives

Plan components in all alternatives contribute to species viability by managing habitat to maintain viable and sustainable populations of wildlife and fish species and by improving and protecting habitat for threatened, endangered, and sensitive species (1987 Plan, pages 22-1, 23; FW-Eco-DC-1; FW-WFP-DC-1, 2, 3, 5, 6, 8; FW-WFP-G-3, 10). See At-risk Species in the Wildlife and Plant Issues and Topics section above for more information.

Most of Alpine Tundra occurs in the Kachina Peaks Wilderness, which is on the San Francisco Peaks. Designated wilderness areas would be managed according to applicable laws, policy, and Forest Plan direction to preserve wilderness resource values and wilderness quality, and to emphasize wilderness recreation (1987 Plan, pages 105 to 112; SA-Wild-DC-1 to 11; SA-Wild-S-1, 2; SA-Wild-G-1 to 7). Wilderness designation prohibits motorized use and mechanized use. Motorized and mechanized access can kill or damage plants, can degrade the habitat through soil compaction and soil loss, and can introduce non-native species that compete with native plants for resources. This can negatively affect the reproduction and survival of individual plants or populations. Ground-disturbing activities are primarily confined to main trails, trailheads, and key points of interest at which invasive species introduction and establishment, or accelerated erosion could occur, depending on the level of use. The lack of ground-disturbing activities elsewhere in the wilderness would reduce the risk of invasive plant introduction and dispersal by motorized or mechanized use.

The alternatives would not vary in effects for the 40 acres within the Snowbowl Ski Area, because the alternatives would not lead to changes in the operating permit for the site.

All alternatives address the threat of invasive plants by pointing to the Final Environmental Impact Statement for the Treatment of Noxious or Invasive Weeds (USDA Forest Service 2005). This direction includes best management practices, among other guidance, which would help prevent, mitigate, and reduce the threat of invasive plants. All alternatives prioritize treatments, call for incorporating control measures in project planning and implementation, and emphasize coordination with partners (1987 Plan, pages 23, 69, 70, 182, 206-14, 206-76, 206-101, 201-116; FW-Invas-DC-1, 2, 3; FW-Invas-G-1, 2, 3; FW-Invas-MgtApp; FW-WFP-DC-10; FW-Graz-MgtAp; FW-RdsFac-G-8; FW-Rec-Dev-DC-9; FW-Rec-Dev-G-2; FW-TerrERU-Grass-DC-2). Additional information and analysis is discussed under the Non-native or Invasive Species topic in the Wildlife and Plant Topics and Issues section. Although no significant weed issues have been identified in Alpine Tundra, this guidance would be useful if weed issues occur in the future.

All alternatives close the ERU to off-trail hiking during snow-free periods (1987 Plan pages 108; 110; SA-Wild-S-3), prohibit horse and pack stock (except for limited administrative use) on the Humphrey’s Trail and Weatherford Trail above Doyle Saddle; prohibit camping above tree line; and prohibit recreational livestock above tree line or in the watersheds draining into the Inner Basin (1987 Plan, page 108; MA-Peaks-S-1, 3; MA-InBsn-S-1; SA-Wild-S-4). These measures protect the fragile environment of Alpine Tundra, including the threatened San Francisco Peaks ragwort and its critical habitat. These components indirectly protect the talus slopes within the ERU by protecting the Alpine Tundra itself.

Ground disturbance is also reduced because the Alpine Tundra is closed to grazing and is not part of any allotment (1987 Plan, page 110; Chapter 4 of Revised Plan, Grazing Suitability, table 12).

The portion of Alpine Tundra in the Inner Basin is limited to day-use foot traffic (1987 Plan page 108; MA-InBsn-G-7).

The San Francisco Peaks Alpine Tundra Management Plan (1984) is incorporated into alternative A and into the Recovery Plan for the San Francisco Peaks ragwort (USDI Fish and Wildlife Service 1987) by reference. This management plan discusses the physical components of the Alpine Tundra habitat, dividing the habitat into boulder fields, fellfield-snow-bed communities, and fellfields. The boulder fields and fellfields are roughly equivalent to the talus slopes. Only the fellfields are occupied by San Francisco Peaks ragwort.

Alternative A

Using the analysis process described under the Species Viability section above, table 25 shows that under alternative A, the vegetation quality of Alpine Tundra is classified as good, which means it has a low departure from desired conditions and the number, size, and evenness of distribution of habitat areas across the landscape is similar to reference conditions. There is a trend away from desired conditions due to climate change, which is causing a shift to more meadow habitat. Vegetation quality may become fair in the long term still with a trend away from desired conditions. Soil quality would remain good with a static trend relative to desired conditions.

There is a moderate likelihood that Alpine Tundra could be a limiting factor to the viability of the associated species. This likelihood was derived by combining the value for habitat abundance with the value for vegetation quality. Vegetation quality was used instead of soil quality, because vegetation is assumed to respond faster than soil to treatments or disturbances, and thus, would better reflect differences between alternatives.

The management effect would be a 2, which means that plan components in alternative A maintain or improve protection and management for most habitat occurrences in the plan area, and thus, contribute to the maintenance and sustainability of Alpine Tundra and the viability of the associated species than alternative A.

The 1987 Plan lacks specific components for Alpine Tundra ERU, likely because it largely occurs in wilderness, so wilderness direction would prevail. The ERU is mentioned in the description of the Kachina Peaks Wilderness as a fragile 2-square-mile zone that contains a threatened plant (1987 Plan, page 101).

In addition to occurring in designated wilderness, a portion of Alpine Tundra falls within the special permit Snowbowl Ski Area. The 1987 Plan adopts the EIS on the ski area proposal, and facility development is guided by the ski area master development plan based on approved environmental analysis (1987 Plan, pages 19, 188). This master development plan is done at the district level, not the forest Plan level. In developed recreation areas (i.e., Snowbowl), developed recreation is emphasized (1987 Plan, page 188). The Snowbowl special-use authorization area will be fenced to physically exclude grazing (1987 Plan, page 190).

A portion of Alpine Tundra ERU falls within the Inner Basin Management Area. Alpine Tundra would be protected by plan components that close this management area to public travel by vehicle and domestic livestock. Day-use only foot or bicycle traffic would be permitted. The emphasis on watershed condition and protecting water quality should also protect Alpine Tundra (1987 Plan, pages 191, 192).

The San Francisco Peaks Research Natural Area includes 77 acres of Alpine Tundra and alternative A also proposes an expansion of the research natural area that includes an additional 139 acres of the Alpine Tundra ERU. This acreage would have a dual designation with wilderness (1987 Plan, page 193) and would be managed according to that direction.

Alternative A does not specifically address climate change or resiliency; however, it mentions that the purpose of the plan was to integrate planning principles from National Forest Management Act regulations (36 CFR 219.1 (b)) including responding to changing conditions of land and other resources, which could include climate change (1987 Plan, page 1). In comparison, climate change and resiliency are common themes in alternatives B (modified), C, and D.

Alternative A did not establish definitions, desired conditions, and standards and guidelines for talus slopes, and there is no direction for management of talus slopes and the habitats they provide (USDA Forest Service 2016i). Talus slopes are key habitats for some of the associated species. For additional information and analysis on talus slopes, see the Cliffs, Rocky Outcrops, and Talus Slopes section below.

Alternative B (modified)

Using the analysis process described under the Species Viability section above, table 25 shows that under alternative B (modified) the vegetation quality of Alpine Tundra would be good with a trend away from desired conditions. This means it has a low departure from desired conditions and the number, size of habitat areas, or evenness in distribution across the landscape is similar or only slightly reduced relative to desired conditions. Under alternative B (modified), it is unclear how departure would be affected. If current climate trends persist, the ERU may become moderately departed with respect to vegetation, and this trend would continue away from the desired condition.

Soil quality would remain good with a static trend relative to desired conditions.

There would be a moderate likelihood that Alpine Tundra would be a limiting factor to the viability of associated species. This likelihood was derived by combining the value for habitat abundance with the value for vegetation quality. Vegetation quality was used instead of soil quality because vegetation is assumed to respond faster than soil to treatments or disturbances, and thus, would better reflect differences between alternatives.

The management effect for alternative B (modified) is a 2, which indicates plan components under this alternative maintain or improve protection and management for most habitat occurrences in the plan area, and thus, contribute to the maintenance and sustainability of Alpine Tundra and the viability of the associated species similar to alternative A.

Alternative B (modified) provides direction that would promote properly functioning ecosystems that are resilient to natural disturbances and climate change; promote characteristic disturbances; and reduce the threat of uncharacteristic disturbances (FW-Eco-DC-1 to 4; FW-TerrERU-All-DC-2). These components acknowledge the role of natural disturbance. For the Alpine Tundra ERU, these include disturbances such as weather extremes and natural shifting of the substrate (i.e., landslides).

Unlike alternative A, alternative B (modified) has ERU-specific direction that provides for a functioning, resilient ecosystem with all its components, processes, and conditions that support

high-elevation ecological communities and sustain rare or narrowly endemic species, including San Francisco Peaks ragwort and graceful buttercup (FW-TerrERU-AT-DC-1, 2).

Recreation would be managed to maintain, protect, or improve ecological attributes, processes and habitat for native species, and to be in balance with the capacity of other resources to support recreation activities (FW-TerrERU-AT-G-1; SA-Wild-S-1 to 5; FW-Rec-All-G-2). Trail use would remain on established trail surfaces, especially in sensitive areas, and unplanned user-created trails are rare (FW-Rec-Trails-DC-11). Trails should be designed, built, rerouted, or maintained using best management practices that address impacts to other resources and promote sustainable trail surfaces (FW-Rec-Trails-G-1.)

The desired conditions for wilderness contribute to the preservation of San Francisco Peaks ragwort, graceful buttercup, and crenulate moonwort, and their habitat. A wilderness desired condition focuses on preserving the primitive integrity of wilderness, while preserving the range of social and ecological values (SA-Wild-DC-1). This would contribute to the conservation of the Kachina Peaks Wilderness and the Alpine Tundra within it, including the small portion occupied by San Francisco Peaks ragwort and its habitat, and other alpine species, by maintaining the ecological function of the area. A second desired condition (SA-Wild-DC-2) focuses on preserving ecosystems and ecological resources within wilderness by ensuring that they are functioning properly and reflect natural processes. Disturbances would play their natural role, while accounting for public health and safety outside of the wilderness area (SA-Wild-DC-4). Examples of disturbance in the Kachina Peaks Wilderness that affect San Francisco Peaks ragwort habitat are rock slides in the Alpine Tundra, and fires in the upper elevations of the Spruce-Fir forest. The desired conditions also promote diversity and the natural assemblage of native, indigenous species including San Francisco Peaks ragwort (SA-Wild-DC-3).

Guidelines for wilderness state that management activities and permitted uses should be designed to maintain or move toward the desired conditions for wilderness and other resources (SA-Wild-G-1); that signs and cairns should be restricted to those necessary to protect resources or for public safety (SA-Wild-G-6); and that trails and signs should be managed to discourage and reduce off-trail travel (SA-Wild-G-9). These guidelines would protect Alpine Tundra vegetation by managing trail usage.

Alternative B (modified) provides for the San Francisco Peaks Research Natural Area as well as the eastside expansion that was analyzed in alternative A, but never implemented. The desired conditions for established and proposed RNAs are to provide excellent examples of the ecological features for which they were designated (SA-RNABotGeo-DC-1) and function as reference areas to study natural processes and as baseline areas for measuring long-term ecological change where natural conditions and processes are preserved and maintained (SA-RNABotGeo-DC-2). San Francisco Peaks RNA and other RNAs on the forest provide opportunities for research, study, observation, monitoring and for educational opportunities that do not modify the conditions for which they were established (SA-RNABotGeo-DC-4), while preserving and maintaining genetic diversity (SA-RNABotGeo-DC-3). With the inclusion of the Alpine Tundra habitat of San Francisco Peaks ragwort, the area will provide an example of the habitat and would be useful in the study of ecological change that could affect San Francisco Peaks ragwort and other species associated with Alpine Tundra, especially in the future with predicted climate change.

The components discussed for the Alpine Tundra ERU also apply to the talus slopes within it. Unlike alternative A, alternative B (modified) contains forestwide direction that protects

biophysical components, including talus slopes. Desired conditions provide direction to keep geological features, including talus slopes, generally undisturbed by human activities, while maintaining the cultural and natural resource values of these features (FW-BioPhys-Geo-DC-1). They also specifically mention the importance of talus slopes as specialized habitat for San Francisco Peaks ragwort, and maintain and protect habitat for federally listed, sensitive, and rare wildlife and plant species associated with the special niche habitat (FW-BioPhys-Geo-DC-6, 7). Guidelines for geological features state that projects should be designed and forest uses should be managed to maintain the integrity and function of caves, karst, cliffs, and talus, and mitigation measures should be designed to mimic pre-disturbance conditions and functions (FW-BioPhys-Geo-G-1).

Alternative C

Alternative C has the same effects as alternative B (modified).

Alternative D

Alternative D has the same effects as alternative B (modified).

Riparian Forest Types

The three riparian forest types on the Coconino NF are: Cottonwood Willow Riparian Forest (Cottonwood Willow), Mixed Broadleaf Deciduous Riparian Forest (Mixed Broadleaf), and Montane Willow Riparian Forest (Montane Willow). Each riparian forest type consists of two or more riparian ERUs (see descriptions of riparian forest types and Appendix E in the Plan.

Affected Environment

Amount

There are about 3,158 acres of Cottonwood Willow Riparian Forest within the administrative boundary of the Coconino NF. About 1,324 acres (42 percent) is managed by the forest. The remaining acres of Cottonwood Willow are in private, State, Tribal, and other Federal ownership.

Table 26 summarizes the information used to estimate that the likelihood that Cottonwood Willow Riparian Forest Type would be a limiting factor to the viability of the associated species. The abundance is categorized as rare because at 1,324 acres it occupies about 0.1 percent of the forest. Habitats classified as rare generally have less than 100 occurrences, or patches of the habitat cover less than 1 percent of the forest.

There are about 8,723 acres of Mixed Broadleaf Deciduous Riparian Forest within the administrative boundary of the Coconino NF. About 5,926 acres (68 percent) is managed by the forest. Most of the acreage not managed by the forest is privately owned.

Table 27 summarizes the information used to estimate the likelihood that Mixed Broadleaf Deciduous Riparian Forest Type would be a limiting factor to the associated species. The abundance is categorized as Rare because at 5,926 acres it occupies about 0.3 percent of the forest. Habitats classified as Rare generally have less than 100 occurrences, or patches of the habitat cover less than 1 percent of the forest.

Montane Willow Riparian Forest covers approximately 3,908 acres within the administrative boundary. About 3,568 acres (91 percent) is managed by the Coconino NF. Most of the remaining acres are on private land.

Table 28 summarizes the information used to estimate the likelihood that Montane Willow Riparian Forest Type would be a limiting factor to the viability of the associated species. The abundance is categorized as rare, because at 3,568 acres, it occupies about 0.2 percent of the forest. Habitats classified as rare generally have less than 100 occurrences, or patches of habitat that cover less than 1 percent of the forest.

Habitat Quality and Distribution

In reference conditions, riparian forests were functioning properly and invasive or non-native species were not present. Proper functioning condition means that adequate vegetation, landforms, or large woody debris is present to dissipate stream energy associated with high flows; filter sediment, capture bedload, and aid in floodplain development; improve floodwater retention and groundwater recharge; develop root masses that stabilize streambanks; develop diverse ponding and channel characteristics to provide habitat for fish, waterfowl and other uses, and support greater biodiversity. When riparian forests are properly functioning, vegetation composition, structure and function is diverse, productive, and provides habitat for those species that rely on them for their survival.

Primary natural disturbances in riparian forest ecosystems include flooding, adjacent landslides, and changing climatic conditions, such as drought or extreme temperatures.

Cottonwood Willow occurs in patches distributed along the lower gradient reaches of perennial streams including the Verde River, Towel Creek, Lower Oak Creek, Lower West Clear Creek, and Dry Beaver Creek as well as other perennial and intermittent streams and tributaries. Dominant vegetation includes: Fremont cottonwood, willow, ash, box elder, alder and others. Various grasses and forbs are usually present. Associated higher stream terraces support a mix of riparian and upland vegetation, including mesquite and desert willow. Floodplains tend to have greater vegetation productivity (i.e., biomass) than terraces. Consequently, floodplains have greater ability to resist erosion and recycle nutrients.

Using the analysis process described under the Species Viability section above, table 26 shows that the riparian functional condition of Cottonwood Willow Riparian Forest is classified as fair and is slowly trending toward reference conditions. This means it has a moderate departure from reference conditions and the number, size of habitat areas, or evenness in distribution across the landscape is somewhat reduced relative to reference conditions. Localized areas have a static trend relative to reference as a result of high dispersed recreational impacts. These areas include some portions of the Verde River and associated tributaries, and easily accessible areas of Dry Beaver Creek, Lower Oak Creek, and Lower West Clear Creek. Lower Oak Creek has been the most impacted by the ground disturbance and vegetation removal from high intensity unmanaged recreation and by degraded water quality resulting from unmanaged sanitation.

Soil quality in Cottonwood Willow is considered poor and trending slowly toward reference conditions. Impaired conditions exist where recreation disturbances occur or in some areas that are still recovering from past livestock grazing. In these areas, there is lower surface litter, lower understory production, poor species composition, and more visible sheet and rill erosion compared to reference conditions. Consequently, these soils have a reduced ability to recycle nutrients and resist erosion. Soils on lower-lying floodplains are similar to reference conditions and able to recycle nutrients and resist erosion within their inherent capability.

There is a high likelihood that Cottonwood Willow Riparian would be a limiting factor to the viability of the associated species. This likelihood was derived by combining the value for habitat abundance with the value for riparian functional condition. Riparian functional condition was used instead of soil quality because riparian function is assumed to respond faster than soil to treatments or disturbances and thus would better reflect differences between alternatives.

Table 26 also compares management effect by alternative. Management effect categorizes the relative expected outcome of plan language in each alternative in terms of maintaining habitat quality and is the result of plan decisions, including plan objectives. Management effect category values are 1, 2, 3, and 4. The lower the management effects rating the more effective the alternative is for maintaining the habitat. The effects of the alternatives are explained in greater detail in the discussions on the alternatives that follow.

Mixed Broadleaf occurs in patches distributed across mid-elevation portions of Sycamore Canyon, West Clear Creek, Upper Oak Creek, Red Tank Draw, Wet Beaver Creek, Walker Creek, Fossil Creek, and associated tributaries. It is adjacent to the communities of Sedona and Village of Oak Creek. Mixed Broadleaf consists of a vegetation mix of riparian woodlands and shrublands with various dominant species, depending on site-specific characteristics. Vegetation can include: Arizona sycamore, thin leaf alder, willow, conifers, box elder, narrow leaf or Fremont cottonwoods, velvet ash, Arizona walnut, and often contains oaks and conifers, including Arizona cypress, from adjacent uplands.

Using the analysis process described under the Species Viability section above, table 27 shows that the riparian functional condition of Mixed Broadleaf Deciduous Riparian Forest is classified as good with the majority of the habitat slowly trending toward reference conditions. This means it has a low departure from reference conditions and the number, size of habitat areas, or evenness in distribution across the landscape is similar or only slightly reduced relative to reference conditions. There are several localized exceptions to the condition and trend in areas that are accessible to high recreation use that have resulted in soil compaction and vegetation damage. These areas are:

- Beaver Creek 5th code HUC: Condition fair, trend slowly toward reference condition;
- Oak Creek 5th code HUC: Condition good to fair, trend static relative to reference condition;
- West Clear Creek 5th code HUC: Condition good, trend static relative to reference condition;
- Fossil Creek 5th code HUC: Condition good, trend slowly toward reference condition in general, but away from reference condition in high recreation use areas.

Soil condition and productivity in Mixed Broadleaf Deciduous are good with a static trend relative to reference conditions.

There is a moderate likelihood that Mixed Broadleaf Deciduous Riparian would be a limiting factor to the viability of the associated species. This likelihood was derived by combining the value for habitat abundance with the value for riparian functional condition. Riparian functional condition was used instead of soil quality, because riparian function is assumed to respond faster than soil to treatments or disturbances, and thus, would better reflect differences between alternatives.

Table 26. Summary of coarse filter analysis for Cottonwood Willow Riparian Forest type

Habitat	Existing	Alternative A	Alternatives B (modified), C, and D	Associated Species
Abundance	Rare	Rare	Rare	Southwestern willow flycatcher, western yellow-billed cuckoo, Colorado pikeminnow, Gila chub, Gila topminnow, headwater chub, loach minnow, razorback sucker, spikedace, roundtail chub, narrow-headed gartersnake, Northern Mexican gartersnake, lowland leopard frog, bald eagle, desert sucker, Little Colorado sucker, roundtail chub, Sonora sucker, a caddisfly (*Lepidostoma knulli*), a caddisfly (*Wormaldia planae*), A mayfly (*Moribaetis mimbresaurus*), Balmorhea saddle-case caddisfly, California floater, Fossil springsnail, Page springsnail, western red bat, Arizona toad, common black hawk, bluehead sucker, longfin dace, Arizona snaketail, Persephone's darner, Redrock stonefly, beaver
Quality-Riparian Functional Condition	Fair, slowly toward	Fair, slowly toward except portions of Dry Beaver and Spring Creeks	Good, slowly toward	
Verde River, Towel Creek	Mostly fair, slowly toward. Some portions of Verde River Static (Childs, private lands, recreation impacts)	Mostly fair, slowly toward. Some portions static (Childs, private land, areas with recreation impacts).	Good, toward	
Spring Creek, Dry Beaver Creek	Fair, static	Fair, static	Good, toward	
Quality-Soil	Poor, slowly toward	Poor, slowly toward		
Likelihood of Limitation	High	High	Moderate	
Management effect		3: Plan components maintain or improve protection and management for some habitat occurrences in the plan area.	2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.	

Table 27 also compares management effect by alternative. Management effect categorizes the relative expected outcome of plan language in each alternative in terms of maintaining habitat quality and is the result of plan decisions, including plan objectives. Management effect category values are 1, 2, 3, and 4. The lower the management effects rating, the more effective the alternative is for maintaining the habitat. The effects of the alternatives are explained in greater detail in the discussions on the alternatives that follow.

Montane Willow is patchily distributed along perennial water at higher elevations such as East Clear Creek and its tributaries; seasonally intermittent streams; wet meadows; and isolated springs. Trees include: Bebb's willow, narrowleaf cottonwood, velvet ash, cherry, box elder, Arizona walnut, and Arizona alder. Dominant shrubs include red osier dogwood, willows, and

woods rose. The understory consists of a variety of grass and grasslike species, including sedge, Baltic rush, spikerush, and deergrass. Outlying populations may have unique genetic components.

Table 27. Summary of coarse filter analysis for Mixed Broadleaf Deciduous Riparian Forest type

Habitat	Existing	Alternative A	Alternatives B (modified), C, and D	Associated Species
Abundance	Rare	Rare		Chiricahua leopard frog, southwestern willow flycatcher, western yellow-billed cuckoo, Colorado pikeminnow, Gila chub, Gila topminnow, Gila trout, headwater chub, loach minnow, razorback sucker, roundtail chub, spikedace, narrow-headed gartersnake, Northern Mexican gartersnake, lowland leopard frog, bald eagle, desert sucker, Little Colorado sucker, roundtail chub, Sonora sucker, a caddisfly (*Lepidostoma knulli*), a caddisfly (*Wormaldia planae*), A mayfly (*Moribaetis mimbresaurus*), Balmorhea saddle-case caddisfly, California floater, Fossil springsnail, common black hawk, McGillivray's warbler, beaver, western red bat, Arizona toad, Alcove bog orchid, Arizona bugbane, Cochise sedge, Ertter's Rose, Metcalfe's tick trefoil, MacDougal's aletes
Quality-Riparian Functional Condition	Good, static to slowly toward	Good, static to slowly toward	Good, slowly toward except portions of Fossil Creek and Wet Beaver Creek are static in areas of high recreational impacts	
Beaver Creek 5th code HUC	Fair, slowly toward	Fair, slowly toward	Good but fair in recreation impacted areas/toward	
Oak Creek 5th code HUC	Good to fair, static	Good to fair, static	Good, toward	
West Clear Creek 5th code HUC	Good, static	Good, static	Good, slowly toward	
Fossil Creek Lower Verde River 5th code HUC	Good, slowly toward but trending away in areas of high recreation use on Fossil Creek	Good, slowly toward but away in high recreation use areas on Fossil Creek	Good, toward	
Quality-Soil	Good, static	Good, static	Good, slowly toward	
Likelihood of Limitation	Moderate except high in Beaver Creek 5th code HUC and portions of Oak Creek 5th code HUC	Moderate except high in Beaver Creek 5th code HUC and portions of Oak Creek 5th code HUC	Moderate except high in Beaver Creek 5th code HUC in high recreation use areas	
Management effect		3: Plan components maintain or improve protection and management for some habitat occurrences in the plan area.	2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.	

Using the analysis process described under the Species Viability section above, table 28 shows that the riparian functional condition of Montane Willow Riparian Forest is generally classified as good. This means it has a low departure from reference conditions and the number, size of habitat areas, or evenness in distribution across the landscape is similar or only slightly reduced relative to reference conditions. The trend is slowly toward to static relative to reference conditions. There are several localized exceptions to the condition and trend in areas that are accessible to high

recreation use. High recreation use has resulted in soil compaction and vegetation damage. These areas are:

- Portions of East Clear Creek and its tributaries in the Upper Clear Creek 5th code HUC: Condition poor, trend static relative to reference condition;
- Fern Mountain Botanical Area: Condition poor, trend static relative to reference condition.

Table 28. Summary of coarse filter analysis for Montane Willow Riparian Forest type

Habitat	Existing	Alternative A	Alternatives B (modified), C, and D	Associated Species
Abundance	Rare	Rare		Chiricahua leopard frog, Gila trout, Little Colorado spinedace, loach minnow, roundtail chub, narrow-headed gartersnake, bald eagle, desert sucker, Little Colorado sucker, Sonora sucker, California floater, Western red bat, Arizona toad, common black hawk, MacGillivray's warbler, bluehead sucker, beaver, Arizona bugbane, Bebb's Willow, Blumer's dock, Cochise sedge, Ertter's rose
Quality-Riparian Functional Condition	Mostly Good, slowly toward to static	Good, static to trending slowly toward	Good, slowly toward	
East Clear Creek and tributaries in Upper Clear Creek 5^{th} code HUC and Fern Mountain Botanical Area	Poor, static	Fair, toward	Good, toward	
Quality-Soil	Good, static	Good, static	Good, slowly toward	
Likelihood of Limitation	Moderate except High in the Upper Clear Creek 5^{th} code HUC in East Clear Creek and tributaries and Fern Mountain Botanical Area	Moderate except High in the Upper Clear Creek 5^{th} code HUC in East Clear Creek and tributaries and Fern Mountain Botanical Area	Moderate	
Management Effect	Not applicable	3: Plan components maintain or improve protection and management for some habitat occurrences in the plan area.	2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.	

The poor riparian functional condition in portions of East Clear Creek and its tributaries is primarily due to excessive elk use and/or excessive livestock grazing, and nonpoint sources of sediment from roads. The poor riparian functional condition in the Fern Mountain Botanical Area is due to water diversions to private land, which reduces the amount of water that would have historically been associated with the botanical area. Soil quality (condition and productivity) is good with a static trend relative to reference conditions

Table 28 shows there is an overall moderate likelihood that Montane Willow Riparian Forest would be a limiting factor to the associated species in most areas. There is a high likelihood that Montane Willow Riparian Forest would be a limiting factor to the associated species in East Clear Creek and its tributaries in the Upper Clear Creek 5th code HUC and in the Fern Mountain Botanical Area. These likelihoods were derived by combining the value for habitat abundance with the values for riparian functional condition. Riparian functional condition was used instead of soil quality, because riparian condition is assumed to respond faster than soil to treatments or disturbances, and thus, would better reflect differences between alternatives.

Table 28 also compares management effect by alternative. Management effect categorizes the relative expected outcome of plan language in each alternative in terms of maintaining habitat quality and is the result of plan decisions, including plan objectives. Management effect category values are 1, 2, 3, and 4. The lower the management effects rating, the more effective the alternative is for maintaining the habitat. The effects of the alternatives are explained in greater detail in the discussions on the alternatives that follow.

Designated wilderness: There are 113 acres (9 percent) of Cottonwood Willow in designated wilderness: Mazatzal Wilderness (93 acres) and Sycamore Canyon (20 acres). There are about 2,073 acres of Mixed Broadleaf Deciduous (35 percent) in designated wilderness: Fossil Springs (496 acres), Mazatzal (139 acres), Munds Mountain (412 acres), Red Rock-Secret Mountain (16 acres), Sycamore Canyon (350 acres), West Clear Creek (414 acres), and Wet Beaver Creek (248 acres). There are about 451 acres of Montane Willow (13 percent) in designated wilderness: Munds Mountain (13 acres), Red Rock- Secret Mountain (229 acres), West Clear Creek (191 acres), and Wet Beaver (18 acres).

There are 487 acres (37 percent) of Cottonwood Willow on the scenic portion of the Verde Wild and Scenic River.

There are 118 acres of Montane Willow (3 percent) in the Oak Creek Research Natural Area and proposed Rocky Gulch Research Natural Area.

There are 18 acres of Cottonwood Willow within the Verde Valley Botanical Area, 10 acres of Mixed Broadleaf Deciduous Riparian in the Fossil Springs Botanical Area, and 35 acres (less than 1 percent) of Montane Willow in the Fern Mountain Botanical Area.

There are 12 acres of Montane Willow Riparian Forest in the Griffith Springs Environmental Study Area.

Associated Species

Associated species for Cottonwood Willow are listed in table 26, for Mixed Broadleaf Deciduous in table 27, and for Montane Willow in table 28.

Risk Factors

Threats common to streamcourses and riparian vegetation include uncharacteristic fire as a result of uncharacteristically dense upland forest conditions, dispersed recreation, roads and trails that occur in riparian areas or are hydrologically connected to them, upland grazing management practices, water diversion and use, and herbivory in riparian areas by domestic livestock and wildlife ungulates. Invasive non-native plants threaten the regeneration potential of native species in some portions of the riparian forest types.

The increased risk of uncharacteristic fire results from past fire exclusion, which allowed forest conditions to become denser and more prone to fires that burn into the tree canopy, rather than predominantly in the understory. Uncharacteristic fires can result in high soil burn severity, accelerated erosion and excessive sedimentation to streamcourses, excessive or increased water flow, and uncharacteristic flooding, which can result stream channel scour, incision, and degradation and removal of vegetation and coarse woody debris in the riparian forest types. Uncharacteristic fire can also spread from adjacent fire-adapted ERUs into riparian forest types, especially during drought. These conditions result in loss of vegetation and drying of the riparian area, which can facilitate establishment or spread of invasive nonnative vegetation. Invasive plants such as tamarisk may also facilitate uncharacteristic fire behavior in riparian forests.

Past fire exclusion has resulted in increased stand densities in upland areas topographically above or adjacent to riparian forest types. The increased tree density has resulted in increased evapotranspiration by trees in these upland areas, reducing the amount of water in the soil unsaturated zone, or vadose zone (i.e., water in soil above the permanent groundwater surface). These conditions have adversely affected aquifer recharge and groundwater discharge to surface waters, including springs and stream channels. Forest thinning in upland areas followed by reintroduction of fire to fire-adapted ERUs is expected to increase short-term vadose water. Springer et al. (2006) determined that a frequent reintroduction of fire following forest thinning and initial prescribed fire could maintain soil water levels sufficient for maintenance of conditions conducive to healthy riparian ecosystems.

Dispersed recreation in easily accessed areas has the potential to remove or damage riparian vegetation, compact soil, and destabilize streambanks when excessive. In doing so, it creates areas of bare soil that leads to erosion and sedimentation into streams and reduces riparian function and water quality. Bare soils can readily become sites where nonnative and invasive plants become established, which can further alter riparian vegetation communities.

Roads and trails in riparian forest types can redirect and concentrate surface water flows. This can result in decreased flows in some areas and excessive flows in others, altering water availability to riparian vegetation. The bare areas of roads and trails are prone to accelerated erosion and due to close proximity to stream channels have potential to deliver sediment directly to stream channels. They can also deliver sediment into adjacent riparian areas and bury riparian vegetation, including tree seedlings, reducing localized riparian forest regeneration potential.

Upland grazing management practices can result in areas of reduced vegetative cover and bare soils in localized areas where livestock concentrate for long periods or where trampling and trailing occurs. The consequences can include reduced water infiltration from bare areas leading to increased surface runoff and accelerated soil erosion, sediment delivery to riparian areas resulting in damage or loss of riparian vegetation, degradation of surface water quality, channel incision, headcutting, and gully formation.

Excessive herbivory by domestic livestock and wildlife ungulates can remove excessive amounts of vegetation, lower densities, contribute to a loss of soil function, and alter vegetation structure and composition (Fleischner 1994). Currently, the forest does not permit livestock grazing along the Verde River. This restriction has resulted in improved riparian conditions along the river during the last 10 years. Many other allotments have also reduced occurrence of livestock grazing in perennial streams to hardened areas or to times when grazing pressure does not adversely affect riparian area condition. Consequently, herbivory is considered a threat in localized areas.

Water diversion and use interrupts stream flow and prevents surface water from reaching riparian areas. Livestock tanks capture flow that could otherwise contribute to baseflow in riparian streamcourses. Numerous springs on the forest that have been developed (flow captured and diverted to troughs and water tanks) to support domestic livestock water needs. Water quantity is also at risk due to increased demand for water from the State's growing population and commercial sector. As a result, many of the risks to water quality and quantity and watershed condition are outside the administrative control of the Forest Service either because their source is on lands of other ownership or because the State of Arizona has the authority to regulate them (such as water rights and diversions).

Localized areas in the Upper Clear Creek 5th code HUC are at risk because of dispersed recreation and ungulate herbivory, which is under control of the Arizona Game and Fish Department. This HUC includes East Clear Creek, its tributaries and intermittent stream courses with riparian habitat. The areas of most concern are those that are accessible to human activities. This HUC is also recovering from a legacy of improperly located and poorly maintained roads (especially user-created roads) and a legacy off-highway vehicle use. Legacy issues refer to vegetation removal, soil compaction, soil loss, and erosion associated with historic grazing ; with areas that were open to off-highway vehicles prior to implementation of the Travel Management Rule; and with improperly located roads or past road maintenance. Soil and vegetation conditions that are a consequence of these legacy issues are expected to improve over time as the affected areas heal.

The accessible areas of the Beaver Creek 5th code HUC are at risk because of dispersed recreation. This HUC is also recovering from a legacy off-highway vehicle use, a legacy of improperly located and poorly maintained roads (especially user-created roads), and legacy livestock grazing. This HUC includes Beaver Creek, Dry Beaver Creek, Red Tank Draw, Walker Creek, and some intermittent stream courses with riparian vegetation.

The accessible areas of the Oak Creek 5th code HUC are threatened by dispersed recreation and affected by a legacy of improperly located and poorly maintained roads (especially user-created roads and social trails). The lower portion of Oak Creek is affected by legacy grazing issues and legacy off-highway vehicle use. This HUC includes Oak Creek, Spring Creek, and intermittent stream courses with riparian vegetation. Legacy road, off-highway vehicle use, and grazing issues refer to vegetation removal, soil compaction, soil loss, and erosion associated with past grazing practices; with areas that were open to off-highway vehicles prior to implementation of the Travel Management Rule; and issues with past road maintenance. Although some of the causes of the departures have been addressed, particularly with implementation of the Travel Management Rule, the sedimentation into connected watercourses, and the soil and vegetation issues should gradually decrease as the affected areas heal.

Portions of the Fossil-Lower Verde River 5th code HUC are at risk of high amounts of dispersed recreation. This HUC is recovering from a legacy off-highway vehicle use and poorly located and maintained roads (especially user-created roads).

Invasive plants can cause a decline in quality of native species regeneration and cause a potential reduction in instream flows because they draw more water from the water table than native trees. The exception is along about 23 miles of the Verde River (from Camp Verde on down) and 7 miles along Fossil Creek where riparian forests are trending toward reference conditions due to invasive weed treatments. Fire intensity and severity can increase in response to invasive plant

species, primarily tamarisk and Russian olive. Severe fires remove overstory species from burn areas and can convert these sites to a nonnative species mix.

Environmental Consequences

Common to All Alternatives

Plan components in all alternatives contribute to species viability by managing habitat to maintain viable and sustainable populations of wildlife and fish species and by improving and protecting habitat for threatened, endangered, and sensitive species (1987 Plan, pages 22-1, 23; FW-Eco-DC-1; FW-WFP-DC-1, 2, 3, 5, 6, 8; FW-WFP-G-3, 10). See At-risk Species in the Wildlife and Plant Issues and Topics section above for more information.

All alternatives address the threat of invasive plants. Invasive plants can increase as a consequence of ground disturbance and once established would compete with native species for water and nutrients or could alter the fire regime. All alternatives address the threat of invasive plants by pointing to the Final Environmental Impact Statement for the Treatment of Noxious or Invasive Weeds (USDA Forest Service 2005). This direction includes best management practices, among other guidance, which would help prevent, mitigate, and reduce the threat of invasive plants. All alternatives prioritize treatments, call for incorporating control measures in project planning and implementation, and emphasize coordination with partners (1987 Plan, pages 23, 69, 70, 182, 206-14, 206-76, 206-101, 201-116; FW-Invas-DC-1, 2; FW Invas-G-1, 2, 3; FW-Invas-MgtApp; FW-Graz-MgtApp; FW-RdsFac-G-8; FW-Rec-Dev-DC-9; FW-Rec-Dev-G-2). Additional information and analysis is discussed under the Non-native or Invasive Species topic in the Wildlife and Plant Topics and Issues section.

Under all alternatives, the forest would continue to pursue instream flow rights at similar levels (1987 Plan, page 206-116, 74; FW-Water-DC-1, 2, 5; FW-Water-G-3, 5), which, if obtained, would ensure that new requests for water rights would not negatively impact water quantity for wildlife habitat and riparian vegetation. Procurement of instream flow water rights would improve the extent of uninterrupted streamflows across NFS lands, thereby, providing greater aquatic and riparian habitat continuity and resilience.

Plan components in all alternatives have plan objectives or management emphasis to improve or restore riparian ecosystems, direction to use best management practices, and would use either filter strips (alternative A) or aquatic management zones (remaining alternatives) to protect water quality and to avoid detrimental changes in water temperature, chemical composition, sediment deposits, or blockages. These plan components would maintain or improve water conditions, habitat for aquatic and riparian species, and connected downstream resources. See 1987 Plan, pages 23, 71, 72, 72-1, 172-177; FW-Rip-Wtlnds-O-1; FW-Rip-Spr-O-1; FW-Rip-RipType-O-1; FW-WFP-O-4; FW-Rip-All-G-3; FW-Rip-Strm-G-2; FW-Water-G-4; FW-BioPhys-Geo-G-8.

The concept of filter strips in alternative A is replaced with the newer concept of aquatic management zones in alternative B (modified). Filter strips and aquatic management zones are best management practices that reduce sedimentation, soil compaction, and loss of vegetative cover from ground-disturbing management activities on soils, water quality, and riparian vegetation.

All alternatives would not allow permanent salt within ¼ mile of the edge of any riparian area except alternatives B (modified), C, and D would broaden this guideline to apply to salts,

minerals, and other supplements with the intention to protect sensitive resources from excessive trampling, compaction, salinization, and other impacts (1987 Plan, page 175, FW-Graz-G-5).

About 9 percent of Cottonwood Willow, 35 percent of the Mixed Broadleaf Deciduous Riparian Forest, and 13 percent of the Montane Willow Riparian Forest is in designated wilderness. Designated wilderness areas would be managed according to applicable laws, policy and Forest Plan direction to preserve wilderness resource values and wilderness quality, and to emphasize wilderness recreation (1987 Plan, pages 105 to 112; SA-Wild-DC-1 to 11; SA-Wild-S-1, 2; SA-Wild-G-1 to 7). Wilderness designation limits most active vegetation management because motorized use and mechanized use is not allowed. Motorized and mechanized access can kill or damage plants, can degrade the habitat through soil compaction and soil loss, and can introduce non-native species that compete with native plants for resources. This can negatively affect the reproduction and survival of individual plants or populations. Ground-disturbing activities are primarily confined to main trails, trailheads, and key points of interest at which invasive species introduction and establishment, or accelerated erosion could occur depending on the level of use. The lack of ground-disturbing activities elsewhere would be beneficial by reducing the risk of invasive plant introduction and dispersal by motorized or mechanized use. However, limited access associated with designated wilderness could preclude restoration treatments that require motorized equipment for treatments or safety, or make them harder to do logistically. Lack of restoration treatments could result in missed fire return intervals, increased and unnatural levels of fuels, increased density of shrubs and trees, or establishment and spread of invasive or non-native species. This could slow the trend toward desired conditions or increase the risk of uncharacteristic fires in localized areas more so than in the other alternatives. Uncharacteristic fire could facilitate the spread or establishment of invasive or non-native species, which could then alter area hydrology, fire regime, and biodiversity.

About 118 acres of Montane Willow occur within the already designated Oak Creek Research Natural Area and the proposed Rocky Gulch Research Natural Area. All alternatives include beneficial guidance for management of research natural areas that would allow natural processes and natural conditions to prevail. This guidance would minimize recreational impacts by restricting camping, prohibiting recreation fires and limiting non-commercial group size (1987 Plan, page 196-1; SA-RNABotGeo-S-1; SA-RNABotGeo-G-6). In addition, access should be restricted as needed to maintain their natural, unmodified condition and commercial tours would be prohibited except in support of approved research (1987 Plan, page 196-2; SA-RNABotGeo-S-2). This guidance would reduce the potential for human-caused fires and maintain the natural conditions for which the research natural area was designated, which include properly functioning soils and vegetation. This guidance would also mitigate soil compaction, soil loss, and vegetation damage from some recreational activities. Designated wilderness direction would prevail in the Oak Creek Research Natural Area because it overlaps the Red Rock-Secret Mountain Wilderness.

There are 18 acres (about 1 percent) of Cottonwood Willow within the Verde Valley Botanical Area, 10 acres (less than 1 percent) of Mixed Broadleaf Deciduous Riparian in the Fossil Springs Botanical Area, and 35 acres (less than 1 percent) of Montane Willow in the Fern Mountain Botanical Area. Off-road travel in botanical areas is not allowed in any alternative (1987 Plan, page 194; SA-RNABotGeo-DC-5; SA-RNABotGeo-G-1). New utility corridors would also avoid botanical areas (1987 Plan, page 79; FW-SpecUse-G-10). This would result in less disturbance to soil and plants, in less erosion and soil compaction, and eliminate habitat damage from these activities. This is a negligible effect because of the small amount of acres involved.

All alternatives provide language for monitoring, including the use of aquatic macroinvertebrates as monitoring indicators for condition of waterways and riparian areas. Water quality monitoring using the Arizona Department of Environmental Quality standards is also supported under all alternatives.

Alternative A

Using the analysis process described under the Species Viability section above, table 26 shows that the riparian functional condition of Cottonwood Willow Riparian Forest is classified as fair. This means it has a moderate departure from desired conditions and the number, size of habitat areas, or evenness in distribution across the landscape is somewhat reduced relative to desired conditions. Under the plan direction in alternative A, riparian functional condition is expected to slowly trend toward the desired condition of properly functioning, resilient riparian areas except in Spring Creek and Dry Beaver Creek where the trend would be static relative to desired conditions due to areas of high recreation use and private land. Soil quality in Cottonwood Willow would continue to be poor, but would slowly move toward desired conditions.

There is a high likelihood that Cottonwood Willow would be a limiting factor to the viability of the associated species under this alternative. This likelihood was derived by combining the value for habitat abundance with the value for riparian functional condition. Riparian functional condition was used instead of soil quality, because riparian function is assumed to respond faster than soil to treatments or disturbances, and thus, would better reflect differences between alternatives.

Using the analysis process described under the Species Viability section above, table 27 shows that the riparian functional condition of Mixed Broadleaf Deciduous Riparian Forest is classified as good. This means it has a low departure from desired conditions and the number, size of habitat areas, or evenness in distribution across the landscape is similar or only slightly reduced relative to desired conditions. Under the plan direction in alternative A, riparian functional condition is expected to have a static trend or slowly trend toward the desired condition of properly functioning, resilient riparian areas. There are several localized exceptions to the condition and trend in areas that are accessible to high recreation use that has resulted in soil compaction and vegetation damage. These areas are:

- Beaver Creek 5th code HUC: Condition fair, trend slowly toward desired condition;
- Oak Creek 5th code HUC: Condition good to fair, trend static relative to desired condition;
- West Clear Creek 5th code HUC: Condition good, trend static relative to desired condition;
- Fossil Creek 5th code HUC: Condition good, trend slowly toward desired condition in general, but trend away from desired condition on recreations areas.

Soil condition and productivity in Mixed Broadleaf Deciduous would remain good. About 69 percent of this riparian forest type has satisfactory or satisfactory but inherently unstable soil conditions. In these areas, soil is functioning properly. About 31 percent of this riparian forest type has impaired soil conditions. Under the management direction in this alternative, overall soil condition and productivity would remain static relative to desired conditions.

There is a moderate likelihood that Mixed Broadleaf Deciduous would be a limiting factor to the viability of the associated species under this alternative, except it would have a high likelihood in the portions of the Beaver Creek 5th code HUC and Oak Creek 5th code HUC where recreation use is high. These likelihoods were derived by combining the value for habitat abundance with the value for riparian function condition. Riparian functional condition was used instead of soil quality, because riparian function is assumed to respond faster than soil to treatments or disturbances, and thus, would better reflect differences between alternatives.

Using the analysis process described under the Species Viability section above, table 28 shows that the riparian functional condition of Montane Willow Riparian Forest is classified overall as good. This means it has a low departure from desired conditions and the number, size of habitat areas, or evenness in distribution across the landscape is similar or only slightly reduced relative to desired conditions. Under the plan direction in alternative A, riparian functional condition is expected to have a static trend or slowly trend toward the desired condition of properly functioning, resilient riparian areas. There is a localized exception to the condition and trend in the portions of East Clear Creek and its tributaries and the Fern Mountain Botanical Area, which would be in fair condition and trending toward desired conditions.

Soil condition and productivity in Montane Willow would remain good. Under the management direction in this alternative, overall soil quality would remain static relative to desired conditions.

There is a moderate likelihood that Montane Willow would be a limiting factor to the viability of the associated species under this alternative, except it would have a high likelihood in the portions of East Clear Creek and its tributaries in the Upper Clear Creek 5th code HUC and in the Fern Mountain Botanical Area. These likelihoods were derived by combining the value for habitat abundance with the value for riparian function condition. Riparian functional condition was used instead of soil quality, because riparian function is assumed to respond faster than soil to treatments or disturbances, and thus, would better reflect differences between alternatives.

The management effect for all three riparian forests is a 3 under alternative A, which means the plan components maintain or improve protection and management for some habitat occurrences in the plan area. However, alternative A contributes less to the maintenance and sustainability of riparian forests and the viability of the associated species than the other alternatives.

Alternative A would maintain or improve riparian forests because it has a focus on riparian recovery; preventing damage to riparian vegetation, stream banks, and channels; and restoring degraded riparian areas to good condition as soon as possible (1987 Plan, pages 65-8, 172, 174). In support of this, alternative A would also construct 10 miles of fences per decade for the first two decades where necessary to protect riparian regeneration from grazing (1987 Plan, page 175). Other protective language includes the following: Only beneficial new special uses are allowed in riparian areas and exceptions such as utility line or roads crossing stream courses are designed to minimize the extent and magnitude of impact to riparian areas (1987 Plan, page 177). Aggressive fire suppression may be used to prevent resource damage utilizing methods that minimize long-term adverse impacts to riparian habitats (1987 Plan, page 177). In addition, acquisition of riparian areas through land exchange is a high priority (1987 Plan, pages 177 and 185). The plan would manage commercial uses, and recreation in some areas, to protect riparian values (1987 Plan, pages 206-10, 22, 26, and 39).

Much of the plan language for riparian forests in alternative A is outdated and does not include current science about vegetative condition and natural disturbances. This alternative has less potential for improvement to riparian functional condition compared to the other alternatives primarily because alternative A does not distinguish between the various riparian areas that occur on the forest and lacks plan components relative to composition, structure, and function.

Plan components in the Sedona-Oak Creek Ecosystem would maintain riparian pasture and riparian exclosures to prevent livestock trespass, which can degrade sensitive species habitat (1987 Plan, page 206-12) and directs that fire management activities protect riparian areas (1987 Plan, page 206-11). In Oak Creek Canyon MA 14, there is a goal to ensure woody materials, such as logs, tree limbs, and snags, are present in riparian communities for prey base habitat, aquatic nutrient cycling, and soil retention consistent with public safety (1987 Plan, page 185).

Alternative A does not allow precommercial thinning or piling thinning slash in riparian areas, which may preclude restoration of riparian forest habitat if conditions have facilitated conifer establishment in riparian areas (1987 Plan, page 176). This may not be beneficial for riparian habitat and aquatic environments depending on site-specific circumstances.

Mineral material excavation within the riparian zone is permissible in this alternative after environmental analysis and authorized mineral activities will maintain or improve riparian conditions (1987 Plan, page 177). This is potentially positive for riparian habitat and streamcourses; however, the likelihood of having beneficial mineral activities within a riparian zone is low, due to the nature of mineral activities.

Uncharacteristic fire can result in uncharacteristic flooding or wildfire in non-fire-adapted ecosystems like riparian forests. The current plan reduces the threats of uncharacteristic fire on departed vegetation types (1987 Plan, pages 65-2, 65-3, 65-4, 65-5, 65-11, 206-11, 206-75, 206-77). Reducing threats of uncharacteristic fire would reduce the risk of high soil burn severity that could otherwise result in accelerated soil erosion, loss of protective vegetative ground cover and tree and herbaceous species including riparian areas. Reducing the threat of uncharacteristic fire would also indirectly reduce the threat of uncharacteristic flooding. The 1987 plan supports the use of wildfire managed for resource objectives (1987 Plan, pages 10, 65-4, 94, 111, 112, 137, 144, 147, 155, 157); however, it is more difficult to implement (1987 Plan, pages 94, 112, 137, 144, 147, 155, 157) than in alternative B (modified). Although language in the 1987 plan allows the use of the wildfire resource benefit fire tool and protects long-term soil productivity, watershed function, water quality and riparian function, the plan language in the other alternatives has broader applicability and is easier to implement. However, this language is not as strategic and does not have as much forestwide applicability as in alternative B (modified).

The threat of dispersed recreation to riparian resources is not addressed forestwide in alternative A. Special areas such as the Verde Wild and Scenic River and wilderness, and the management areas within Flagstaff/Lake Mary Ecosystem Area and the Sedona-Oak Creek Planning Area most specifically address the conflicts and strategies to resolve resource damage in riparian areas (1987 Plan, pages 105; 115-4; 187-1; 196-2; 206-9 to 206-11; 206-15; 206-22; 206-39; 206-62 to 206-64; 206-66; 206-68; 206-78 to 206-79). All of these goals and guidelines are similar in that they set general expectations that recreation impacts should not destabilize ecosystems, and specifically, that certain activities known to result in resource-recreation conflicts should be limited in a way that reduces their footprint or that they are not allowed in these areas. Overall, this direction addresses dispersed recreation's impact to riparian areas in some areas where there

have been past conflicts and resource damage, but it provides very limited direction when previously low use areas are "discovered" and see increases in recreation that are unexpected, such as the Fossil Creek Wild and Scenic River. As a result, alternative A addresses this threat sporadically compared with alternatives B (modified), C, and D, but it does mitigate some of the areas where the conflict is most pronounced.

Plan components in alternative A (Forestwide Range and Forestwide Riparian) protect and minimize impacts to riparian areas through management and fencing, but they also manage impacts through seeding, which could include non-native plant species (1987 Plan, pages 69, 176, and 174). However, it also allows salting to improve livestock distribution. Salting could be used in riparian areas to improve livestock management by concentrating cattle in certain areas, a practice that could be detrimental to associated species and their habitat, and salting could be used in upland areas to distribute livestock outside of riparian areas (1987 Plan, pages 68 and 175). This is offset by a standard that requires that forage use be maintained at a level that assures recovery and continued existence of listed species (1987 Plan, pages 66-1 and 174) and specific objectives to protect riparian areas and allow them to recover in the first 20 years of the plan (1987 Plan, page 175).

There are 45 acres (less than 1 percent) of Mixed Broadleaf Deciduous Riparian in the proposed West Clear Creek Research Natural Area. This proposed research natural area is in a different location than the proposed West Clear Creek Research Natural Area in alternative B (modified), and is close to a relatively high use recreation area. Recreationists seeking to escape the overcrowding in the Fossil Creek Area or seeking a more remote experience may use this area and compact soil, increase erosion, and damage vegetation in high use areas. Nonetheless, existing plan language would protect watershed condition and maintain natural ecological conditions and impose use restrictions to keep this area in natural and unmodified conditions. If designated, the research natural area would be closed to off-road driving and there would be no harvest of timber products including firewood (1987 Plan, page 194). This area would also be protected by plan language that would limit recreation use depending on carrying capacity, and Allotment Management Plans would have provisions to protect the ecological condition of the special area (1987 Plan, page 195). Special use authorizations that would or could adversely affect or change the character of the area would not be allowed and fire suppression tactics that minimize damage to the research natural area s and other special areas would be used (1987 Plan, page 196).

Cottonwood Willow is found in the Verde Valley Botanical Area and Montane Willow occurs in the Fern Mountain Botanical Area, which contains Bebb's willow and Blumer's dock. Plan direction for botanical areas is found in Management Area 17 in which the management emphasis directs the forest to maintain the existing conditions and natural processes of the area while prohibiting activities such as cross-country travel (1987 Plan, page 194). This provides an additional layer of protection for this riparian forest type as well as associated species and their habitats. Off-road travel in botanical areas is not allowed in any alternative (1987 Plan, page 194; SA-RNABotGeo-DC-5; SA-RNABotGeo-G-1). New utility corridors would also avoid botanical areas (1987 Plan, page 79; FW-SpecUse-G-10). This would result in less disturbance to soil and plants, in less erosion and soil compaction, and eliminate habitat damage from these activities. This is a negligible effect because less than 1 percent of Montane Willow is in botanical areas.

The 1987 plan has management emphasis for Griffith's Spring Environmental Study Area that would be beneficial for Montane Willow Riparian Forest (1987 Plan, page 198). The management

emphasis includes continuing improvements to this area that would protect stream banks, riparian vegetation, and aquatic wildlife species. Road closure and trail relocation and construction would mitigate the effects of recreation, roads, and trails. These effects include vegetation loss, damage to streambanks, soil compaction, and excessive water turbidity. Fence installation would prevent browsing damage to willows from elk and deer. Guidelines for environmental study areas would also be protective of Montane Willow Riparian Forest within these areas. Guidelines would preclude livestock grazing and new special-use authorizations or amendments that would or could adversely affect or change the character of the environmental study area. Fencing would be used as needed to control dispersed recreation (1987 Plan, pages 198 and 199).

Alternative B (modified)

Using the analysis process described under the Species Viability section above, table 26 shows that the riparian functional condition of Cottonwood Willow Riparian Forest is classified as good. This means it has a low departure from desired conditions and the number, size of habitat areas, or evenness in distribution across the landscape is similar or only slightly reduced relative to desired conditions. Under the plan direction in this alternative, riparian functional condition is expected to slowly trend toward the desired condition of properly functioning, resilient riparian areas. Soil condition and productivity in Cottonwood Willow would remain poor. Under the management direction in this alternative, overall soil condition and productivity would trend slowly toward desired conditions in most areas, including litter, vegetation composition, and understory composition.

Under alternative B (modified), Cottonwood Willow has a moderate likelihood of being a limiting factor to the viability of the associated species. This likelihood was derived by combining the value for habitat abundance with the value for riparian function condition. Riparian functional condition was used instead of soil quality, because riparian function is assumed to respond faster than soil to treatments or disturbances, and thus, would better reflect differences between alternatives.

Using the analysis process described under the Species Viability section above, table 27 shows that the riparian functional condition of Mixed Broadleaf Deciduous Riparian Forest is classified as good. This means it has a low departure from desired conditions and the number, size of habitat areas, or evenness in distribution across the landscape is similar or only slightly reduced relative to desired conditions. Under the plan direction in this alternative, riparian functional condition is expected to trend toward the desired condition of properly functioning, resilient riparian areas. There are several localized exceptions to the condition and trend in areas that are accessible to high recreation use that has resulted in soil compaction and vegetation damage. These areas are:

- Beaver Creek 5th code HUC: Condition good, trend toward desired condition in general. Condition fair, trend toward desired condition in high recreation use areas;
- Oak Creek 5th code HUC: Condition good, trend toward desired condition;
- West Clear Creek 5th code HUC: Condition good, trend slowly toward desired condition;
- Fossil Creek 5th code HUC: Condition good, trend toward desired condition.

Soil condition and productivity in Mixed Broadleaf Deciduous would remain poor. About 69 percent of this riparian forest type has satisfactory or satisfactory but inherently unstable soil conditions. In these areas, soil is functioning properly. About 31 percent of this riparian forest

type has impaired soil conditions. Under the management direction in this alternative, overall soil condition and productivity would trend slowly toward desired conditions in most areas, including litter, vegetation composition, and understory composition.

Under alternative B (modified), Mixed Broadleaf Deciduous has a moderate likelihood of being a limiting factor to the viability of the associated species based on abundance and riparian functional condition, except it would have a high likelihood in the portions of the Beaver Creek 5th code HUC where recreation use is high (table 27). This likelihood was derived by combining the value for habitat abundance with the value for riparian function condition. Riparian functional condition was used instead of soil quality, because riparian function is assumed to respond faster than soil to treatments or disturbances, and thus, would better reflect differences between alternatives.

Using the analysis process described under the Species Viability section above, table 28 shows that the riparian functional condition of Montane Willow Riparian Forest is classified as good. This means it has a low departure from desired conditions and the number, size of habitat areas, or evenness in distribution across the landscape is similar or only slightly reduced relative to desired conditions. Under the plan direction in this alternative, riparian functional condition is expected to have a static trend or slowly trend toward the desired condition of properly functioning, resilient riparian areas.

East Clear Creek and its tributaries in the Upper Clear Creek 5th code HUC would improve faster than in alternative A. This portion of Montane Willow Riparian Forest would be in good condition and trend toward desired conditions.

Soil condition and productivity in Montane Willow would remain good and improve faster than in alternative A. Soil would slowly trend toward desired conditions.

Under alternative B (modified), Montane Willow has a moderate likelihood of being a limiting factor to the viability of the associated species. This likelihood was derived by combining the value for habitat abundance with the value for riparian function condition. Riparian functional condition was used instead of soil quality, because riparian function is assumed to respond faster than soil to treatments or disturbances, and thus, would better reflect differences between alternatives.

The management effect for all three riparian forests is a 2 under alternative B (modified), which means that the plan components in maintain or improve protection and management for most habitat occurrences in the plan area. This rating is primarily because there are updated desired conditions and guidelines that support the composition, structure, and function of riparian forests, connectivity between uplands and aquatic and riparian areas, and the maintenance of habitat for species (FW-Rip-All-DC-1, 2, 3, 5; FW-Rip-All-G-2, 3; FW-Rip-RipType-DC-1 to 6; FW-Rip-RipType-G-1, 2, 3; FW-WFP-DC-6). The desired conditions manage for vegetation diversity and riparian function including in priority watersheds (FW-Rip-RipType-DC-1, 2; FW-Water-G-2; FW-Rip-RipType-O-1). More site-specific aquatic management zone guidelines protect riparian function and water quality (FW-Rip-All-G-3). Plan components in the Wildlife, Fish and Plant section also contribute to the viability of species associated with riparian areas by promoting properly functioning ecosystems that have the necessary physical and biological components to meet the needs of associated native species (FW-WFP-DC-1, 3). This provides clearer and more consistent direction for managers.

Alternative B (modified) has plan language to avoid or reduce soil compaction or disturbance and excessive vegetation use from domestic livestock in riparian areas. For example, in the livestock grazing section, grazing should be managed to meet or move toward desired conditions for other forest resources. Structural range improvements should be built and utilized in a manner consistent with desired conditions for riparian areas and other sensitive resources. See FW-Graz-G-2, 4, 5. In addition, where permitted livestock has access to riparian areas, forage use should maintain those species, allow for plant regeneration, and lead to diverse age classes of woody riparian species where the potential exists. This guideline does not apply to fine-scale activities or facilities that are used to reduce livestock impacts to riparian areas at a larger scale, such as intermittent livestock crossing locations and water gaps. See FW-Graz-G-7. Soil productivity, soil condition, and vegetation quality and abundance within the area affected by these fine-scale structures or activities would be of lower quality and abundance compared to areas outside these areas.

A desired condition in Land Adjustments promotes the retention of open space values including those related to riparian character. Guidelines in Land Adjustments promote considering areas that contain or influence wetlands, riparian areas, or other water-related features, and considering habitat for threatened, endangered, and sensitive species when acquiring land (FW- LndAdj-DC-1, G-1).

A guideline in Special Uses would protect riparian resources by recommending against issuing a lands and recreation special-use permit for activities proposed to occur within 200 feet of perennial streams, springs, or waters that contribute to or support sensitive resources such as federally listed or Southwestern Region sensitive species (FW-SpecUse-G-3).

Plan components in other sections of the plan would also maintain and promote the sustainability of riparian habitat. For example, permanent and temporary road construction and relocation should occur outside of streamcourses and aquatic management zones except where crossing is required (FW-RdsFac-G-5). Plan components in the Pine Belt and Oak Creek Management Areas promote protection of riparian habitat in Pumphouse Wash and along Oak Creek (MA-PineBelt-DC-4; MA-OakCrk-DC-5; MA-OakCrk-G-5). A management approach in the Roads and Facilities section reminds managers that riparian areas that are classified as impaired or non-attaining due to sedimentation or alterations to hydrology related to the road would be a prioritizing factor in naturalization of decommissioned and unauthorized roads.

In addition to the acres within designated wilderness, there are 21 acres of Mixed Broadleaf Deciduous in the Davey’s Recommended Wilderness Area. There would be 2,094 acres (or about 35 percent) of Mixed Broadleaf in either designated or recommended wilderness. There are no acres of Montane Willow or Cottonwood Willow in recommended wilderness in alternative B (modified).

Recommended wilderness would reduce impacts from motorized use by promoting motorized vehicle use only for limited administrative and permitted activities (SA-RWild-DC-1, 2, 5; SA-RWild-G-1, 3, 5). Mechanized uses that maintain and do not detract from wilderness values would be allowable. However, new trails should be designed for non-motorized and non-mechanized activities that preserve wilderness character (SA-RWild-DC-6; SA-RWild-G-5). Implementation of these plan components would reduce disturbance to soil and vegetation from motorized or mechanized uses, which could be beneficial to associated species. If designated by Congress, the wilderness areas would be managed according to applicable laws, policy, and

Forest Plan direction (SA-Wild-DC-1 to 11; SA-Wild-O-1, 2; SA-Wild-S-1 to 5; SA-Wild-G-1 to 11). However, limited access associated with recommended (and designated) wilderness could preclude restoration treatments that require motorized equipment for treatments or safety, or make them harder to do logistically. Site-specific circumstances would also influence which or whether restoration treatments might be precluded. Delay or absence of restoration treatments could result in missed fire return intervals, increased and unnatural levels of fuels, increased density of shrubs and trees, or establishment and spread of invasive or non-native species. This could slow the trend toward desired conditions or increase the risk of uncharacteristic fires in localized areas more so than in the other alternatives. Uncharacteristic fire could facilitate the spread or establishment of invasive or non-native species, which could then alter area hydrology, fire regime, and biodiversity.

There are 18 acres of Mixed Broadleaf in the proposed West Clear Creek Research Natural Area, which is in a different location in West Clear Creek than in alternative A. Direction for designated botanical areas and for designated and proposed research natural areas in this alternative would support habitat for the associated species by promoting and protecting properly functioning ecosystems and designing activities and uses to maintain or move toward desired conditions and minimize impacts to ecosystems (SA-RNABotGeo-DC-1, 2, 5; SA-RNA-BotGeo-G-1, 3, 4, 5, and 7). Although protective, this language would have a negligible effect on Mixed Broadleaf Deciduous Riparian due to the small amount of acres. Wilderness direction would prevail in the proposed West Clear Creek Research Natural Area.

There are 11 acres of Mixed Broadleaf Deciduous Riparian in the proposed Cottonwood Basin Botanical Area. Direction for designated botanical areas in this alternative would support riparian forest habitat for the associated species by promoting properly functioning ecosystems that are not negatively impacted from human activities or permitted uses (SA-RNABotGeo-DC-5; SA-RNABotGeo-G-1, 3, 4, 5). Habitat and properly functioning ecosystems would also be maintained in localized areas because of recreation and transportation suitability recommendations in chapter 4 of the revised plan. These recommendations state that new motorized areas, permanent roads, temporary roads, and motorized travel are not suitable in botanical and geological areas.

Habitat and properly functioning ecosystems would also be maintained in localized areas because of recreation and transportation suitability recommendations (chapter 4 of the revised plan). These recommendations state that new motorized areas, permanent roads, temporary roads, and motorized travel are not suitable in designated and recommended wilderness areas and botanical and geological areas. This adds to the protections that are associated with these special areas from ground-disturbing activities.

Alternative C

Alternative C has the same effects as alternative B (modified), except 13 wildernesses are recommended instead of 3.

In addition to the 113 acres of Cottonwood Willow in designated wilderness, there are 233 acres in recommended wilderness. The recommended wilderness acres are distributed among two recommended wildernesses: Cimarron-Boulder (22 acres) and Hackberry (211 acres). There would be about 26 percent of the ERU in either designated or recommended wilderness.

For Mixed Broadleaf Deciduous, in addition to the 2,073 acres of designated wilderness, there are 662 acres in recommended wilderness: Black Mountain (183 acres), Cedar Bench (11 acres), Cimarron-Boulder (201 acres), Davey's (21 acres), Hackberry (238 acres), and Walker Mountain (7 acres). There would be about 46 percent of Mixed Broadleaf Deciduous Riparian Forest in either designated or recommended wilderness.

In addition to the 451 acres of Montane Willow in designated wilderness, there are 438 acres in recommended wilderness: Barbershop (170 acres), Deadwood Draw (9 acres), and East Clear Creek (259 acres). There would be about 25 percent of Montane Willow Riparian Forest in either designated or recommended wilderness.

The effects are similar, but the scale of effect is slightly larger than in alternative B (modified). Recommended wilderness would reduce impacts from motorized use by promoting motorized vehicle use only for limited administrative and permitted activities (SA-RWild-DC-1, 2, 5, 6; SA-RWild-G-1, 3, 5). Mechanized uses that maintain and do not detract from wilderness values would be allowable. However, new trails should be designed for non-motorized and non-mechanized activities that preserve wilderness character (SA-RWild-DC-6; SA-RWild-G-5). Implementation of these plan components would reduce disturbance to soil and vegetation from motorized or mechanized uses which could be beneficial to associated species. If designated by Congress, the wilderness areas would be managed according to applicable laws, policy and Forest Plan direction (SA-Wild-DC-1 to 11; SA-Wild-O-1, 2; SA-Wild-S-1 to 5; SA-Wild-G-1 to 11). However, limited access associated with recommended (and designated) wilderness could preclude restoration treatments that require motorized equipment for treatments or safety, or make them harder to do logistically. Site-specific circumstances would also influence which or whether restoration treatments might be precluded. Delay or absence of restoration treatments could result in the establishment and spread of invasive or non-native species. This could slow the trend toward desired conditions.

Habitat and properly functioning ecosystems would also be maintained in localized areas because of recreation and transportation suitability recommendations. Like alternative B (modified), these recommendations for alternative C state that new motorized areas, permanent roads, temporary roads, and motorized travel are not suitable in designated and recommended wilderness areas and botanical and geological areas. This affects more acres than in alternative B (modified) because there are more acres of recommended wilderness under alternative C.

Alternative D

Alternative D has the same effects as alternative B (modified) except it only proposes the Cottonwood Basin Geological Area. The geological area does not overlap any riparian forest. The area covered by the Cottonwood Basin Botanical Area in alternative B (modified) would be managed under the forestwide and management area direction applicable to the area in alternative D. Alternative D includes no recommended wilderness areas. The recommended wilderness areas of alternative B (modified) would be managed under the forestwide and management area direction applicable to the area in alternative D.

Wetlands

Affected Environment

Amount

Wetlands cover approximately 11,654 acres within the administrative boundary of the Coconino NF. About 10,121 acres (87 percent) are managed by the forest. The remaining 13 percent is in county and private ownership.

Table 29 summarizes the information used to estimate the likelihood that wetlands would be a limiting factor to the associated species. The abundance is categorized as rare because, at 10,121 acres, it occupies about 0.5 percent of the forest. Habitats classified as rare generally have less than 100 occurrences, or patches of the habitat cover less than 1 percent of the forest.

Habitat Quality and Distribution

Wetlands include bodies of water such as wetlands and natural lakes and their associated vegetation composition and structure. Wetlands may be saturated with water year-round or seasonally. The dominant vegetation is hydrophytes, or "water-loving" plants (plants adapted to living in an aquatic environment). Neither wetlands nor riparian forest types are fire-adapted, but wetlands are occasionally burned to maintain open water for waterfowl. The primary natural disturbance is changing water levels, including flooding (USDA Forest Service 2016b).

Using the analysis process described under the Species Viability section above, table 29 shows that the wetland functional condition for wetlands is generally classified as good when total acres are considered and fair when evaluated based on the number of wetlands. This means that based on total acres, wetlands have a low departure from reference conditions and the number, size of habitat areas, or evenness in distribution across the landscape is similar or only slightly reduced relative to reference conditions. This is primarily because protection and restoration has been focused on the larger wetlands or those with the most permanent or deepest water (semi-permanent or seasonal wetlands).

Based on the number of wetlands, wetlands have a moderate departure from reference conditions and the number, size of habitat areas, or evenness in distribution across the landscape is somewhat reduced relative to reference conditions. The trend is toward reference condition. This is a reflection of protection and restoration not being focused on smaller wetlands or those with shallow or less permanent water (ephemeral and temporary wetlands).

Wetland condition and trend can vary in localized areas depending on degree of protection from disturbance. Some wetlands are fenced from livestock and wildlife and have few-human related impacts. Others are fenced but have a water gap that allows livestock or wildlife access to water and most human-related impacts may have been addressed. Still other wetlands may not be fenced, or may exclude only livestock but not wildlife, and few to no human-related impacts have been addressed. Condition can also be influenced by site-specific factors such as adjusting the length, timing, and intensity of livestock grazing.

Soil condition and productivity are poor with a static trend relative to reference conditions. About 11 percent of this riparian forest type has satisfactory or satisfactory but inherently unstable soil conditions. In these areas, soil is functioning properly. About 89 percent of this riparian forest type has impaired soil conditions.

There is a moderate likelihood that wetland habitat could be limiting to the associated species based on the total number of acres of wetlands and a high likelihood based on the number of wetlands. The likelihoods that habitat would be limiting to the associated species were derived by combining the value for habitat abundance with the value for vegetation quality. Vegetation quality was used instead of soil quality, because vegetation is assumed to respond faster than soil to treatments or disturbances, and thus, would better reflect differences between alternatives.

Table 29 compares management effect by alternative. Management effect categorizes the relative expected outcome of plan language in each alternative in terms of maintaining habitat quality and is the result of plan decisions, including plan objectives. Management effect category values are 1, 2, 3, and 4. The lower the management effects rating the more effective the alternative is for maintaining the habitat. The effects of the alternatives are explained in greater detail in the discussions on the alternatives that follow.

There are 15 acres of wetlands in the Mogollon Rim Botanical Area.

Table 29. Summary of coarse filter analysis for Wetlands

Habitat	Existing	Alternative A	Alternatives B (modified), C, and D	Associated Species
Abundance	Rare	Rare		Chiricahua leopard frog, Northern Mexican gartersnake, lowland leopard frog, northern leopard frog, bald eagle, Arizona toad, Arizona sneezeweed. Bollander’s quillwort, Oak Creek triteleia, Pond lily
Quality-wetland functional condition	By acreage: Good, trending toward By number of wetlands: Fair, trending toward	By acres: good, trending toward By number of wetlands: Fair, trending toward	Good, toward	
Quality-Soil	Poor, static	Poor, static	Poor, toward	
Likelihood of Limitation	By acreage: Moderate By number of wetlands: High	By acreage: Moderate By number of wetlands: High	Moderate considering wetland functional condition High considering the number of wetlands	
Management effect		3: Plan components maintain or improve protection and management for some habitat occurrences in the plan area.	2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.	

Risk Factors

Risk factors include excessive wildlife herbivory, excessive livestock grazing, invasive species, and dispersed recreation in localized areas. High levels of dispersed recreation in easily accessed and localized areas may cause ground disturbance, soil compaction, and vegetation removal, and could lead to accelerated erosion and sedimentation into connected waters.

Excessive herbivory by wildlife and domestic livestock can cause soil compaction and can change the structure and composition of vegetation to the extent it influences ecosystem processes. Livestock grazing is managed under permit. Most of the wetlands, and their associated earthen stock tanks or other infrastructure, are associated with water rights for livestock and wildlife. Wildlife management is the responsibility of the Arizona Game and Fish Department.

The introduction, presence, and spread of invasive animal species such as bullfrogs and crayfish, and non-native or invasive fish can have significant impacts because they eat, compete with, and can hybridize with native species. Some species consume aquatic vegetation, changing the composition, structure, and function of the aquatic environment. Other invasive species, such as aquatic zebra mussels, would pose a significant threat to species and ecosystems if they became established on the forest.

Associated Species

See associated species in table 29.

Environmental Consequences

Common to All Alternatives

Plan components in all alternatives contribute to species viability by managing habitat to maintain viable and sustainable populations of wildlife and fish species and by improving and protecting habitat for threatened, endangered, and sensitive species (1987 Plan, pages 22-1, 23; FW-Eco-DC-1; FW-WFP-DC-1, 2, 3, 5, 6, 8; FW-WFP-G-3, 10). See At-risk Species in the Wildlife and Plant Issues and Topics section above for more information.

All alternatives address the threat of invasive plants. Invasive plants can increase as a consequence of ground disturbance and once established would compete with native species for water and nutrients or could alter the fire regime. All alternatives address the threat of invasive plants by pointing to the Final Environmental Impact Statement for the Treatment of Noxious or Invasive Weeds (USDA Forest Service 2005). This direction includes best management practices, among other guidance, which would help prevent, mitigate, and reduce the threat of invasive plants. All alternatives prioritize treatments, call for incorporating control measures in project planning and implementation, and emphasize coordination with partners (1987 Plan, pages 23, 69, 70, 182, 206-14, 206-76, 206-101, 201-116; FW-Invas-DC-1, 2; FW Invas-G-1, 2, 3; FW-Invas-MgtApp; FW-Graz-MgtApp; FW-RdsFac-G-8; FW-Rec-Dev-DC-9; FW-Rec-Dev-G-2). Additional information and analysis is discussed under the Non-native or Invasive Species topic in the Wildlife and Plant Topics and Issues section.

Plan components in all alternatives have plan objectives or management emphasis to improve or restore riparian ecosystems, direction to use best management practices, and would employ either filter strips (alternative A) or aquatic management zones (remaining alternatives) to protect water quality and to avoid detrimental changes in water temperature, chemical composition, sediment deposits, or blockages. These plan components would maintain or improve water conditions, habitat for aquatic and riparian species, and connected downstream resources. See 1987 Plan, pages 23, 71, 72, 72-1, 172-177; FW-Rip-Wtlnds-O-1; FW-Rip-Spr-O-1; FW-Rip-RipType-O-1; FW-WFP-O-4; FW-Rip-All-G-3; FW-Rip-Strm-G-2; FW-Water-G-4; FW-BioPhys-Geo-G-8.

All alternatives would not allow permanent salt within ¼ mile of the edge of any riparian area except alternatives B (modified), C, and D would broaden this guideline to apply to salts,

minerals, and other supplements with the intention to protect sensitive resources from excessive trampling, compaction, salinization, and other impacts (1987 Plan, page 175, FW-Graz-G-5).

For all alternatives, the contribution of sediment to water quality resulting from vegetation management, trail maintenance, and construction and from human and livestock disturbances to riparian areas is expected to be similar because the best management practices used for implementation of these activities are the same across alternatives. Best management practices are expected to reduce or mitigate sedimentation. Plan language under all alternatives directs implementing site-specific best management practices for ground-disturbing projects (1987 Plan, page 71; FW-Soil-G-1, 2, 3). Implementation of this direction would avoid or limit ground-disturbing activities that could cause loss of protective vegetative ground cover or cause increased sedimentation. Where such disturbances cannot be avoided, project-specific best management practices should be developed. Finally, specific project design features would be required on projects occurring on slopes greater than 40 percent grade where soils with moderate or severe erosion hazard ratings occur or where soils are sensitive to degradation when disturbed.

Thinning of dense forest canopies results in decreased evapotranspiration and short-term increase in water yield to connected streams, springs, and wetlands (USDA Forest Service 1974). All alternatives would thin ponderosa pine forests at about the same rate (FW-TerrERU-PP-O-1, 2, 3). Thinning would result in short-term improvement of riparian structure, composition and function due to the decrease in evapotranspiration and a corresponding increase in water yield. This would be specific to wetlands that are connected to ponderosa pine forests.

Off-road travel in the Mogollon Rim Botanical Area is not allowed in any alternative (1987 Plan, page 194; SA-RNABotGeo-DC-5; SA-RNABotGeo-G-1). New utility corridors would also avoid the Mogollon Rim Botanical Area (1987 Plan, page 79; FW-SpecUse-G-10). This would result in less disturbance to soil and plants, in less erosion and soil compaction, and eliminate habitat damage from these activities.

Alternative A

Using the analysis process described under the Species Viability section above, table 29 shows that wetland functional condition is generally classified as good when total acres are considered and fair when number of wetlands are considered. This means that, based on total acres, wetlands have a low departure from reference conditions and the number, size of habitat areas, or evenness in distribution across the landscape is similar or only slightly reduced relative to reference conditions. Based on the number of wetlands, wetlands have a moderate departure from reference conditions and the number, size of habitat areas, or evenness in distribution across the landscape is somewhat reduced relative to reference conditions. Under the plan direction in alternative A, wetland functional condition is expected to have a trend toward desired conditions.

Soil condition and productivity would remain poor. About 11 percent of this riparian forest type has satisfactory or satisfactory but inherently unstable soil conditions. In these areas, soil is functioning properly. About 89 percent of this riparian forest type has impaired soil conditions. Under the management direction in this alternative, overall soil condition and productivity would remain static relative to desired conditions.

There is a moderate likelihood that wetlands would be limiting to the associated species based on acreage, and a high likelihood that it would be limiting based on number of wetlands. These likelihoods were derived by combining the value for habitat abundance with the value for wetland

functional condition. Wetland functional condition was used instead of soil quality, because wetland function is assumed to respond faster than soil to treatments or disturbances, and thus, would better reflect differences between alternatives.

The management effect is a 3 under alternative A, which means the plan components maintain or improve protection and management for some habitat occurrences in the plan area, and thus, contribute less to the viability of associated species than the other alternative. However, alternative A contributes less to the maintenance and sustainability of wetlands and the viability of the associated species than the other alternatives.

Alternative A would maintain or improve wetlands because it has a focus on riparian recovery, preventing damage to riparian vegetation, streambanks, and channels, and restoring degraded riparian areas to good condition as soon as possible (1987 Plan, pages 65-8, 172, 174). In support of this, alternative A would also construct 10 miles of fences per decade for the first two decades where necessary to protect key wet meadows, wetlands, and riparian regeneration from grazing (1987 Plan, page 175). Other protective language includes the following: Only beneficial new special uses are allowed in riparian areas and exceptions such as utility line or roads crossing stream courses are designed to minimize the extent and magnitude of impact to riparian (1987 Plan, page 177). Aggressive fire suppression may be used to prevent resource damage utilizing methods that minimize long-term adverse impacts to riparian habitats (1987 Plan, page 177). In addition, acquisition of riparian areas through land exchange is a high priority (1987 Plan, pages 177 and 185). The plan would manage commercial uses, and recreation in some areas, to protect riparian values (1987 Plan, pages 206-10, 22, 26, and 39).

However, much of the plan language for wetlands in alternative A is outdated and does not include current science about vegetative condition and natural disturbances. This alternative has less potential for improvement to wetland condition compared to the other alternatives, primarily because alternative A does not distinguish between the various riparian areas differentiated in alternative B (modified) and lacks plan components relative to composition, structure, and function.

Wetlands occur in the Mogollon Rim Botanical Area. Plan direction for botanical areas is found in Management Area 17. The management emphasis directs the forest to maintain the existing conditions and natural processes of the area, while prohibiting activities such as cross-country travel (1987 Plan, page 194). This provides an additional layer of protection for wetlands and other habitats that overlap these special areas.

Alternative B (modified)

Using the analysis process described under the Species Viability section above, table 29 shows that wetland functional condition is generally classified as good when either the total acres or the number of wetlands are considered. This means that wetlands have a low departure from reference conditions and the number, size of habitat areas, or evenness in distribution across the landscape is similar or only slightly reduced relative to reference conditions. Under the plan direction in alternative B (modified), wetland functional condition is expected to have a trend toward desired conditions.

Soil condition and productivity would remain poor, but trend toward desired conditions under the management direction in this alternative.

Under alternative B (modified), wetlands have a moderate likelihood of being a limiting factor to the viability of the associated species, based on abundance and riparian functional condition (table 29). This is true regardless of whether acreage and number of wetlands are considered. Wetland functional condition was used instead of soil quality, because wetland function is assumed to respond faster than soil to treatments or disturbances, and thus, would better reflect differences between alternatives.

The management effect rating is classified as 2, which means plan components maintain or improve protection and management for most habitat occurrences in the plan area. This rating is primarily because there are updated desired conditions and guidelines that support wetland composition, structure, and function, connectivity between uplands and aquatic and riparian areas, and the maintenance of habitat for species (FW-Rip-Wtlnds-DC-1, 2, FW-Rip-All-DC-1, 3, 5, FW-Rip-All-G-2, 3, FW-WFP-DC-6).

In contrast to alternative A, alternative B (modified) provides clearer direction for managers by having specific plan components that describe the function, structure, and composition of wetlands (FW-Rip-Wtlnds-DC-1, 2). Wetland riparian condition and soil quality would improve with the implementation of plan objectives that would restore 5 to 10 wetlands during each 10-year period over the life of the plan (FW-Rip-Wtlnds-O-1). The desired conditions manage for vegetation diversity and riparian function including in priority watersheds (FW-Rip-RipType-DC-1, 2, FW-Water-G-2, FW-Rip-RipType-O-1). More site-specific aquatic management zone guidelines protect riparian function and water quality (FW-Rip-All-G-3) (USDA Forest Service 2016b). Plan components in the Wildlife, Fish and Plant section also contribute to the viability of species associated with riparian areas by promoting properly functioning ecosystems that have the necessary physical and biological components to meet the needs of associated native species (FW-WFP-DC-1, 3).

Direction for designated botanical areas in this alternative would support wetland habitat for the associated species by promoting properly functioning ecosystems that are not negatively impacted from human activities or permitted uses (SA-RNABotGeo-DC-5, and SA-RNABotGeo-G-1, 3, 4, 5). Habitat and properly functioning ecosystems would also be maintained in localized areas because of recreation and transportation suitability recommendations in chapter 4 of the revised plan. These recommendations state that new motorized areas, permanent roads, temporary roads, and motorized travel are not suitable in botanical and geological areas.

Alternative B (modified) has plan language to avoid or reduce soil compaction or disturbance and excessive vegetation use from domestic livestock in riparian areas. For example, in the livestock grazing section, grazing should be managed to meet or move toward desired conditions for other forest resources. Structural range improvements should be built and utilized in a manner consistent with desired conditions for riparian areas and other sensitive resources. See FW-Graz-G-2, 4, 5. In addition, where permitted livestock has access to riparian areas, forage use should maintain those species, allow for plant regeneration and lead to diverse age classes of woody riparian species where the potential exists. This guideline does not apply to fine-scale activities or facilities that are used to reduce livestock impacts to riparian areas at a larger scale, such as intermittent livestock crossing locations and water gaps. See FW-Graz-G-7. Soil productivity, soil condition, and vegetation quality and abundance within the area affected by these fine-scale structures or activities would be of lower quality and abundance compared to areas outside these areas.

A desired condition in Land Adjustments promotes the retention of open space values including those related to riparian/wetland character. Guidelines in Land Adjustments promote considering areas that contain or influences wetlands, riparian areas, or other water-related features and considering habitat for threatened, endangered and sensitive species when acquiring land (FW-LndAdj-DC-1,G-1).

A guideline in Special Uses would protect riparian resources by recommending against issuing a lands and recreation special use permit for activities proposed to occur within 200 feet of perennial streams, springs, or waters that contribute to or support sensitive resources such as federally listed or Southwestern Region sensitive species (FW-SpecUse-G-3).

Plan components in other sections of the plan would also maintain and promote the sustainability of wetlands. For example, permanent and temporary road construction and relocation should avoid wetlands (FW-RdsFac-G-5). Desired conditions in the Pine Belt, Anderson Mesa, and Long Valley Management Areas promote functioning wetlands that provide nesting and migratory habitat for waterfowl and shorebirds (MA-PineBelt-DC-1, MA-AMesa-DC-4, MA-LongV-DC-6). A management approach in the Roads and Facilities section reminds managers that wetlands that are classified as impaired or non-attaining due to sedimentation or alterations to hydrology related to the road would be a prioritizing factor in naturalization of decommissioned and unauthorized roads.

There are no acres of Wetlands in recommended wilderness in alternative B (modified).

Alternative C

Alternative C has the same effects as alternative B (modified), except there are 3 acres of wetlands in recommended wilderness in alternative C. These acres are in the Barbershop recommended wilderness area, and represent about 0.03 percent of wetland acres on the forest. Plan language would emphasize primitive and undeveloped wilderness characteristics and ecological systems, non-motorized activities, limited motorized use, and be generally protective of wetlands; however, this would be a negligible effect at the landscape level due to the small amount of acres. See FW-RWild-DC-1, 2, 5, 6, G-3, 5.

The effects to wetlands under alternative C are the same as alternative B (modified), except there is additional management direction for wetlands in the Anderson Mesa, Blue Ridge, and East Clear Creek Management Areas in addition to that found in the revised plan. This additional management direction is beneficial because it emphasizes the ecological integrity of watersheds and native vegetation, protected and restored wetlands, low disturbance recreation activities that do not negatively impact soil conditions or hydrologic flow, and reduced disturbance from public motorized access (MA-AMesa-DC-1, 3, 10,12, G-1, 2, 3; BlueRidge-DC-1, 3, 10, G-1, 2, 3; MA-EastClr-DC-1, 3, 10, G-1, 2, 3). This plan language could improve degraded conditions where they occur and reduce potential negative impacts such as accelerated erosion and sedimentation into water from recreation.

Alternative D

Alternative D has the same effects as alternative B (modified).

Springs

Affected Environment

Springs occur where groundwater is forced to the surface, offering sufficient moisture to support hydrophytic or riparian vegetation. In some cases, springs drain into karst topography or cave ecosystems. About 10 different spring types occur on the forest. They are classified by how they emerge from the ground.

Amount

There are over 340 springs within the forest boundary. Although many existing springs are located where they occurred historically, some springs are no longer present on the landscape. This could be due to changing conditions in their watershed or aquifer or geological factors such as earthquakes. Their abundance is considered rare.

Habitat Quality and Distribution

Springs are located primarily in the following 5th code watersheds: Middle Little Colorado River, Canyon Diablo, Lower Little Colorado River, Upper Verde River, and Lower Verde River.

Water flow can vary within and between years. Water chemistry can be unique. Isolation of springs and the amount of solar radiation they receive are associated with the number of endemic species (Stevens and Meretsky 2013).

In reference conditions, springs were not interrupted by roads, dams, culverts, diversions or other structures. They were connected to the water table and uplands. Water was not polluted and water chemistry was unaltered by humans. Invasive or non-native plant and animal species were absent. Spring plants and wildlife consisted of species distributed in natural patterns of abundance and diversity within the capacity of the spring. Primary natural disturbances include a range of temperature and precipitation patterns that reflect the inherent variability in climate and weather. Earthquakes or other geological disturbances changed spring flow or conditions in localized areas. Isolated springs remained isolated and functioned as paleorefugia. Paleorefugia are long-term stable habitats in which natural selection, isolation, and adaptation (sometimes to extreme environmental conditions) result in restricted or endemic species, such as snails, plants, and invertebrates (Stevens and Meretsky 2008).

Using the analysis process described under the Species Viability section above, table 30 shows that springs that are assumed accessible, highly modified with stock tanks or pipelines or other infrastructure, and unfenced or unprotected are classified as poor. They are highly departed from reference conditions and classified as either nonfunctioning or functioning-at-risk. Undeveloped springs that are fenced and/or are not accessible are classified as good. They are assumed to have a low departure from reference conditions; to be trending toward reference conditions; to be in functional condition; and to have the number, size of habitat areas, or evenness in distribution across the landscape that is similar or only slightly reduced relative to reference conditions. Springs that have characteristics that lie between springs classified as poor and good are considered to be in fair condition with a slow trend toward reference conditions. They are classified as functioning-at-risk, i.e., they are in functional condition but an existing soil, water, or vegetation attribute makes them susceptible to degradation.

Table 30 compares management effect by alternative. Management effect categorizes the relative expected outcome of plan language in each alternative in terms of maintaining habitat quality and

is the result of plan decisions, including plan objectives. Management effect category values are 1, 2, 3, and 4. The lower the management effects rating, the more effective the alternative is for maintaining the habitat. The effects of the alternatives are explained in greater detail in the discussions on the alternatives that follow.

Table 30. Summary of coarse filter analysis for Springs

Habitat	Existing	Alternative A	Alternatives B (modified), C, and D	Associated Species
Abundance	Rare	Rare		Chiricahua leopard frog, southwestern willow flycatcher, Gila topminnow, lowland leopard frog, northern leopard frog, a caddisfly (*Lepidostoma knulli*), a mayfly (*Moribaetis mimbresaurus*), Balmorhea saddle-case caddisfly, California floater, Fossil springsnail, Page springsnail, Alcove bog orchid, Arizona sneezeweed,Bebb's willow, Blumer's dock, Cochise sedge, Mogollon thistle, Arizona toad, Alberta arctic, Arizona snaketail, Persephone's darner, Redrock stonefly, Oak Creek triteleia
Quality	Poor for developed, accessible, unprotected springs/away; Good for undeveloped springs that are protected or have poor access/toward; Fair for springs between High and Low/ Slowly toward	Poor, away for developed, accessible, unprotected springs Good, toward for undeveloped springs that are fenced, protected, inaccessible Fair, slowly toward for springs between poor and good	Poor, away for developed, accessible, unprotected springs Good, toward for undeveloped springs that are fenced, protected, inaccessible Fair, slowly toward for springs between poor and good	
Likelihood of Limitation	High for poor and fair condition, Moderate for good condition	High for poor quality, Moderate for fair quality, or Low for good quality	High for poor quality, Moderate for fair quality, or Low for good quality	
Management effect		4: Decline in habitat quality as a result of management or lack of management that result from plan components. Plan components may not exist or may be few.	2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.	

Risk Factors

Threats include excessive wildlife herbivory, dispersed recreation, groundwater pumping, spring development, and excessive livestock grazing in localized areas. Groundwater pumping can lower the water table and reduce spring flow; however, it is outside of Forest Service authority to control. Springs are also threatened by fire exclusion in fire-adapted ERUs in their associated watersheds. Fire exclusion has altered the structure in forest and woodland ERUs such that they are more vulnerable to uncharacteristic fire. Precipitation following an uncharacteristic fire can result in accelerated erosion and sedimentation into spring ecosystems, negatively impacting spring function and species composition. Fire exclusion can also alter groundwater recharge of the perched aquifers associated with some springs. It does this because excluding natural fires facilitates dense trees and more tree canopy that can intercept infiltration of precipitation into groundwater, which replenishes perched aquifers. Invasive or non-native plant and/or animal species are a threat in localized areas.

Associated Species

Associated species are listed in table 30.

Environmental Consequences

All Alternatives

Plan components in all alternatives contribute to species viability by managing for sustainable populations of native species and improving and protecting habitat for threatened, endangered, and sensitive species (1987 Plan, pages 22-1, 23, 64, 64-1, 66, 95, 108-2, 180, 187, 206-9, 206-11, 206-12, 206-13, 206-23, 206-30, 206-32, 206-66, 206-67, 206-71, 206-72, 206-79, 206-87, 206-89, 206-98, 206-103, 206-105, 206-108, 206-109, 206-114; FW-WFP-DC-1, 2, 3, 4, 5, 6, 8, and FW-Eco-DC-1). See At-risk Species in the Wildlife and Plant Issues and Topics section above for more information.

All alternatives address the threat of invasive plants. Invasive plants can increase as a consequence of ground disturbance, and once established, would compete with native species for water and nutrients or could alter the fire regime. All alternatives address the threat of invasive plants by pointing to the Final Environmental Impact Statement for the Treatment of Noxious or Invasive Weeds (USDA Forest Service 2005). This direction includes best management practices, among other guidance, which would help prevent, mitigate, and reduce the threat of invasive plants. All alternatives prioritize treatments, call for incorporating control measures in project planning and implementation, and emphasize coordination with partners (1987 Plan, pages 23, 69, 70, 182, 206-14, 206-76, 206-101, 201-116; FW-Invas-DC-1, 2; FW Invas-G-1, 2, 3; FW-Invas-MgtApp; FW-Graz-MgtApp; FW-RdsFac-G-8; FW-Rec-Dev-DC-9; FW-Rec-Dev-G-2). Additional information and analysis is discussed under the Non-native or Invasive Species topic in the Wildlife and Plant Topics and Issues section.

All alternatives have language to meet Arizona water quality standards (1987 Plan, page 28; FW-Water-DC-7, FW-Water-G-5).

Plan components in all alternatives have plan objectives or management emphasis to improve or restore riparian ecosystems, direction to use best management practices, and would use either filter strips (alternative A) or aquatic management zones (remaining alternatives) to protect water quality and to avoid detrimental changes in water temperature, chemical composition, sediment deposits, or blockages. These plan components would maintain or improve water conditions, habitat for aquatic and riparian species, and connected downstream resources. See 1987 Plan, pages 23, 71, 72, 72-1, 172-177; FW-Rip-Spr-G-3 4; FW-Rip-Spr-O-1; FW-Rip-All-G-3; FW-Rip-Strm-G-2; FW-Water-G-4.

Designated wildernesses occur in all alternatives. Designated wilderness areas would be managed according to applicable laws, policy, and Forest Plan direction to preserve wilderness resource values and wilderness quality, and to emphasize wilderness recreation (1987 Plan, pages 105 to 112; SA-Wild-DC-1 to 11; SA-Wild-S-1, 2; SA-Wild-G-1 to 7). Wilderness designation limits most active vegetation management because motorized and mechanized use is not allowed. Motorized and mechanized access can kill or damage plants, can degrade the habitat through soil compaction and soil loss, and can introduce non-native species which compete with native plants for resources. This can negatively affect the reproduction and survival of individual plants or populations. Ground-disturbing activities are primarily confined to main trails, trailheads, and key points of interest at which invasive species introduction and establishment, or accelerated erosion

could occur depending on the level of use. The lack of ground-disturbing activities elsewhere would be beneficial by reducing the risk of invasive plant introduction and dispersal by motorized or mechanized use. However, limited access associated with designated wilderness could preclude restoration treatments that require motorized equipment for treatments or safety, or make them harder to do logistically. Lack of restoration treatments could result in missed fire return intervals, increased and unnatural levels of fuels, increased density of shrubs and trees, or establishment and spread of invasive or non-native species. This could slow the trend toward desired conditions or increase the risk of uncharacteristic fires in localized areas more so than in the other alternatives. Uncharacteristic fire could facilitate the spread or establishment of invasive or non-native species, which could then alter area hydrology, fire regime, and biodiversity.

Alternative A

Using the analysis process described under the Species Viability section above, table 30 shows that under alternative A, habitat quality for springs ranges from poor to good depending on the degree of spring development, protection, and accessibility. Trends range from away from desired conditions for springs in poor condition; toward desired conditions for springs in good condition; and slowly toward desired conditions for springs in fair condition. Likelihoods that springs would be limiting to the viability of the associated species range from moderate to high (table 30). These likelihoods were derived by combining the value for habitat abundance with the values for quality. Springs classified as being in poor or fair condition would have a high likelihood and springs classified as being in good condition would have a moderate likelihood.

Management effect is considered a 4, which means there could be a decline in habitat quality as a result of management or lack of management that result from plan components. Plan language for springs is mainly found in management area 12, Riparian and Open Water, which includes riparian forests, wetlands, marshes, ponds, and springs. Much of the language in alternative A is outdated and does not include current science about riparian condition, processes, and natural disturbances. This alternative has less potential for improvement to the functional condition of springs compared to the other alternatives, primarily because alternative A does not distinguish between the various riparian areas that occur on the forest and lacks plan components relative to composition, structure, and function.

Alternative A does contain beneficial plan components that would maintain or improve riparian in general, but it has a strong focus on riparian forests and streams. Alternative A emphasizes riparian recovery; preventing damage to riparian vegetation, streambanks, and channels; and restoring degraded riparian areas to good condition as soon as possible (1987 Plan, pages 65-8, 172, 174). In support of this, alternative A would also construct 10 miles of fences per decade for the first two decades where necessary to protect riparian regeneration from grazing (1987 Plan, page 175). Other protective language includes the following: Only beneficial new special uses are allowed in riparian areas, and exceptions such as utility line or roads crossing stream courses are designed to minimize the extent and magnitude of impact to riparian areas (1987 Plan, page 177). Aggressive fire suppression may be used to prevent resource damage utilizing methods that minimize long-term adverse impacts to riparian habitats (1987 Plan, page 177). In addition, acquisition of riparian areas through land exchange is a high priority (1987 Plan, pages 177, 185). The plan would manage commercial uses, and recreation in some areas, to protect riparian values (1987 Plan, pages 206-10, 22, 26, and 39). Plan components under alternative A provide limited guidance for non-native aquatic species control, but not forestwide. Control of the impacts of non-native plant and animal species and discouraging the introduction of new non-natives is advocated in the Flagstaff Lake Mary Ecosystem Area and Sedona/Oak Creek Area (1987 Plan,

pages 206-9, 206-72). Alternative A contributes less to the maintenance and sustainability of streamcourses on the forest and the viability of the associated species than the other alternatives.

Alternative A lacks plan components that address connectivity between riparian areas and uplands, between riparian and aquatic habitats and groundwater, and along streams. These connections are essential for properly functioning spring ecosystems. Alternative A plan language lacks guidance on protecting and maintaining groundwater quality and aquifer levels, but does provide focus on keeping an inventory of groundwater and evaluating management practices (1987 Plan, page 73). Substantial groundwater drawdown has occurred on non-NFS land due to excessive well pumping, but this is outside the control and authority of the forest. Consequently, the trend for groundwater (and the springs that depend on it) is away from desired conditions on non-forest administered lands and static on forest lands for alternative A.

Uncharacteristic fire can result in uncharacteristic flooding, sedimentation, or wildfire in non-fire-adapted ecosystems like springs. The current plan reduces the threats of uncharacteristic fire on departed vegetation types (1987 Plan, pages 65-2, 65-3, 65-4, 65-5, 65-11, 206-11, 206-75, and 206-77). Reducing threats of uncharacteristic fire in fire-dependent ecosystems would reduce the risk of high soil burn severity that could otherwise result in accelerated soil erosion, loss of protective vegetative ground cover and tree and herbaceous species including in riparian areas. Reducing the threat of uncharacteristic fire would also indirectly reduce the threat of uncharacteristic flooding.

Prescribed fire and wildfires managed for resource objectives may be used in fire-adapted ecosystems in alternative A, but there is no provision for using wildfires managed for resource objectives in the wildland-urban interface (1987 Plan, pages 92, 155, 165) and the language to manage wildfires for resource objectives in wilderness impedes the use of this tool (1987 Plan, pages 111, 112). This plan language limits the restoration of fire as a natural process in the wildland-urban interface and in wilderness, and canopy cover and shrub density would be expected to increase in these areas. There would also be increased potential for uncharacteristic fire in the wildland-urban interface and wilderness portions of this ERU. This is particularly problematic where the landownership pattern is intermixed with different ownerships. Indirect negative consequences to springs could be decreased water infiltration to the aquifers that support springs due to increased transpiration by increased density of shrubs and trees; decreased water infiltration because tree canopies intercept snow and it could evaporate before it has a chance to reach the ground and infiltrate into the soil; or increased likelihood of accelerated erosion or sedimentation from uncharacteristic fire.

The threat of dispersed recreation to riparian resources is not addressed forestwide in alternative A. Special areas such as the Verde Wild and Scenic River and wilderness, and the management areas within Flagstaff/Lake Mary Ecosystem Area and the Sedona-Oak Creek Planning Area most specifically address the conflicts and strategies to resolve resource damage in riparian areas (1987 Plan, pages 105, 115-4; 187-1, 196-2, 206-9 to 206-11, 206-15, 206-22, 206-39, 206-62 to 206-64, 206-66, 206-68, 206-78 to 206-79). All of these goals and guidelines are similar in that they set general expectations that recreation impacts should not destabilize ecosystems, and specifically, that certain activities known to result in resource-recreation conflicts should be limited in a way that reduces their footprint or that they are not allowed in these areas. Overall, this direction addresses dispersed recreation’s impact to riparian areas in some areas where there have been past conflicts and resource damage, but it provides very limited direction when previously low use areas are “discovered” and see increases in recreation that are unexpected,

such as the Fossil Creek Wild and Scenic River. As a result, alternative A addresses this threat sporadically compared with alternatives B (modified), C, and D, but it does mitigate some of the areas where the conflict is most pronounced.

Plan components in alternative A (Forestwide Range and Forestwide Riparian) protect and minimize impacts to riparian areas through management and fencing, but they also manage impacts through seeding, which could include non-native plant species that could compete with native spring vegetation or alter spring hydrology (1987 Plan, pages 69, 176, and 174). It also allows salting to improve livestock distribution. Salting could be used in spring areas to improve livestock management by concentrating cattle in certain areas, a practice which could be detrimental to associated species and their habitat, but salting could also be used in upland areas to distribute livestock outside of riparian areas (1987 Plan, pages 68 and 175). This is offset by a standard that requires that forage use be maintained at a level that assures recovery and continued existence of listed species (1987 Plan, pages 66-1 and 174) and specific objectives to protect riparian areas and allow them to recover in the first 20 years of the plan (1987 Plan, page 175).

Alternative B (modified)

Using the analysis process described under the Species Viability section above, table 30 shows that under alternative B (modified), habitat quality for springs ranges from poor to good depending on the degree of spring development, protection, and accessibility. Trends range from away from desired conditions for springs in poor condition; toward desired conditions for springs in good condition; and slowly toward desired conditions for springs in fair condition.

Likelihoods that springs would be limiting to the viability of the associated species range from moderate to high (table 30). These likelihoods were derived by combining the value for habitat abundance with the values for quality. Springs classified as being in poor or fair condition would have a high likelihood and springs classified as being in good condition would have a moderate likelihood.

Management effect is considered a 2, which means the plan components maintain or improve protection and management for most habitat occurrences in the plan area. Alternative B (modified) contributes more to the maintenance and sustainability of springs on the forest and the viability of the associated species than alternative A. This is because alternative B (modified) has desired conditions, guidelines, and an objective to guide spring management on the forest. Desired conditions are spring-specific and better provide for the composition, structure and function of spring ecosystems than alternative A. They promote functional physical and biological resources consistent with waterflow patterns, recharge, and geochemistry appropriate to the site; diverse composition and seral stages of native aquatic and riparian species consistent with spring type, slope, aspect, disturbances and natural solar energy budget; and spring riparian zones capable of processing sediment, bedload, water quality and supporting perched water-bearing zones and groundwater recharge (FW-Rip-Spr-DC-1, 2, 3). Goals emphasize springs that are rarely developed and altered by human-made structures, consistent with existing water rights and claims and promote physical and biological components that provide habitat for species that are narrowly endemic or have restricted distributions (FW-Rip-Spr-DC-4 and 5). Guidelines would manage recharge areas to maintain or improve spring discharge; would maintain or procure water rights, and would protect spring sources (FW-Rip-Spr-G-1, 2, 4). These guidelines would maintain or improve water quantity and quality and help protect the biodiversity, endemic species, cultural values, and unique ecological and biophysical characteristics of springs.

Guidance is also provided for the protection of groundwater resources and procurement of instream flows (FW-Water-DC-3,5, FW-Water-G-3). This would maintain baseflows and contribute to the resilience of spring ecosystems to climate and weather variability. The plan objective would restore riparian function to at least 25 springs not in properly functioning condition every 10 years to provide water quantity and aquatic habitat for the recovery of plant and animal species (FW-Rip-Spr-O-1). Other beneficial language regarding mitigating the effects of roads, connectivity of drainages, connectivity between streamcourses and upland habitats (FW-RdsFac-G-2, 5). These guidelines would avoid accelerated soil erosion and loss of vegetation due to roads, protect water quality; and require that permanent and temporary road construction and relocation would avoid springs.

Alternative B (modified) removes the plan language limitations that restrict the use of wildfire managed for resource benefits in designated wilderness allowing wildfire to play its natural role in wilderness where it is feasible to do so (SA-Wild-DC-4). In contrast to alternative A, alternative B (modified) removes the restrictions that prohibit the use of wildfires managed for resource benefits in the wildland-urban interface. This could facilitate the use of fire for restoration or fuels reduction and would help reduce the vulnerability of springs to uncharacteristic fire, accelerated erosion, and increased evapotranspiration from increased density of trees.

Alternative B (modified) has plan language to avoid or reduce soil compaction or disturbance and excessive vegetation use from domestic livestock in riparian areas. For example, in the livestock grazing section, grazing should be managed to meet or move toward desired conditions for other forest resources. Structural range improvements should be built and utilized in a manner consistent with desired conditions for riparian areas and other sensitive resources. See FW-Graz-G-2, 4, 5. In addition, where permitted livestock has access to riparian areas, forage use should maintain those species, allow for plant regeneration, and lead to diverse age classes of woody riparian species where the potential exists. This guideline does not apply to fine-scale activities or facilities that are used to reduce livestock impacts to riparian areas at a larger scale, such as intermittent livestock crossing locations and water gaps. See FW-Graz-G-7. Soil productivity, soil condition, and vegetation quality and abundance within the area affected by these fine-scale structures or activities would be of lower quality and abundance compared to areas outside these areas.

Language in the recreation and trail sections could reduce vegetation, soil, and water damage to springs associated with recreation. Recreation would be managed to maintain, protect, or improve ecological attributes, processes and habitat for native species and to be in balance with the capacity of other resources to support recreation activities (SA-Wild-S-1 to 5; FW-Rec-All-G-2). Trail use would remain on established trail surfaces, especially in sensitive areas and unplanned user-created trails are rare (FW-Rec-Trails-DC-11). Trails should be designed, built, rerouted, or maintained utilizing best management practices that address impacts to other resources and promote sustainable trail surfaces (FW-Rec-Trails-G-1.)

A guideline in Special Uses would protect riparian resources by recommending against issuing a lands and recreation special-use permit for activities proposed to occur within 200 feet of perennial streams, springs, or waters that contribute to or support sensitive resources such as federally listed or Southwestern Region sensitive species (FW-SpecUse-G-3).

Habitat and properly functioning ecosystems would also be maintained in localized areas because of recreation and transportation suitability recommendations (chapter 4 of the revised plan). These recommendations state that new motorized areas, permanent roads, temporary roads, and motorized travel are not suitable in designated and recommended wilderness areas and botanical and geological areas. This adds to the protections that are associated with these special areas from ground-disturbing activities.

Alternative B (modified) recommends three wilderness areas but they have no known springs.

Alternative C

Alternative C has the same consequences as alternative B (modified), except it would recommend a total of 13 wilderness areas. The Abineau and Strawberry Crater recommended wilderness areas are assumed to not have any springs. Recommended wilderness would reduce impacts from motorized use by promoting motorized vehicle use only for limited administrative and permitted activities (SA-RWild-DC-1, 2, 5; SA-RWild-G-1, 3, 5). Mechanized uses that maintain and do not detract from wilderness values would be allowable. However, new trails should be designed for non-motorized and non-mechanized activities that preserve wilderness character (SA-RWild-DC-6; SA-RWild-G-5). Implementation of these plan components would reduce disturbance to soil and vegetation from motorized or mechanized uses, which could be beneficial to associated species. Limited access associated with recommended (and designated) wilderness could preclude restoration treatments that require motorized equipment for treatments or safety, or make them harder to do logistically. Site-specific circumstances would also influence which or whether restoration treatments might be precluded. Delay or absence of restoration treatments could result in missed fire return intervals, increased and unnatural levels of fuels, increased density of shrubs and trees, or establishment and spread of invasive or non-native species. This could slow the trend toward spring desired conditions or increase the risk of uncharacteristic fires in localized areas more so than in the other alternatives. Uncharacteristic fire could facilitate the spread or establishment of invasive or non-native species, which could then alter area hydrology, fire regime, and biodiversity.

Alternative D

Alternative D has same consequences as alternative B (modified).

Perennial streamcourses, Ephemeral and intermittent streamcourses

Affected Environment

On the Coconino NF, there are three types of streamcourses, or drainages: perennial, ephemeral, and intermittent. They differ in the timing and duration of waterflow and corresponding vegetation. Streamcourses include their associated drainages and flood plains. Perennial streamcourses flow year-round except during extended drought, and though some of their flows may be below the surface, they support riparian vegetation. Ephemeral streamcourses flow short term in response to storm events and lack riparian vegetation. Intermittent streamcourses flow seasonally, usually in response to snowmelt and may contain perennial pools. Some intermittent streamcourses support riparian vegetation and some do not. The vegetation in ephemeral drainages is not as diverse as perennial systems, but ephemeral drainages support different vegetative species than in the adjacent uplands.

Amount

There are an estimated 5,977 miles of streamcourses within the administrative boundary of the Coconino NF. The forest manages about 4,975 of these miles (83 percent),with the remaining miles occurring on lands in various ownerships. About 85 percent of the ephemeral streamcourse miles, 85 percent of the intermittent streamcourse miles, and 68 percent of the perennial streamcourse miles within the administrative boundary are managed by the forest.

Of the streamcourse miles managed by the forest, about 76 percent are ephemeral, 19 percent are intermittent, and 5 percent are perennial. Table 31 and table 32 summarize the information used to estimate the likelihoods that the various streamcourse types would be limiting to the viability of the associated species. Ephemeral streamcourses are classified as common because they are widespread and frequently encountered on the forest. Intermittent streamcourses are classified as occasional because their distribution is more limited than ephemeral, and they are not encountered as frequently or are encountered seasonally. Perennial streamcourses are classified as rare because their distribution is limited and restricted to specific locations on the forest.

Habitat Quality and Distribution

In reference conditions, water was not interrupted by roads, dams, culverts, diversions or other structures. Streamcourses were connected to the water table, floodplains, and uplands. Water was not polluted. Invasive or non-native plant and animal species were absent. Streamcourses had sufficient vegetation, landforms, or large woody debris to dissipate stream energy associated with high flows; filter sediment, capture bedload, and aid in floodplain development; and improve floodwater retention and groundwater recharge.

Primary natural disturbances include flooding, adjacent landslides, and changing climatic conditions, such as drought or extreme temperatures.

Streamcourses, in general, are found forestwide in a variety of substrates, topography, and gradients. Streamcourses are associated with riparian forests. See the section on riparian forests for additional information. On the Coconino NF, most perennial streamcourses are located on the southern and western portions of the forest.

Using the analysis process described under the Species Viability section above, table 31 shows that habitat quality for perennial streamcourses is poor with a static trend relative to reference conditions. This means it has a high departure from reference conditions and the number, size of habitat areas, or evenness in distribution across the landscape is reduced relative to reference conditions.

Quality is considered poor because some streams have declining flows; some streams exceed State water quality standards, most streams have invasive or non-native aquatic species, and most streamside vegetation has invasive non-native plants. Streamflow and some well data indicate a recent downward trend in groundwater levels adjacent to Flagstaff and communities in the Verde Valley, particularly in areas that have the high groundwater pumping on private lands but is outside the control of the Forest Service. Continued or increased pumping may negatively affect the base flow of streams, especially the Verde River, Beaver Creek, West Clear Creek, and Oak Creek because domestic use is high adjacent to these streams, which are in the Upper Verde River and Lower Verde River 4th code watersheds (USDA Forest Service 2016j). Most perennial streams generally have static or slightly declining flows forecast for the future due to climate and increased use and groundwater withdrawals on and off-forest leading to reduced quality and

abundance of habitat for associated species with a few exceptions. Fossil Creek has had the power plant decommissioned, and therefore, withdrawals reduced, and lower Oak Creek (at Sedona and Cornville) has a static to slightly increasing trend (USDA Forest Service 2016j). In other perennial streams on the forest, surface water use is higher than historical conditions because the number of campgrounds has increased and there is increased recreational use. The static to downward trend in streamflow is expected to continue over the next 20 years. In addition, groundwater demand is expected to exceed supply in the foreseeable future, likely affecting base flow of streams (USDA Forest Service 2016j), thus further limiting habitat for associated species.

Quality of perennial streams is also impacted by non-point sources of pollution. On the Coconino NF, the most important non-point sources of pollution are from sediment generated from roads near drainages and livestock grazing (USDA Forest Service 2016j).

Perennial stream quality is also considered poor where there are non-native animals that compete with, prey on, or share diseases with native species. Non-native animals can alter the composition and structure of the aquatic environment. Non-native species are found in most of the waterbodies on the forest at varying levels. A barrier for invasive species was placed in Spring Creek in 2015, to separate native fishes from non-native species in that area. There is also a barrier in Fossil Creek.

Table 31. Summary of coarse filter analysis for perennial streamcourses

Habitat	Existing	Alternative A	Alternatives B (modified), C, and D	Associated Species
Abundance	Rare	Rare		Chiricahua leopard frogs, Colorado pikeminnow, Gila chub, Gila topminnow, Gila trout, headwater chub, Little Colorado spinedace, loach minnow, razorback sucker, roundtail chub, spikedace, narrow-headed gartersnake, northern Mexican gartersnake, lowland leopard frogs, desert sucker, Little Colorado sucker, roundtail chub, Sonora sucker, a caddisfly (*Lepidostoma knulli*), a caddisfly (*Wormaldia planae*), a mayfly (*Moribaetis mimbresaurus*), California floater, Fossil springsnail, Page springsnail, bluehead sucker, longfin dace, Arizona snaketail, Persephone's darner, Redrock stonefly, beaver
Quality	Poor, static	Poor, static	Poor, trending toward	
Likelihood of Limitation	High	High	High	
Management effect		4: Decline in habitat quality as a result of management or lack of management that result from plan components. Plan components may not exist or may be few.	2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.	

There is a high likelihood that perennial streams would be a limiting factor to the viability of the associated species. These likelihoods were derived by combining the values for habitat abundance with the values for quality.

Table 31 also compares management effect by alternative. Management effect categorizes the relative expected outcome of plan language in each alternative in terms of maintaining habitat quality, and is the result of plan decisions, including plan objectives. Management effect category values are 1, 2, 3, and 4. The lower the management effects rating, the more effective the alternative is for maintaining the habitat. The effects of the alternatives are explained in greater detail in the discussions on the alternatives that follow.

Using the analysis process described under the Species Viability section above, table 32 shows that habitat quality for intermittent and ephemeral streamcourses in locations accessible to motorized vehicles is poor with a static trend relative to reference conditions, and fair with a static trend in inaccessible locations. This means intermittent and ephemeral streamcourses have a high departure from reference conditions in accessible locations and moderate departure in inaccessible locations. Easy to get to locations are accessible for motorized vehicles, livestock, and various dispersed or permitted activities. The potential for accelerated erosion, sedimentation, soil compaction, vegetation loss, vegetation damage, and pollution is higher in these locations. Some of these impacts (such as sediments or pollution) could travel down drainages and affect inaccessible locations.

There is a high likelihood that intermittent streamcourses would be a limiting factor to the viability of the associated species in accessible locations but a moderate likelihood in inaccessible locations. There is a moderate likelihood that ephemeral streamcourses would be a limiting factor to the viability of the associated species in accessible locations, but a low-moderate likelihood in inaccessible locations. These likelihoods were derived by combining the values for habitat abundance with the values for quality.

Table 32 also compares management effect by alternative. Management effect categorizes the relative expected outcome of plan language in each alternative in terms of maintaining habitat quality and is the result of plan decisions, including plan objectives. Management effect category values are 1, 2, 3, and 4. The lower the management effects rating, the more effective the alternative is for maintaining the habitat. The effects of the alternatives are explained in greater detail in the discussions on the alternatives that follow.

Risk Factors

Perennial streams and ephemeral and intermittent watercourses have the same risk factors as described for Riparian Forests above.

In addition to Riparian Forest risk factors, the post-fire sediment load to streams can result in loss of suitable habitat for associated species, fish mortality, and in some cases long-term alteration of water chemistry and turbidity. Wildfires can cause water quality changes that can kill aquatic vertebrates and macroinvertebrates (Rinne 2004, USDI Fish and Wildlife Service 2005b, Rhodes 2007), negatively alter the food base for fishes (Earl and Blinn 2003), and can result in stream and riparian vegetation alteration that negatively affects aquatic ecosystems and habitat (USDI Fish and Wildlife Service 2005b).

Associated Species

Associated species are listed in table 31 and table 32.

Table 32. Summary of coarse filter analysis for ephemeral and intermittent streamcourses

Habitat	Existing	Alternative A	Alternatives B (modified), C, and D	Associated Species
Intermittent	**streamcourses**			Chiricahua leopard frog, northern Mexican gartersnake, lowland leopard frog, northern leopard frog, a mayfly (*Moribaetis mimbresaurus*), Arizona toad
Abundance	Occasional	Occasional	Occasional	
Quality	Accessible: Poor, static Inaccessible: Fair, static	Accessible: Poor, static Inaccessible: Fair, static	Accessible: Poor, trending slowly toward Inaccessible: Fair, trending slowly toward	
Likelihood of Limitation	Accessible: High Inaccessible: Moderate	Accessible: High Inaccessible: Moderate	Accessible: High Inaccessible: Moderate	
Ephemeral	**streamcourses**			
Abundance	Common	Common	Common	
Quality	Accessible: Poor, static Inaccessible: Fair, static	Accessible: Poor, static Inaccessible: Fair, static	Accessible: Poor, trending slowly toward Inaccessible: Fair, trending slowly toward	
Likelihood of Limitation	Accessible: Moderate Inaccessible: Low-Moderate	Accessible: Moderate Inaccessible: Low-Moderate	Accessible: Moderate Inaccessible: Low-Moderate	
Management effect		3: Plan components maintain or improve protection and management for some habitat occurrences in the plan area.	2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.	

Environmental Consequences

Common to All Alternatives

All alternatives address the threat of invasive plants. Invasive plants can increase as a consequence of ground disturbance, and once established, would compete with native species for water and nutrients or could alter the fire regime. All alternatives address the threat of invasive plants by pointing to the Final Environmental Impact Statement for the Treatment of Noxious or Invasive Weeds (USDA Forest Service 2005). This direction includes best management practices, among other guidance, which would help prevent, mitigate, and reduce the threat of invasive plants. All alternatives prioritize treatments, call for incorporating control measures in project planning and implementation, and emphasize coordination with partners (1987 Plan, pages 23, 69, 70, 182, 206-14, 206-76, 206-101, 201-116; FW-Invas-DC-1, 2; FW Invas-G-1, 2, 3; FW-Invas-MgtApp; FW-Graz-MgtApp; FW-RdsFac-G-8; FW-Rec-Dev-DC-9; FW-Rec-Dev-G-2). Additional information and analysis is discussed under the Non-native or Invasive Species topic in the Wildlife and Plant Topics and Issues section.

Under all alternatives, the forest would continue to pursue instream flow rights at similar levels (1987 Plan, page 206-116, 74; FW-Water-DC-1, 2, 5; FW-Water-G-3, 5), which, if obtained, would ensure that new requests for water rights would not negatively impact water quantity for wildlife habitat and riparian vegetation. Procurement of instream flow water rights would improve the extent of uninterrupted streamflows across NFS lands, thereby providing greater aquatic and riparian habitat continuity and resilience.

All alternatives have language to meet Arizona water quality standards (1987 Plan, page 28, FW-Water-DC-7 and G-5).

Plan components in all alternatives have plan objectives or management emphasis to improve or restore riparian ecosystems and direction to use best management practices, and would use either filter strips (alternative A) or aquatic management zones (remaining alternatives) to protect water quality and to avoid detrimental changes in water temperature, chemical composition, sediment deposits, or blockages. These plan components would maintain or improve water conditions, habitat for aquatic and riparian species, and connected downstream resources. See 1987 Plan, pages 23, 71, 72, 72-1, 172-177; FW-Rip-Wtlnds-O-1; FW-Rip-Spr-O-1; FW-Rip-RipType-O-1; FW-WFP-O-4; FW-Rip-All-G-3; FW-Rip-Strm-G-2; FW-Water-G-4; FW-BioPhys-Geo-G-8.

All alternatives provide language for monitoring, including the use of aquatic macroinvertebrates as monitoring indicators for condition of waterways and riparian areas. Water quality monitoring using the Arizona Department of Environmental Quality standards is also supported under all alternatives.

Alternative A

Using the analysis process described under the Species Viability section above, table 31 shows that under alternative A, habitat quality for perennial streamcourses is poor with a static trend relative to desired conditions. This means it has a high departure from desired condition mainly because alternative A has little language that addresses non-native or invasive animal species. Table 32 shows that habitat quality for intermittent and ephemeral streamcourses does not change from existing conditions.

There is a high likelihood that perennial streams would be a limiting factor to the viability of the associated species. There is a high likelihood that intermittent streamcourses would be a limiting factor to the viability of the associated species in accessible locations but a moderate likelihood in inaccessible locations. There is a moderate likelihood that ephemeral streamcourses would be a limiting factor to the viability of the associated species in accessible locations, but a low-moderate likelihood in inaccessible locations. These likelihoods were derived by combining the values for habitat abundance with the values for quality.

The management effect for perennial streamcourses is a 4 under alternative A, which means the plan components maintain or improve protection and management for few to no habitat occurrences in the plan area. This is because there is little plan language for invasive or non-native animal species or disease, which can significantly and negatively alter the quality of aquatic ecosystems. Portions of Spring Creek and Fossil Creek would have a low likelihood of being limiting to the associated fish species because fish barriers separate native from non-native species. Plan components under alternative A provide limited guidance for non-native aquatic species control, but not forestwide. Control of the impacts of non-native plant and animal species and discouraging the introduction of new non-natives is advocated in the Flagstaff Lake Mary

Ecosystem Area and Sedona/Oak Creek Area (1987 Plan, pages 206-9, 206-72). Alternative A has language to cooperate with the Arizona Game and Fish Department in evaluating proposals for re-introducing extirpated species into suitable habitat, on fish stocking and public access for fishing, and to prevent and/or remove unapproved introduced or invasive species (1987 Plan, page 65-12).

The management effect for intermittent and ephemeral streamcourses is a 3 under alternative A, which means the plan components maintain or improve protection and management for some habitat occurrences in the plan area. Alternative A contributes less to the maintenance and sustainability of streamcourses on the forest and the viability of the associated species than the other alternatives.

Alternative A has the same effects as described in Environmental Consequences for Riparian Forests. In addition, alternative A lacks plan components that address connectivity between riparian areas and uplands, between riparian and aquatic habitats and ground water, and along streams. These connections are essential for properly functioning ecosystems.

Alternative A plan language lacks guidance on protecting and maintaining groundwater quality and aquifer levels, but does provide focus on keeping an inventory of groundwater and evaluating management practices (1987 Plan, page 73). Substantial groundwater drawdown has occurred on non-NFS land due to excessive well pumping, but this is outside the control and authority of the forest. Consequently, the trend for groundwater (and the streams that depend on it) is away from desired conditions on non-forest administered lands and static on forest lands for alternative A.

Alternative B (modified)

Using the analysis process described under the Species Viability section above, table 31 shows that under alternative B (modified), habitat quality for perennial streamcourses is poor, but instead of a static trend, there is a trend toward desired conditions. This means it has a high departure from reference conditions. This is mainly because the presence of invasive or non-native animal species in streamcourses is not likely to change, but there is plan language that addresses non-native or invasive animal species, which provides more guidance and flexibility for managers to address this threat. Table 32 shows that habitat quality for intermittent and ephemeral streamcourses does not change from existing conditions, but the trends would improve slowly toward desired conditions rather than remain static, as in alternative A.

There is a high likelihood that perennial streams would be a limiting factor to the viability of the associated species. There is a high likelihood that intermittent streamcourses would be a limiting factor to the viability of the associated species in accessible locations, but a moderate likelihood in inaccessible locations. There is a moderate likelihood that ephemeral streamcourses would be a limiting factor to the viability of the associated species in accessible locations, but a low-moderate likelihood in inaccessible locations. These likelihoods were derived by combining the values for habitat abundance with the values for quality.

The management effect for all three streamcourse types improves to a 2 under alternative B (modified), which means the plan components maintain or improve protection and management for most habitat occurrences in the plan area. Alternative B (modified) contributes more to the maintenance and sustainability of streamcourses on the forest and the viability of the associated species than alternative A.

Alternative B (modified) has the same effects as described in Environmental Consequences for Riparian Forests in addition to the following:

The management effect rating is based on language regarding mitigating the effects of roads, connectivity of drainages, connectivity between streamcourses and upland habitats, and earthen stock tank locations (to minimize impacts to sensitive resources) (see FW-ConstWat-G-1 and 2, FW-RdsFac-G-2, 5, 7 and 9). Alternative B (modified) would apply aquatic management zones or best management practices to perennial, intermittent, or ephemeral drainages to maintain the chemical, physical, and biological conditions of connected or downstream caves, karst, and lava tubes (FW-BioPhys-Geo-G-8). The water quantity or baseflows of intermittent and perennial streams would be sustained to mimic seasonal flow regimes and riparian ecosystems and corridors would promote the natural role of water, natural hydrogeomorphic processes, sediment movement and capture, woody debris recruitment and retention, and root masses, and maintain water tables (FW-Water-DC-5, FW-Rip-All-DC-1). Other updated desired conditions promote streamcourses having access to their floodplains and natural sinuosity, so flood energy can be dissipated without causing damage to the channel streambanks; promote natural disturbances in streamcourses; and provide more detailed desired conditions on the functioning of perennial and intermittent streamcourses and their floodplains (FW-Rip-Strm-DC-1, 2, and 3).

Unlike alternative A, alternative B (modified) has a desired condition that promotes ephemeral and intermittent streamcourses as habitat and movement corridor for species (FW-WFP-DC-4 and 6). A management approach in Stream Ecosystems reminds managers that ephemeral streamcourses may be protected at the project level depending on downstream water quality issues. Another management approach in the same section encourages coordination with local, State, private, and other Federal agencies to ensure that natural streamcourses are maintained and not fragmented by development, which would maintain their function as movement corridors.

As described in the Watersheds and Water section in volume 1, alternative B (modified) better protects groundwater (and thereby streamcourses) through maintenance of base flows, protection of water quality, and procurement of instream flows (FW-Water-DC-3, 5, 7 and FW-Water-G-3). Implementing this guidance would improve the ability of the soil to resist erosion and infiltrate water, improving water quality and quantity. Riparian vegetation would improve along streambanks, aiding in the ability to filter sediments; capture bedload; aid floodplain development; and improve flood-water retention, groundwater recharge, and intermittent and perennial streamflow, thereby, reducing erosion, improving water quality, and protecting against water quality degradation. Riparian area function would improve, as would floodwater retention, streamflow, and groundwater recharge. Consequently, maintenance of groundwater and water quantity including streamflow should be better protected and move toward desired conditions implementing alternative B (modified) more than alternative A. Lands of other ownership have seen substantial groundwater drawdown due to excessive well pumping, but are outside the control and authority of the forest. Consequently, the trend is away on non-forest administered lands and likely toward for alternative B (modified).

In contrast to alternative A, plan language in alternative B (modified) addresses connectivity of habitats forestwide. This alternative addresses interconnected terrestrial, riparian, and aquatic habitats through desired conditions that would promote access to new habitats, perpetuation of genetic diversity, species movements, dispersal, and migration (FW-Water-DC-4, 6; FW-Rip-All-DC-1, 2, 3; FW-Rip-All-G-2; FW-Rip-RipType-G-2; FW-TerrERU-All-DC-3; FW-TerrERU-Grass-DC-3; FW-WFP-DC-6; FW-WFP-G-6; and MA-AMesa-DC-3). This language would

maintain or improve habitat permeability and mitigate effects to linkages. See the section on Connectivity under Wildlife and Plant Issues and Topics above for more information.

Alternative B (modified) better addresses the threat of invasive species and disease than alternative A by supporting native species and addressing disease and invasive or non-native species forestwide. The plan components for invasive species can be applied to any non-native plant or animal on the forest. The forestwide desired conditions for invasive species (FW-Invas-DC-1 and 2) and guidelines (FW-Invas-G-1, 2, 3) apply to all organisms. Unlike alternative A, invasive species guidance is incorporated in many portions of this alternative. See the section on Non-native or Invasive Species under Wildlife and Plant Issues and Topics above for more information.

Alternative C

Alternative C is the same as alternative B (modified).

Alternative D

Alternative D is the same as alternative B (modified).

Cliffs, Rocky Outcrops, and Talus Slopes

Affected Environment

Cliffs are vertical or near vertical rock faces. They range in size from a few feet to hundreds of feet tall and are inherently dynamic, subject to rock fall, ice, and wind and water erosion. Cliff resources include any naturally occurring material or substances such as plant and animal life, paleontological deposits, and minerals. Cliffs have unique geology, geomorphology, and microclimates, and provide habitats for plants and animals adapted to a vertical environment. They provide perches, roosts, and nest sites for raptors such as peregrine falcons, and microsites for a variety of vegetation. Cliff dwellings and other heritage sites may occur on cliffs. Small animals such as bats and wood rats are known to occasionally use these sites. Rocky outcrops can be small cliffs or exposures of rock.

Talus slopes are geological features composed of a collection of fine to coarse rock fragments at the base of mountains or cliffs accumulated through periodic rock fall from adjacent cliff faces or steep slopes. Talus slopes comprise the slopes of cinder cones. Length, width, and depth of talus slopes can vary widely, as can the size of rock fragments. They are inherently dynamic, subject to natural rock movement, freeze-thaw action, wind and water erosion, and avalanches. Talus slope resources include any material or substance occurring naturally such as plant and animal life, sediments, and minerals as well as associated archaeological features. They provide habitat and hibernacula for small mammals, reptiles, plants, and invertebrates. They can be devoid of vegetation or sparsely vegetated. Disturbance from recreation or management activities can destabilize the talus slopes and alter habitat (USDA Forest Service 2016j). The federally threatened San Francisco Peaks ragwort occurs on talus slopes.

Amount

Cliffs, rocky outcrops, and talus slopes are considered to be common because they are currently located where they were historically. The exact amount of these geological features on the forest is not known.

Habitat Quality and Distribution

The distribution of cliffs, rocky outcrops, and talus slopes is considered to be similar to reference conditions. Cliffs are distributed forestwide and are especially notable within numerous canyons on the forest, along the Mogollon Rim, in the Red Rock-Secret Mountain Wilderness, and on prominent landforms such as Mount Elden. Examples of areas containing cliffs include the many canyons of streams draining the Mogollon Rim plateau such as East Clear Creek, Barbershop Canyon, West Clear Creek, Fossil Creek, the Mogollon Rim, and others. There are other canyon areas that contain cliffs in the Verde Valley and Sedona area including Oak Creek Canyon, Sycamore Canyon, and others. Most of these canyons are incised in sedimentary bedrock. Other cliffs may be found in basalt lava flows. Red Mountain Geological Area is an excellent example of cliff formations on the forest. Talus slopes also occur forestwide.

The quality of the cliff, rocky outcrop, and talus slope environments (geology, hydrology, available microclimates, aspect, topography, natural processes, biology) is considered to be similar to reference conditions at the landscape level, so quality is classified as good. There are site-specific and localized areas where modifications have occurred such as road cuts, cinder pits, and rock climbing areas. In some cases, portions of cliffs, outcrops, or talus slopes have been removed. In other cases, modifications have been slight, e.g., widening of cracks.

The likelihood that cliffs, rocky outcrops, and talus slopes are limiting to the viability of the associated species is low (table 33).

Table 33. Summary of the coarse filter analysis for Cliffs, Rocky Outcrops, and Talus Slopes

Habitat	Existing	Alternative A	Alternatives B (modified), C, and D	Associated Species
Abundance	Common	Common		California condor, Mexican spotted owl, San Francisco Peaks ragwort, American peregrine falcon, bald eagle, Allen’s lappet-browed bat, spotted bat, Pale Townsend’s big-eared bat, spotted bat, Flagstaff pennyroyal, Lyngholm’s cliffbrake, rock fleabane, Senator Mine alum-root, golden eagle, greater western mastiff bat, black spleenwort, ebony spleenwort, Fossil Creek bedstraw, Utah bladderfern
Quality	Good	Good, static		
Likelihood of Limitation	Low	Low		
Management effect		4: Decline in habitat quality as a result of management or lack of management that result from plan components. Plan components may not exist or may be few.	2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.	

Table 33 compares management effect by alternative. Management effect categorizes the relative expected outcome of plan language in each alternative in terms of maintaining habitat quality and is the result of plan decisions, including plan objectives. Management effect category values are 1, 2, 3, and 4. The lower the management effects rating, the more effective the alternative is for maintaining the habitat. The effects of the alternatives are explained in greater detail in the discussions on the alternatives that follow.

Risk Factors

No activities affect cliffs and rocky outcrops landscapewide. The exceptions would be where people interface with these features, such as near viewpoints, along trails and roads, and at rock climbing areas and dispersed camping sites. Likely impacts are localized and include soil compaction, surface disturbance, vegetation trampling and removal, and disturbance of wildlife. Other localized impacts could include cliff removal and modification during road construction or maintenance, or during slope stabilization. These activities would affect individuals of certain species

No activities affect talus slopes forestwide. Localized disturbance from recreation or management activities, however, can destabilize the talus slopes and alter habitat in specific areas. Habitats that are located on talus slopes are vulnerable to damage or modification from ground-disturbing activities that could alter humidity levels, increase sedimentation, or destabilize slopes, which could alter habitat for certain species.

Associated Species

Associated species are listed in table 33.

Environmental Consequences

Common to All Alternatives

Plan components in all alternatives contribute to species viability by managing habitat to maintain viable and sustainable populations of wildlife and fish species and by improving and protecting habitat for threatened, endangered, and sensitive species (1987 Plan, pages 22-1, 23; FW-Eco-DC-1; FW-WFP-DC-1, 2, 3, 5, 6; FW-WFP-G-3, 10). See At-risk Species in the Wildlife and Plant Issues and Topics section above for more information.

Most of the wilderness areas on the forest are in canyons or in mountainous terrain, and therefore, potentially contain cliffs, rocky outcrops, and talus slopes. Cliffs are specifically mentioned in the descriptions of Wet Beaver Wilderness, Red Rock-Secret Mountain Wilderness and Munds Mountain Wilderness (1987 Plan, pages 101 to 104). All of the existing wildernesses in alternatives B (modified), C, and D include descriptions of topography that could potentially contain these features. Designated wilderness areas would be managed according to applicable laws, policy, and Forest Plan direction to preserve wilderness resource values and wilderness quality, and to emphasize wilderness recreation (1987 Plan, pages 105 to 112; SA-Wild-DC-1 to 11; SA-Wild-DC-S-1, 2; SA-Wild-DC-G-1 to 7). Mechanized and motorized travel is prohibited in designated wilderness, and therefore, these activities would not impact these geological features. However, dispersed recreation such as rock climbing, hiking, canyoneering, and bouldering would still be allowable activities. These activities can cause erosion of surfaces, rock fall, crushing of plants, and rock slides or slides on talus slopes in localized areas. Some cliffs contain prehistoric cliff dwellings, which are protected by law regulation and policy in all alternatives.

All alternatives close the Alpine Tundra ERU (which contains cliffs, rocky outcrops, and talus slopes) to off-trail hiking during snow-free periods (1987 Plan pages 108, 110; SA-Wild-S-3); prohibit horse and pack stock (except for limited administrative use) on the Humphrey’s Trail and Weatherford Trail above Doyle Saddle; prohibit camping above tree line; and prohibit recreational livestock above tree line or in the watersheds draining into the Inner Basin (1987 Plan, page 108; MA-Peaks-S-1, 3; MA-InBsn-S-1; SA-Wild-S-4). These measures protect these

geological features by protecting the Alpine Tundra itself. The Alpine Tundra is closed to grazing and is not part of any allotment (1987 Plan, page 110; Chapter 4 of Revised Plan, Grazing Suitability, table 12). The portion of Alpine Tundra that is located in the Inner Basin of the San Francisco Peaks is limited to day-use foot traffic (1987 Plan, page 108; MA-InBsn-G-7). This plan language is protective of these geological features by reducing ground-disturbing activities.

Alternative A

Using the analysis process described under the Species Viability section above, table 33 shows that under alternative A the quality of cliffs, rocky outcrops, and talus slopes is classified as good. This means there is a low departure from desired conditions and the number, size, and evenness of distribution of habitat areas across the landscape are similar to reference conditions. The quality was considered good, because it was assumed that the associated species could only occur in suitable sites and would not occur in unsuitable sites (those categorized as poor or fair).

There is a low likelihood that these geological features would be a limiting factor to the viability of the associated species. This likelihood was derived by combining the value for habitat abundance with the value for habitat quality. There would be a moderate likelihood if the habitat for a particular species was categorized as fair, and a high likelihood of limitation if species habitat was classified as poor.

The management effect is a 4. This means there could be a decline in habitat quality as a result of management or lack of management that result from plan components. Plan components may not exist or may be few. Alternative A contributes less to the maintenance and sustainability of cliffs, rocky outcrops, and talus slopes and the viability of the associated species than the other alternatives.

Plan components for cliffs and rock outcrops are generally lacking in alternative A, thus there is little direction for management of these features and the environments they provide. Guidance for cliffs is generally limited to visual quality and their importance to archaeology. Scenery guidance for cliffs occurs in the Red Cliff and Front Country Management Areas (1987 Plan, pages 206-43, 206-46). Alternative A directs the forest to manage and stabilize several of the major known cliff dwellings (1987 Plan, page 56). Management of the stability and integrity of talus slopes and cliffs and their ecosystems is not addressed in alternative A, and so, the consequences of this alternative would be that there would be no direction for management of these features and the habitats they provide.

Alternative B (modified)

Using the analysis process described under the Species Viability section above, table 33 shows that under alternative B (modified), the quality of cliffs, rocky outcrops, and talus slopes would be classified as good, same as alternative A. The quality was considered good because it was assumed that the associated species could only occur in suitable sites and would not occur in unsuitable sites (those categorized as poor or fair).

There is a low likelihood that these geological features would be a limiting factor to the viability of the associated species. This likelihood was derived by combining the value for habitat abundance with the value for habitat quality. There would be a moderate likelihood if the habitat for a particular species was categorized as fair, and a high likelihood of limitation if species habitat was classified as poor.

In contrast to alternative A, the management effect is a 2, which means that plan components in alternative B (modified) maintain or improve protection and management for most habitat occurrences in the plan area and thus contribute more to the maintenance and sustainability of cliffs, rocky outcrops, and talus slopes and the viability of the associated species than alternative A.

Unlike alternative A, alternative B (modified) addresses the management of cliffs, rocky outcrops, and talus slopes in Geological Features, which is a subsection of the Biophysical Features section.

Desired conditions would maintain the physical and ecological integrity of these geological features. Plan components would seek to maintain cliffs and other biophysical features in generally undisturbed conditions and protect them from human activities, maintaining the cultural, archaeological, geological, hydrological, paleontological, biological, and aesthetic resources of these features (FW-BioPhy-Geo-DC-1). Plan components also acknowledge the importance of the specialized habitats for plants and animals that depend on them (FW-BioPhy-Geo-DC-6). A guideline requires that projects be designed and uses be managed to maintain the integrity and function of caves, karst, cliffs, and talus slopes. Where alteration of these resources cannot be avoided, they should be mitigated to mimic pre-disturbance conditions and function (FW-BioPhys-Geo-G-1). A desired condition in Wildlife, Fish and Plants provides direction to preserve the composition, structure, and function of the ERUs and the associated physical features including cliffs and rock piles that provide habitat and refugia for the plants and animals that depend on them (FW-WFP–DC-5).

Springs, in general, are important habitat components on the forest. Hanging gardens are a subtype of springs and are formed where water emerges from an underground source on a cliff face, often at the juncture of geologically distinct rock layers. Forestwide desired conditions for springs (FW-Rip-Spr-DC-5) provide guidance to preserve the physical and biological components of springs that provide habitat for narrowly endemic species and those with restricted distributions such as alcove bog orchid.

The scenic integrity of cliffs is broadly addressed in this alternative. A forestwide Scenic Resources desired condition recognizes the importance of cultural, historic, and unique geological features for their inherent scenic values, and would apply to cliffs for both the cultural and geological integrity (FW-Scenic-DC-6). This guidance is broader because it does not specifically mention “cliffs,” but unlike alternative A, this guidance applies forestwide.

Forestwide desired conditions for recreation contain guidance that would apply to recreation activities that could affect cliffs by altering microclimates or cliff surfaces and features used by a variety of species. A forestwide recreation desired condition states that low impact recreation principles are widely practiced and sites are free from litter, graffiti, and vandalism (FW-Rec-All-DC-5). This desired condition would help maintain cliffs in their natural conditions. The forestwide guidance for dispersed recreation includes a desired condition to maintain areas used for dispersed recreation in their natural character to the extent possible, while having minimal evidence of human waste and resource damage (FW-Rec-Disp-DC-3). This guidance would help to preserve cliff faces, cracks, and microclimates necessary for species habitat requirements, and would minimize resource damage from uses such as rock climbing.

There is no specific direction in the Heritage section of the forest plan that applies to cliff dwellings, but protection of these sites by law, policy, and direction relating to heritage sites would also protect cliff dwellings and the cliffs with which they are associated.

Recommended wilderness in alternative B (modified) could contain cliffs, rocky outcrops, or talus slopes although the extent is unknown. Plan components for recommended wilderness would reduce impacts from motorized use by promoting motorized vehicle use only for limited administrative and permitted activities (SA-RWild-DC-1, 2, 5, 6; SA-RWild-G-1, 3, 5). Mechanized uses that maintain and do not detract from wilderness values would be allowable. However, new trails should be designed for non-motorized and non-mechanized activities that preserve wilderness character (SA-RWild-DC-6; SA-RWild-G-5). Implementation of these plan components would reduce disturbance to these geological features. In addition, it is unlikely that roads or trails would occur or be built on cliffs or talus slopes that are generally inaccessible. This language could reduce disturbance to rocky outcrops. However, because rocky outcrops can be more accessible than cliffs and more stable than talus slopes, roads and trails could be more likely to intersect them.

Alternative C

Alternative C would have the same effects as alternative B (modified), except there could be more areas of cliffs, rocky outcrops, and talus slopes affected by the higher number of recommended wilderness acres proposed in this alternative. The extent of the geological features is not known. The protective effect of recommended wilderness would be localized.

Alternative D

Alternative D would have the same effects as alternative B (modified), except there would be no recommended wilderness.

Caves

Affected Environment

Caves include any naturally occurring void, cavity, recess, or system of interconnected passages beneath the Earth’s surface or within a cliff or ledge, and that is large enough to permit a person to enter, whether the entrance is excavated or naturally formed. This definition includes any fissure, crack, lava tube, natural pit, sinkhole, or other opening, which is an extension of a cave entrance or an integral part of the cave.

Cave resources include any material or substance occurring naturally in caves such as plant and animal life, archaeological materials, paleontological deposits, water and sediments, minerals, cave formations, and cave relief features. Most cave resources are not replaceable or renewable. Some caves are of traditional importance to various American Indian groups.

Caves provide nest, roost, and den sites, and habitat for cave-dwelling and endemic species. A cave’s suitability for bat roost and hibernacula is determined primarily by cave microclimate; particularly temperature and humidity, as well as protection from disturbance. Bats, especially large roosting colonies, are important to cave ecosystems, because cave ecosystems rely almost entirely on the surface for nutrients and bats deposit considerable amounts of surface nutrients into caves via guano. Consequently, cave-roosting bats can support an entire ecosystem, and are often considered keystone species.

Amount

Caves are categorized as common because most caves are assumed to be currently located where they were in reference condition, but not all cave locations are known by the Forest Service.

Habitat Quality and Distribution

The distribution is considered to be similar to reference conditions. Because not all caves are known and because mapping and inventory is lacking for many caves, cave quality is considered variable. Cave quality includes geology, available microclimates, hydrology, topography, natural processes, and biology. Some caves are plugged or significantly compromised due to site-specific circumstances such as highway construction, well drilling, or because they have been considered hazards. Other caves are in nearly pristine condition.

Using the analysis process described under the Species Viability section above, table 34 shows that cave quality would be considered good when: recreation or other uses are low or at a level where cave attributes are not damaged or compromised and the cave is functioning properly; the cave is inaccessible; and/or the cave is protected from potentially damaging uses by administrative closure, fencing, gating, or other means. Cave quality would be considered poor when: recreation or other uses are high or at a level where cave attributes are damaged or compromised and the cave is not functioning properly; the cave is well-known and accessible and the cave is not protected from potentially damaging uses by administrative closure, fencing, gating, or other means. Cave quality is considered fair when the criteria fall between good and poor.

Table 34 shows that the likelihood that cave habitat would be limiting to the associated species varies from low to high. These likelihoods that habitat would be limiting to the associated species were derived by combining the value for habitat abundance with the value for vegetation quality. Accordingly, when habitat quality is considered good, the likelihood of limitation is low. When habitat quality is fair, the likelihood of limitation is moderate, and when habitat quality is poor, the likelihood of departure is high.

Table 34 compares management effect by alternative. Management effect categorizes the relative expected outcome of plan language in each alternative in terms of maintaining habitat quality and is the result of plan decisions, including plan objectives. Management effect category values are 1, 2, 3, and 4. The lower the management effects rating, the more effective the alternative is for maintaining the habitat. The effects of the alternatives are explained in greater detail in the discussions on the alternatives that follow.

Table 34. Summary of the coarse filter analysis for Caves

Habitat	Existing	Alternative A	Alternatives B (modified), C, and D	Associated Species
Abundance	Common	Common		Allen's lappet-browed bat, Pale Townsend's big-eared bat, spotted bat, southwestern myotis
Quality	Poor: Accessible and heavily used or modified Good: Inaccessible or protected by other means Fair: Lightly Impacted	Good (inaccessible, rarely visited, resources in good condition), Fair (between good and poor), or Poor (accessible, not protected, high visitation, resources highly modified), static	Good (inaccessible, rarely visited, resources in good condition), Fair (between good and poor), or Poor (accessible, not protected, high visitation, resources highly modified), static	
Likelihood of Limitation	Low, Moderate, or High (see text)	Low for caves with good quality, Moderate for caves with fair quality, or High for caves with poor quality	Low for caves with good quality, Moderate for caves with fair quality, or High for caves with poor quality	
Management effect		3: Plan components maintain or improve protection and management for some habitat occurrences in the plan area.	2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.	

Risk Factors

No activities affect cliffs and rocky outcrops landscapewide. The exceptions would be where people interface with these features, such as near view points, along trails and roads, and at rock climbing areas and dispersed camping sites. Likely impacts are localized and include soil compaction, surface disturbance, and vegetation trampling and removal. Other localized impacts could include cliff removal and modification, such as during road construction or maintenance, or during slope stabilization. These activities would affect individuals of certain species.

No activities affect talus slopes forestwide. Localized disturbance from recreation or management activities, however, can destabilize the talus slopes and alter habitat in specific areas. Habitats that are located on talus slopes are vulnerable to damage or modification from ground-disturbing activities that could alter humidity levels, increase sedimentation, or destabilize slopes, which could alter habitat for certain species.

Associated Species

Associated species are listed in table 34.

Environmental Consequences

Common to All Alternatives

Plan components in all alternatives contribute to species viability by managing habitat to maintain viable and sustainable populations of wildlife and fish species and by improving and protecting

habitat for threatened, endangered, and sensitive species (1987 Plan, pages 22-1, 23; FW-Eco-DC-1; FW-WFP-DC-1, 2, 3, 5, 6; FW-WFP-G-3, 10). See At-risk Species in the Wildlife and Plant Issues and Topics section above for more information.

Most of the wilderness areas on the forest are in canyons or in mountainous terrain, and therefore, potentially contain cliffs, rocky outcrops, and talus slopes. Cliffs are specifically mentioned in the descriptions of Wet Beaver Wilderness, Red Rock-Secret Mountain Wilderness and Munds Mountain Wilderness (1987 Plan, pages 101 to 104). All of the existing wildernesses in alternatives B (modified), C, and D include descriptions of topography that could potentially contain these features. Designated wilderness areas would be managed according to applicable laws, policy, and Forest Plan direction to preserve wilderness resource values and wilderness quality, and to emphasize wilderness recreation (1987 Plan, pages 105 to 112; SA-Wild-DC-1 to 11; SA-Wild-DC-S-1, 2; SA-Wild-DC-G-1 to 7). Mechanized and motorized travel is prohibited in designated wilderness, and therefore, these activities would not impact these geological features. However, dispersed recreation such as rock climbing, hiking, canyoneering, and bouldering would still be allowable activities. These activities can cause erosion of surfaces, rock fall, crushing of plants, and rock slides or slides on talus slopes in localized areas. Some cliffs contain prehistoric cliff dwellings, which are protected by law regulation and policy in all alternatives.

All alternatives close the Alpine Tundra ERU (which contains cliffs, rocky outcrops, and talus slopes) to off-trail hiking during snow-free periods (1987 Plan pages 108, 110; SA-Wild-S-3), prohibit horse and pack stock (except for limited administrative use) on the Humphrey’s Trail and Weatherford Trail above Doyle Saddle; prohibit camping above tree line; and prohibit recreational livestock above tree line or in the watersheds draining into the Inner Basin (1987 Plan, page 108; MA-Peaks-S-1, 3; MA-InBsn-S-1; SA-Wild-S-4). These measures protect these geological features by protecting the Alpine Tundra itself. The Alpine Tundra is closed to grazing and is not part of any allotment (1987 Plan, page 110; Chapter 4 of Revised Plan, Grazing Suitability, table 12). The portion of Alpine Tundra located in the Inner Basin of the San Francisco Peaks is limited to day-use foot traffic (1987 Plan, page 108; MA-InBsn-G-7). This plan language is protective of these geological features by reducing ground-disturbing activities.

Alternative A

Utilizing the analysis process described under the Species Viability section above, table 34 shows that caves in good condition would have a low likelihood of being limiting to the associated species, caves in fair condition would have a moderate likelihood of being a limiting factor to the viability of the associated species, and caves in poor condition would have a high likelihood.

The management effect is a 3, which means that plan components maintain or improve protection and management for some habitat occurrences in the plan area. Alternative A contributes somewhat less to the maintenance and sustainability of caves and the viability of the associated species than the other alternatives.

Alternative A would protect or reduce potential impacts to caves designated as significant under the Federal Cave Resources Protection Act of 1988 or those being evaluated because they would be exempt from locational disclosures. Cave locations and resources would also be kept confidential when needed to protect archaeological resources, wildlife habitat, cave biota, geological features, and paleontological deposits. This alternative also promotes the issuance of research permits, which could reduce disturbance to cave environs (1987 Plan, page 51-1).

Alternative A would protect cave ecology and resources by maintaining cave microclimate, hydrology, and entrance vegetation; would not use cave entrances or karst for refuse disposal sites; would consider on a case-by-case basis any request to locate caves using special excavation techniques; would generally not allow major alterations to caves; would not allow drilling over known caves: and would not allow sediments from access roads and drilling sites to be washed or discharged into caves or karst features (1987 Plan, page 51-2).

Alternative B (modified)

Using the analysis process described under the Species Viability section above, table 34 shows that under alternative B (modified), the quality of caves would be classified as good, fair, or poor, same as alternative A. There is also a low likelihood that these geological features would be a limiting factor to the viability of the associated species when the quality of the cave is good, a moderate likelihood when the quality of the cave is fair, and a high likelihood when the quality of the cave is poor. It is assumed that the associated species would occupy suitable habitat, i.e., caves in good condition, because the habitat would meet their life history requirements.

In contrast to alternative A, the management effect is a 2, which means that plan components in alternative B (modified) maintain or improve protection and management for most habitat occurrences in the plan area, and thus, contribute more to the maintenance and sustainability of caves and the viability of the associated species than alternative A.

Alternative B (modified) updates plan components that pertain to caves and karst with goals that would maintain humidity, temperature, and disturbance levels in caves consistent with historic conditions (FW-BioPhys-Geo-DC-3) and that promote the maintenance of undisturbed cave and karst resources (FW-BioPhys-Geo-DC-1). Unlike alternative A, alternative B (modified) has an express goal that would maintain the hydrology of karst landscapes and cave formations by promoting the development or erosion of these features under natural conditions and the naturally fluctuating background levels of water, sediment, organic matter, and dissolved minerals in unpolluted water flowing into, from, or within these systems (FW-BioPhys-Geo-DC-2).

Alternative B (modified) has two guidelines that would protect caves and maintain their ecological integrity. One guideline would require that projects be designed and uses be managed to maintain the integrity and function of caves, karst, cliffs, and talus slopes. Where alteration of these resources cannot be avoided, they should be mitigated to mimic pre-disturbance conditions and function (FW-BioPhys-Geo-G-1). Another guideline would require that aquatic management zones or best management practices be applied to perennial, intermittent, or ephemeral streamcourses to maintain the chemical, physical, and biological conditions of connected or downstream caves, karst, and lava tubes (FW-BioPhys-Geo-G-8).

Alternative B (modified) also has a management approach that reminds managers to collaborate with key stakeholders regarding conservation, interpretation, and education for cave-dwelling species and associated resources.

Alternative C

Alternative C would have the same effects as alternative B (modified).

Alternative D

Alternative D would have the same effects as alternative B (modified).

Coarse Filter Habitat Findings

This section summarizes the coarse filter effects from the Coarse Filter: Habitat section above. Table 35 shows vegetation and soil quality and trend, likelihood that the habitat is limiting, and management effect by terrestrial ERU and by alternative. Vegetation and soil quality reflect the ERU departure and trends from the Vegetation and Fire, and Soil sections in volume I of the FEIS. Using the analysis process described in the Species Viability section above, likelihood of habitat limitation values represent the intersection of abundance and quality. The values range from high (H), moderate-high (M-H), moderate (M), low-moderate (L-M), to low (L). High means that there is a high likelihood that the habitat could be a limiting factor to the viability of the associated species.

Table 35. Summary of coarse filter findings for terrestrial ERUs

<table>
<tr><th>Habitat Factors</th><th>Alternative A</th><th>Alternatives B (modified), C, and D</th></tr>
<tr><td colspan="3">Desert Communities (DC)</td></tr>
<tr><td>Abundance</td><td colspan="2">Occasional</td></tr>
<tr><td>Quality-Vegetation</td><td colspan="2">Poor, away</td></tr>
<tr><td>Quality-Soil</td><td>Fair, static</td><td>Fair, slowly toward</td></tr>
<tr><td>Likelihood of Limitation</td><td colspan="2">H</td></tr>
<tr><td>Management Effect</td><td>3</td><td>2</td></tr>
<tr><td colspan="3">Semi-desert Grassland (SDG)</td></tr>
<tr><td>Abundance</td><td colspan="2">Occasional</td></tr>
<tr><td>Quality-Vegetation</td><td>Poor, away</td><td>Poor, slightly toward</td></tr>
<tr><td>Quality-Soil</td><td colspan="2">Poor, slowly toward</td></tr>
<tr><td>Likelihood of Limitation</td><td colspan="2">H</td></tr>
<tr><td>Management Effect</td><td>3</td><td>2</td></tr>
<tr><td colspan="3">Interior Chaparral (IC)</td></tr>
<tr><td>Abundance</td><td colspan="2">Occasional</td></tr>
<tr><td>Quality-Vegetation</td><td>Good, away then fair, away</td><td>Good, away</td></tr>
<tr><td>Quality-Soil</td><td>Good, static</td><td>Good, toward</td></tr>
<tr><td>Likelihood of Limitation</td><td>L then M</td><td>L</td></tr>
<tr><td>Management Effect</td><td>4</td><td>2</td></tr>
<tr><td colspan="3">Great Basin Grassland (GBG)</td></tr>
<tr><td>Abundance</td><td colspan="2">Occasional</td></tr>
<tr><td>Quality-Vegetation</td><td>Good, away then fair, away</td><td>Good, static</td></tr>
<tr><td>Quality-Soil</td><td>Poor, slowly toward</td><td>Poor, toward</td></tr>
<tr><td>Likelihood of Limitation</td><td>L then M</td><td>L</td></tr>
<tr><td>Management Effect</td><td>3</td><td>2</td></tr>
<tr><td colspan="3">Montane/Subalpine Grassland (MSG)</td></tr>
<tr><td>Abundance</td><td colspan="2">Occasional</td></tr>
<tr><td>Quality-Vegetation</td><td>Good, away then fair, away</td><td>Good, toward</td></tr>
<tr><td>Quality-Soil</td><td>Overall: Poor, static</td><td>Overall: Poor, slowly toward</td></tr>
<tr><td>Likelihood of Limitation</td><td>Low then moderate</td><td>Low</td></tr>
<tr><td>Management Effect</td><td>3</td><td>2</td></tr>
</table>

Habitat Factors	Alternative A	Alternatives B (modified), C, and D
Pinyon Juniper with Grass (PJG)		
Abundance		Common
Quality-Vegetation	Fair, toward then away	Low objective: Fair, toward then slowly away High objective: Fair, toward, then slowly away
Quality-Soil	Good, away	Low objective: Good, slowly toward short term, slowly away long term High objective: Good, slowly toward short term, static long term
Likelihood of Limitation		L-M
Management Effect	3	2
Pinyon Juniper Evergreen Shrub (PJES)		
Abundance		Common
Quality-Vegetation		Fair, away
Quality-Soil	Fair, away	Fair, slowly toward in treated areas otherwise Fair, static
Likelihood of Limitation		L-M
Management Effect	3	2
Pinyon Juniper Woodland (PJW)		
Abundance	Occasional	
Quality-Vegetation	Good, static	
Quality-Soil	Fair, away	Fair, slowly toward
Likelihood of Limitation	L	
Management Effect	3	2
Aspen		
Abundance		Rare
Quality-vegetation	Poor, away	Poor, away
Quality-soil	PP low objective and MCFF, MCIF, SF: Good, static PP high objective: Good, slowly toward	PP low objective: Good, static PP high objective: Good, toward MCFF and MCIF: Good, slowly toward. SF: Good, static
Likelihood of Limitation		H
Management Effect	3	2
Ponderosa Pine (PP)		
Abundance		Common
Quality-Vegetation	Low objective: Poor, toward then Fair, toward High objective: Fair, toward	Low objective: Poor, toward then Fair, toward High objective: Fair, toward
Quality-Soil	Good, toward in treated areas and good, static in untreated areas	Good, toward in treated areas and good, static in untreated areas
Likelihood of Limitation	Low objective: M then L-M; High objective: L-M	Low objective: M then L-M; High objective: L-M
Management Effect	3	2

Habitat Factors	Alternative A	Alternatives B (modified), C, and D
Mixed Conifer with Frequent Fire (MCFF)		
Abundance	Occasional	
Quality-Vegetation	Fair, toward then fair, static	Low objective: Fair, toward then Fair, static High objective: Good, toward then good, static
Quality-Soil	Good, static	Good, slowly toward
Likelihood of Limitation	M	Low objective: M High objective: L
Management Effect	3	2
Mixed Conifer with Infrequent Fire (MCIF)		
Abundance	Occasional	
Quality-Vegetation	Fair, away then poor, away	Fair, static
Quality-Soil	Good, static	Good, slowly toward
Likelihood of Limitation	M then H	M
Management Effect	3	2
Spruce-fir (SF)		
Abundance	Rare	
Quality-Vegetation	Fair, toward	
Quality-Soil	Good, static	
Likelihood of Limitation	H	
Management Effect	4	2
Alpine/Tundra (AT)		
Abundance	Rare	
Quality-vegetation	Good, away	
Quality-Soil	Good, static	
Likelihood of Limitation	M	
Management Effect	2	

Improving habitats, or those maintained in good condition, would contribute to the viability of the associated species. Compared to alternative A, vegetation quality in following habitats are improving under the plan direction in alternatives B (modified), C, and D: Semi-desert Grassland, Great Basin Grassland, Montane/Subalpine Grassland, Pinyon Juniper Woodland, Ponderosa Pine, Mixed Conifer with Frequent Fire under the high treatment objective, Mixed Conifer with Infrequent Fire, Spruce-fir, and Alpine/Tundra.

Vegetation quality in alternatives B (modified), C, and D for Interior Chaparral would improve to good compared to the alternative A long-term trend of fair and away, but the trend would be away from desired conditions for the life of the plan. The good quality habitat would contribute to the viability of the associated species, but viability of the associated species could be a concern after 50 years.

Compared to alternative A, soil quality in following habitats are improving under the plan direction in alternatives B (modified), C, and D: Desert Communities, Interior Chaparral, Great

Basin Grassland, Pinyon Juniper with Grass under the high treatment objective, Pinyon Juniper Evergreen Shrub and Pinyon Juniper Woodland, Aspen, Mixed Conifer with Frequent Fire under the high treatment objective, and Mixed Conifer with Infrequent Fire. Soil quality in Semi-desert Grassland would improve in all alternatives, and Ponderosa Pine, Spruce-Fir, and Alpine/Tundra would remain good in all alternatives.

Under all alternatives, the following terrestrial ERUs have a low to moderate likelihood that habitat would be a limiting factor to the viability of the associated species: Interior Chaparral, Great Basin Grassland, Montane/Subalpine Grassland, all the pinyon juniper types, Ponderosa Pine, and Alpine/Tundra. These likelihood levels would contribute to the viability of the associated species.

Under alternative A, Mixed Conifer with Infrequent Fire would have a moderate-high to high likelihood of being a limiting factor to the viability of the associated species in the long term. This is because treatments levels would remain relatively low, so changes in age class diversity, increased canopy cover, loss of early successional species, and a reduction in herbaceous understory would contribute to a high departure from desired conditions. Under alternatives B (modified), C, and D, this ERU would improve to a moderate likelihood of limitation. Although expected treatment levels would not change, desired conditions in these alternatives have a greater potential to reduce ERU departure and move toward desired conditions than alternative A.

The following terrestrial ERUs have a moderate-high to high likelihood that habitat would be a limiting factor to the viability of the associated species under all alternatives: Desert Communities, Semi-desert Grassland, Aspen, and Spruce-Fir. This is because Desert Communities and Semi-desert Grassland are in poor condition and there are either no plan treatment objectives (Desert Communities) or expected treatment objectives are insufficient to deal with the magnitude of departure (Semi-desert Grassland). The high likelihood of limitation for Aspen is that expected treatment objectives are insufficient to deal with the magnitude of departure and some of the contributing factors to the departure (drought, insects, excessive wildlife herbivory) are outside the control of the Forest Service. The high likelihood of limitation for Spruce-fir is because the ERU is naturally rare.

Table 35 compares management effects by alternatives as well. Management effect is a measure of how well plan components maintain or protect habitat occurrences within the plan area. Three categories of management effect were used: category 2 means that most habitat elements were protected or maintained, category 3 means that some habitat elements were protected or maintained, and category 4 means that few or no habitat elements were protected or maintained. Category 4 generally means that there are few to no plan components to guide management. The management effects are category 2 for alternatives B (modified), C, and D, because these alternatives incorporate plan components that are more comprehensive (forestwide versus one management area), more in line with best available science than alternative A, and address threats that weren't recognized when the current plan was developed and amended. This is discussed in detail under the individual ERUs and habitats above. Notably, alternatives B (modified), C, and D address Interior Chaparral and Spruce-fir, which have little plan direction in alternative A.

Table 36 shows quality and trend, likelihood that the habitat is limiting, and management effect by riparian area and by alternative. Riparian functional condition, wetland functional conditions, quality, and soil quality reflect riparian area departure and trends from the Riparian Area and Soil sections in volume I of the FEIS.

Table 36. Summary of coarse filter findings for riparian areas

Habitat Factors	Alternative A	Alternatives B (modified), C, and D
Cottonwood Willow Riparian Forest (CWRF)		
Abundance	Rare	
Quality- Riparian functional condition	Fair, slowly toward except portions of Verde River, Dry Beaver Creek and Lower Oak Creek are static in areas of high recreation and private land.	Good, slowly toward
Quality-soil	Poor, slowly toward	
Likelihood of Limitation	H	M
Management Effect	3	2
Mixed Broadleaf Deciduous Riparian Forest (MBDFR)		
Abundance	Rare	
Quality-Riparian Functional Condition	Good, majority is static to slowly toward except: Beaver Creek 5th code HUC is Fair, trending slowly toward; Oak Creek 5th code HUC is Fair to Good and static; West Clear Creek 5th code HUC is Good and static; and portions of Fossil Creek where recreation impacts occur are trending away.	Good, majority is slowly toward except: Beaver Creek 5th code HUC is Good, trending toward except Fair in recreation impact areas; Oak Creek 5th code HUC is Good and toward; West Clear Creek 5th code HUC is Good and slowly toward; and Fossil Creek 5th code HUC is Good, toward.
Quality-Soil	Good, static	Good, slowly toward
Likelihood of Limitation	M	
Management Effect	3	2
Montane Willow Riparian Forest (MWRF)		
Abundance	Rare	
Quality-Riparian Functional Condition	Good, static to slowly toward except Fair, toward in Upper Clear Creek 5th code HUC	Same as Alternative A except Upper Clear Creek 5th code HUC is Good, toward.
Quality - Soil	Good, static	Good, slowly toward
Likelihood of Limitation	M except H in Fern Mountain Botanical Area and Upper Clear Creek 5th code HUC in East Clear Creek and tributaries	M
Management Effect	3	2
Wetlands		
Abundance	Rare	
Quality- wetland functional condition	By acres: good, toward By number of wetlands: Fair, toward	Good, toward
Quality-Soil	Poor, static	Poor, slowly toward
Likelihood of Limitation	By acreage: M By number of wetlands: H	M
Management Effect	3	2

Habitat Factors	Alternative A	Alternatives B (modified), C, and D
Springs		
Abundance	Rare	
Quality	Poor for developed, accessible, unprotected springs/away; Good for undeveloped springs that are protected or have poor access/toward; Fair for springs between High and Low/Slowly toward	Poor for developed, accessible, unprotected springs/away; Good for undeveloped springs that are protected or have poor access/toward; Fair for springs between High and Low/Slowly toward
Likelihood of Limitation	High for poor and fair quality, Moderate for good quality	High for poor and fair quality, Moderate for good quality
Management Effect	4	2
Perennial Streamcourses		
Abundance	Rare	
Quality	Poor, static	Poor, toward
Likelihood of Limitation	H because most streams support non-native or invasive fish. Accessible portions of streams are high due to high recreation.	H because most streams support non-native or invasive fish. Accessible portions of streams are high due to high recreation.
Management Effect	4	2
Ephemeral and Intermittent Streamcourses		
Abundance	Occasional	
Quality	Poor, static	Poor, slowly toward
Likelihood of Limitation	Accessible: H Inaccessible: M	
Management Effect	3	2

Habitats that are improving, or those maintained in good condition, would contribute to the viability of the associated species. Compared to alternative A, riparian functional condition in all riparian forest types and wetlands are improving under the plan direction in alternatives B (modified), C, and D. The quality of perennial, ephemeral, and intermittent streamcourses would improve as well. Soil quality would improve in Mixed Broadleaf Deciduous and Montane Willow as well, while Cottonwood Willow is predicted to move slowly toward desired conditions in all alternatives.

Spring quality and trend categories would remain the same between alternatives, but the number of springs in the different categories would change over the life of the plan, depending on various factors such as future workforce capacity, budget, and Forest priorities, which are unknown at this time. The categories are: Poor quality with a trend away from desired conditions for springs that are developed, accessible, and unprotected from human disturbances; good quality with a trend toward desired conditions for undeveloped springs that are protected or have poor access; and fair quality with a slow trend toward desired conditions for springs that fall between poor and good. Any springs that are improved so they move into fair or good quality categories would also contribute to the viability of the associated species.

Under all alternatives, Mixed Broadleaf Deciduous would have a moderate likelihood that habitat would be a limiting factor to the viability of the associated species. The likelihood levels for Cottonwood Willow, Montane Willow, and Wetlands would improve under alternatives B

(modified), C, and D, compared to alternative A. Cottonwood Willow would go from high to moderate likelihood and Montane Willow would go from moderate on a portion of the ERU to moderate for all the ERU. These changes in likelihoods would all contribute to the viability of the associated species.

Likelihoods of habitat limitation do not change between alternatives for springs, perennial streamcourses, or ephemeral and intermittent streamcourses. There would be a moderate likelihood that springs, ephemeral and intermittent streamcourses, and perennial streamcourses would be limiting only when springs are classified in good condition, ephemeral and intermittent streamcourses are hard-to-access, and perennial streamcourses have a barrier or other means that maintain segments free of invasive or non-native species. Otherwise, there are high likelihoods of limitation in accessible, high recreation use areas; areas that support invasive or non-native animal species; or developed, accessible and unprotected springs.

Table 36 compares management effects by alternatives as well. Management effect is a measure of how well plan components maintain or protect habitat occurrences within the plan area. Three categories of management effect were used: category 2 means that most habitat elements were protected or maintained, category 3 means that some habitat elements were protected or maintained, and category 4 means that few or not habitat elements were protected or maintained. Category 4 generally means that there are few to no plan components to guide management.

The management effects are category 2 for alternatives B (modified), C, and D, because these alternatives incorporate plan components that are more comprehensive (forestwide versus a few management areas), more in line with best available science than alternative A, and address threats that weren’t recognized when the current plan was developed and amended. This is discussed in detail under the individual ERUs and habitats above. Notably, alternatives B (modified), C, and D address Interior Chaparral, Spruce-Fir, Springs, invasive or non-native animals and disease (which contribute to departures in perennial streams), and Spruce-fir which have little plan direction in alternative A. Management effect categories for alternative A are 3 or 4.

Table 37 shows abundance, quality and trend, likelihood that the habitat is limiting, and management effect by geological resource and by alternative. Quality reflects information in the Biophysical Features section in volume I of the FEIS, the current forest plan, and revised forest plan.

Table 37. Summary of coarse filter findings for geological resources

Habitat Factors	Alternative A	Alternatives B (modified), C, and D
Cliffs, Rocky Outcrops, and Talus Slopes		
Abundance	Common	
Quality	Good, static	
Likelihood of Limitation	L	
Management Effect	4	2
Caves		
Abundance	Common	
Quality	Good (inaccessible, rarely visited, resources in good condition) , Fair (between good and poor), or Poor (accessible, not protected, high visitation, resources highly modified), static	Good (inaccessible, rarely visited, resources in good condition) , Fair (between good and poor), or Poor (accessible, not protected, high visitation, resources highly modified), static
Likelihood of Limitation	L for caves with good quality, M for caves with fair quality, or H for caves with poor quality	L for caves with good quality, M for caves with fair quality, or H for caves with poor quality
Management Effect	3	2

Cliffs, rocky outcrops, and talus slopes would contribute to the viability of the associated species because they are maintained in good condition under all alternatives. Caves in good and fair condition would also contribute to species viability depending on site-specific conditions and species needs.

Under all alternatives, cliffs, rocky outcrops, talus slopes, and caves in good condition would have a low likelihood of being a limiting factor to the viability of the associated species. Caves classified as fair quality would have a moderate likelihood of being limiting, whereas caves classified as poor would contribute little to the viability of associated species and probably would not be used by the more mobile species.

Table 37 compares management effects by alternatives as well. Cliffs, rocky outcrops, and talus slopes have a management effect of 4 and caves have a management effect of 3 under alternative A. The 1987 plan as amended has few to no plan components that address cliffs, rocky outcrops, and talus slopes and some plan components for caves, but some are out of date. Alternatives B (modified), C, and D have updated plan components for these geological features. The management effects are category 2 for alternatives B (modified), C, and D, because these alternatives incorporate plan components that are more comprehensive (forestwide versus a few management areas), more in line with best available science than alternative A, and address threats that weren't recognized when the current plan was developed and amended. This is discussed in detail under the individual habitats above.

Coarse Filter Species Findings

The two-stage coarse filter/fine filter process for analyzing species is described in the Analysis section under Species Viability above. Viability needs of coarse filter species are generally met by the coarse filter plan components alone, i.e., providing habitat that meets desired conditions or movement toward them. Standards and guidelines help meet the viability needs of species associated with fine filter habitat elements. However, standards and guidelines can also contribute to the viability for some coarse filter species and a portion of the needs of fine filter species can also be provided by coarse filter desired conditions for ERUs and the different habitats.

For all species, plan components in all alternatives contribute to species viability by managing for sustainable populations of native species and improving and protecting habitat for threatened, endangered, and sensitive species (1987 Plan, pages 22-1, 23, 64, 64-1, 66, 95, 108-2, 180, 187, 206-9, 206-11, 206-12, 206-13, 206-23, 206-30, 206-32, 206-66, 206-67, 206-71, 206-72, 206-79, 206-87, 206-89, 206-98, 206-103, 206-105, 206-108, 206-109, 206-114; FW-WFP-DC-1, 2, 3, 4, 5, 6, 8, and FW-Eco-DC-1). See At-risk Species in the Wildlife and Plant Issues and Topics section above for more information.

Species with Low to Moderate Likelihood of Limitation

This section discusses the species with no fine filter threats, whose likelihood of habitat and likelihood of species limitations are low, low-moderate, or moderate across all alternatives for all their habitats. The species in this group include greater western mastiff bat, pinyon jay, and western burrowing owl. Table 38 lists likelihood of habitat and likelihood of species limitations for greater western mastiff bat and pinyon jay. The western burrowing owl is a Southwestern Region sensitive species and discussed in greater detail below. The likelihoods that habitat would be limiting to the associated species were derived by combining the value for habitat abundance with the value for vegetation quality. The likelihoods that the species were limited by its habitat was derived by integrating the likelihood of habitat limitation with the species F Rank.

The greater western mastiff bat is the largest bat in the United States. Its wing structure is adapted for straight rapid flight, so it is unable to drink from water sources less than 30 meters long and needs a vertical drop zone of 10 feet or more to take off from roosts. One dead specimen was reported from Flagstaff in 1992 (AZGFD 2014). A live young bat was reported from the Red Rock Ranger District in 2015. Greater western mastiff bat is classified as an Other forest planning species. These bats roost individually or in colonies in crevices in cliffs and can feed at least 15 miles from their roost sites. They forage for insects over large open bodies of water, at considerable heights covering extensive areas, and on the ground. Their primary threats are associated with their habitat.

The distribution of pinyon jays parallels the distribution of Colorado pinyon pine. Pinyon jays rely on pinyon trees for seed and wander irregularly and erratically for food. They nest in colonies. Pinyon jays are associated with all three pinyon juniper ERUs: Pinyon Juniper Evergreen Shrub (PJES), Pinyon Juniper with Grass (PJG), and Pinyon Juniper Woodland (PJW). Their primary threats are those associated with their habitat. The extensive loss of pinyon pines on the forest in the early 2000s due to drought and subsequent bark beetle infestations will undoubtedly also negatively affect populations (Corman and Wise-Gervais 2005).

The ratings in table 38 indicate that the alternatives would result in effects no more substantial than normal variability in the habitats for these three species. Consequently, there is no risk to

viability and viability is assured. These species are not further analyzed except additional information for the western burrowing owl is provided below because it is a sensitive species.

Table 38. Summary for greater western mastiff bat and pinyon jays

Habitat	Species	Alternative A		Alternatives B (modified), C, and D	
		Likelihood habitat is limiting	Likelihood species is limited by habitat	Likelihood habitat is limiting	Likelihood species is limited by habitat
Cliffs	Greater western mastiff bat	L	L	L	L
PJES	Pinyon jay	L-M	L-M	L-M	L-M
PJW	Pinyon jay	L	L	L	L
PJG	Pinyon jay	L-M	L-M	L-M	L-M

Western burrowing owl

There is one confirmed sighting of western burrowing owl species near (but not on) the forest at about 6,600 feet elevation in a prairie dog colony near Flagstaff (Corman and Wise-Gervais 2005). There is no known occupied habitat. Burrowing owls are associated with Great Basin Grassland, Montane/Subalpine Grassland, and Pinyon Juniper with Grass ERUs. There is an estimated 374,544 acres of habitat on the forest. They are found in flat, open, low-stature grasslands, sparsely vegetated desert shrub, and edges of human-disturbed land. These owls take over burrows of prairie dogs and ground squirrels, and dens of coyote, fox and badger. There are no species-specific risk factors for western burrowing owls. The threats to the species are the same as the threats to the habitat.

Table 39 summarizes the viability analysis for western burrowing owls. This table was developed using the analysis process described under the Species Viability section above. It includes information on the status, F Rank, habitat, habitat condition and trend, likelihood that these species are limited by their habitat, and the projected management effect, by alternative. Management effect categorizes the relative expected outcome of plan language in each alternative in terms of minimizing species viability risk and is the result of plan decisions, including plan objectives. Management effect category values are 1, 2, 3, and 4. The lower the management effects rating for a species' associated habitat, the more effective the alternative is for that species' viability. These topics and the effects of the alternatives are explained in greater detail in the discussions on the alternatives that follow.

Table 39. Analysis summary for western burrowing owl

Species and status	Habitat	Alternative A		Alternatives B (modified), C, and D	
		Habitat condition and trend relative to desired conditions	Likelihood species is limited	Habitat condition and trend relative to desired conditions	Likelihood species is limited
Western burrowing owl (Sensitive)	GBG	Good, away at short term then Fair, away at long term	Short term: L Long term: M	Low and high objectives: Good, static	L
F Rank =FP*	MSG	Good, away at short term then Fair, away at long term	Short term: L Long term: M	Good, toward	L
	PJG	Fair, toward at short term then Fair, away at long term	L-M	Low and high objectives: Fair, toward at short term then Fair, away at long term	L-M
Management Effect		All habitats = 3: Plan components maintain or improve protection and management for some habitat occurrences in the plan area. Quality of habitat is maintained or improved by providing protection, maintenance, and restoration to some occurrences.		All habitats = 2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.	

* FP = Possibly could occur on the forest, but documented occurrences not known.

Common to All Alternatives

There are about 4,184 acres of Pinyon Juniper with Grass (0.02 percent of ERU), 190 acres of Great Basin Grassland (less than 1 percent of ERU), and 628 acres of Montane/Subalpine Grassland (3 percent of ERU) in designated wilderness. Plan language for designated wilderness provides additional protection to these species and would contribute to species viability in all alternatives. For example, ecosystems would be functioning properly and would support a natural assemblage of native species indigenous to the wilderness area; management activities and permitted uses should be designed to maintain or move toward desired conditions for wilderness and other resources, and use levels should be managed to prevent wilderness values from being compromised (1987 Plan, pages 105, 108-1 to 108-4; SA-Wild-DC-2, 3, SA-Wild-G-1, 2).

Alternative A

Table 39 shows that the Great Basin Grassland and Montane/Subalpine Grassland ERUs would remain in good condition in the short term, and fair condition in the long term as tree and shrub cover would continue to increase. Understory abundance and vigor would decline commensurate with increased cover of trees and shrubs. In both cases, the trend would be away from desired conditions.

The Pinyon Juniper with Grass ERU would remain in fair condition in both the short and long term. It would trend toward desired conditions in the short term due to expected mechanical

treatments and burning using wildfire for resource objectives, but move away from desired conditions in the long term because the treatment level is insufficient to offset the negative effects of excess regeneration and closing canopies.

Table 39 also shows that for alternative A the likelihood that habitat would be a limiting to the viability of western burrowing owls ranges from low to moderate depending on the habitat. These likelihoods were derived by combining the species’ F Rank of FP with the likelihood of habitat limitation variables for each ERU: Great Basin Grassland and Montane/Subalpine Grassland (low in the short term, moderate in the long term), and Pinyon Juniper with Grass (low-moderate).

The management effect rows show the relative expected outcome of plan language in terms of minimizing species viability risk. The management effect is classified as a 3 for the Great Basin Grassland, Montane/Subalpine Grassland, and Pinyon Juniper with Grass, which means that plan components in alternative A maintain or improve protection and management for some habitat occurrences in the plan area.

This is primarily because alternative A lacks plan language for the different grassland types that differ from each other in terms of precipitation patterns, composition, soil types, elevation, and structure. Plan language is outdated, for example there is an emphasis on forage species rather than ecological conditions. Alternative A contains language in MA 9 - Mountain Grassland and MA 10 - Grassland and Sparse Pinyon Juniper Above the Rim to emphasize wildlife habitat in these areas (1987 Plan, pages 158 and 162), and it includes one standard and guideline to control the invasion of undesirable plant species to improve and protect wildlife values (1987 Plan, page 164). This would be beneficial for prairie dogs, which feed on native species. In the older sections of the current plan, guidance for grassland composition is focused on a balanced composition of cool and warm season grasses, which may or may not include native plant species. This language does not emphasize forbs, an important food item for many wildlife species. More recently amended sections of the plan, such as in the Flagstaff-Lake Mary Ecosystem Area, have a more ecological approach to composition by promoting diverse healthy populations of native plants and animals with a natural variety of plant species, age classes, and structures, but this guidance is limited to the FLEA analysis area and does not apply forestwide or include all the potential habitat for this species.

For Pinyon Juniper with Grass, this rating is because alternative A also does not distinguish between nor provide desired conditions for the three pinyon juniper types, which differ from each other in composition, structure, and processes. In the 1987 Plan as amended, there is one broad vegetation category of Pinyon Juniper. The different pinyon juniper types are differentiated on the basis of slope. Consequently, vegetation structure, and consequently habitat for these species, would not be equitably, or naturally, distributed across the landscape and managers lack specific guidance for the Pinyon Juniper with Grass ERU. The emphasis on the use of prescribed fire and mechanical treatments to achieve management objectives associated with range and watershed condition could maintain or improve habitat for these species (1987 Plan, pages 148 through 155; 162 through 165). The recommended silvicultural systems provide sufficient flexibility to move toward desired conditions; however, the direction to manage cover in Pinyon Juniper with Grass would leave too much canopy cover across the landscape to return to the desired grassland state of this ERU and areas of too much canopy cover would not favor habitat for these species.

Prescribed fire and wildfires managed for resource objectives may be used in these ERUs, but there is no provision for using wildfires managed for resource objectives in the wildland-urban

interface (1987 Plan, pages 92, 155, and 165) and the language to manage wildfires for resource objectives in wilderness impedes the use of this tool (1987 Plan, pages 111-112). This would limit the restoration of fire as a natural process in the wildland-urban interface and in wilderness, and canopy cover and shrub and tree density would be expected to increase in these areas. There would also be increased potential for uncharacteristic fire in the wildland-urban interface and wilderness portions of these ERUs. This would decrease quality of habitat for this species. The overall impact of not being able effectively manage wildfires for resource objectives in wilderness or wilderness protections for this species is low due to the relatively small proportion of acres in wilderness.

Alternative B (modified)

Table 39 shows that the quality of Great Basin Grasslands and Montane/Subalpine Grassland ERUs would improve, compared to alternative A, to good condition in both the short and long term. The trend for Great Basin Grassland would improve to static relative to desired conditions and the trend for Montane/Subalpine Grasslands would improve to toward desired conditions.

The condition and trend for the Pinyon Juniper with Grass ERU would be fair with a trend toward desired conditions in the short term, but it would trend slowly away from desired conditions in the long term because the treatment levels (FW-TerrERU-PJ-O-1 and 2) are not sufficient to offset the negative effects of excess regeneration and closing canopies. Additional activities in the future would be required to maintain or move toward desired conditions in these ERUs.

Table 39 also shows that the likelihood that western burrowing owl would be limited by habitat quality would range from low to low-moderate, depending on the habitat. These likelihoods were derived by combining this species' F Rank of FP with the likelihood of habitat limitation variables for each ERU: Great Basin Grassland (low), Montane/Subalpine Grasslands (low), and Pinyon Juniper with Grass (low-moderate) (table 9). Low to moderate ratings are considered to be within the natural range of fluctuations for the habitat.

The management effect is classified as a 2 for all the habitats in this group, which means that plan components in alternative B (modified) maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area. This rating is because this alternative distinguishes between the grassland and pinyon juniper habitats on the forest and contains explicit and updated direction on the composition, structure, and processes for these ERUs.

Under this alternative, wildfires may be managed for resource objectives in more areas of the landscape than in alternative A (including wildland-urban interface and wilderness) allowing increased opportunities to reduce the risk of uncharacteristic fire and to restore fire-adapted ecosystems (FW-TerrERU-All-G-2; FW-WUI-DC-4). This could benefit western burrowing owls by decreasing shrubs and trees that encroach on open portions of its habitat.

Habitat for western burrowing owls would fall within one of the three wilderness areas recommended under alternative B (modified): the extension to the existing Strawberry Crater Wilderness. There are 2,327 acres (3 percent) of Great Basin Grassland and 3,619 acres (1 percent) of Pinyon Juniper with Grass in this recommended wilderness. Recommended wilderness would reduce soil compaction, accelerated soil erosion, and vegetation damage that can occur from motorized use by promoting motorized vehicle use only for limited administrative and permitted activities (SA-RWild-DC-1, 2, 5, 6; SA-RWild-G-1, 3, 5). Mechanized uses that

maintain and do not detract from wilderness values would be allowable. However, new trails should be designed for non-motorized and non-mechanized activities that preserve wilderness character (SA-RWild-DC-6; SA-RWild-G-5). Implementation of these plan components would reduce disturbance to soil and vegetation from motorized or mechanized uses, which could be beneficial to associated species. However, limited access associated with recommended and designated wilderness could preclude restoration treatments that require motorized equipment for treatments or safety, or make them harder to do logistically. Site-specific circumstances would influence which or whether restoration treatments might be precluded. Delay or absence of restoration treatments could result in increased density of shrubs and trees or establishment and spread of invasive or non-native species, which could decrease the amount or quality of prey habitat. This could slow the trend toward desired conditions or increase the risk of uncharacteristic fires in localized areas more so than in the other alternatives. Uncharacteristic fire could facilitate the spread or establishment of invasive or non-native species, which could then alter area hydrology, fire regime, and biodiversity. Impacts to the ERUs and western burrowing owl habitat from wilderness recommendation and the combination of designated wilderness plus recommended wilderness would be localized and are unlikely to affect the ERUs at the landscape level because of the small proportion affected.

Alternative C

Alternative C has the same effects as alternative B (modified) except habitat for western burrowing owl would fall within 2 of the 13 wilderness areas recommended in alternative C. There would be the same amount of Great Basin Grassland and Pinyon Juniper with Grass ERUs in the Strawberry Crater extension as in alternative B (modified) and 6 acres (less than 1 percent) of Montane/Subalpine Grassland in the Railroad Draw recommended wilderness.

Alternative D

Alternative D has the same effects as alternative B (modified). The area covered by recommended wilderness in alternative B (modified) would be managed under the forestwide and management area direction applicable to the area in alternative D.

Findings

Considering cumulative effects for wildlife, fish, and plants and the above analyses, all alternatives would provide for the viability of western burrowing owls, although individuals may be impacted by site-specific activities or uses. Consequently, none of the alternatives would lead to a trend toward Federal listing for western burrowing owls, which is a Forest Service sensitive species. Under the plan language in all alternatives, Great Basin Grassland, Montane/Subalpine Grasslands, and Pinyon Juniper with Grass habitat would be maintained in good to fair condition, which would result in effects within the expected normal fluctuations of habitat. Additional activities would be required in the future to maintain or move toward desired conditions in these ERUs.

Species with Moderate-High to Very High Likelihood of Limitation

This section evaluates the remaining coarse filter species: ferruginous hawks, beaver, high-elevation species (Alberta arctic, Colorado blue columbine, corkbark fir, evening grosbeak, golden-crowned kinglet, Hall’s milkweed, MacGillivray’s warbler, Swainson’s thrush, and three-toed woodpecker), and Navajo Mogollon vole. These species have no fine filter threats, but the likelihood of habitat or likelihood of species limitations are not low, low-moderate, or moderate

for all species habitat interactions in all alternatives. Species habitat relationships with likelihoods of moderate-high, high, and very high are further discussed. Species habitat relationships that result in low, low-moderate, or moderate likelihoods are not discussed further because these represent normal fluctuations in the habitats and there are no concerns about viability. The species analyzed in this section are all classified as Other forest planning species except the Navajo Mogollon vole. The vole is a Southwestern Region sensitive species and is discussed in more detail below.

Ferruginous hawk

Ferruginous hawks migrate and winter on the Coconino NF. There is no documented nesting (Corman and Wise-Gervais 2005). The current distribution of breeding birds is restricted to grasslands in northern and northeastern Arizona. Ferruginous hawks range more widely in winter and are found throughout the state, often in agricultural areas and other open habitats (Latta et al. 1999). Ferruginous hawks are associated with Semi-desert Grassland, Great Basin Grassland, and Montane/Subalpine Grassland ERUs. These hawks need diverse early successional states of grasslands, low canopy cover, and herbaceous ground cover to support their prey. Prairie dog towns can be wintering sites as they provide a concentrated prey source. There are no species-specific risk factors for ferruginous hawks. The threats to the species are the same as the threats to the habitat.

Table 40 shows that for ferruginous hawks, Semi-desert Grassland ERU is the only habitat that has a high likelihood of habitat limitation and a moderate-high likelihood that this species would be limited by its habitat. The likelihood that habitat would be limiting to the associated species was derived by combining the value for habitat abundance with the value for vegetation quality.

Under alternative A, the Semi-desert Grassland ERU would be in poor condition with a static trend relative to desired conditions due to continued increases in shrubs and trees and corresponding decreases in understory abundance and vigor. This ERU is recovering from a legacy of excessive grazing, OHV use, as well as ongoing recreational impacts, and drought. Poor conditions would remain because there are no treatment objectives, however, any activities that occur in this ERU would need to follow plan direction. According to the Coarse Filter: Habitat analysis above, the majority of the plan direction for Semi-desert Grassland ERU is in the Verde Valley and Savannah Management Areas. Plan direction is uneven, i.e., a portion of it is outdated (primarily in Verde Valley MA) and a portion of it reflects current science (Savannah MA). Plan language that would positively contribute to habitat quality include an emphasis on improving watersheds in unsatisfactory condition, which could improve vegetation and soil conditions; an emphasis on improving less than satisfactory range conditions. In the Savannah MA, there is an emphasis on letting ecosystem processes play a natural role resulting in an open vegetation structure, which would increase the area occupied by grasses and forbs and decrease the area occupied by shrubs and trees in comparison to recent historic levels. Plan language that does not contribute to habitat quality includes the limitations associated with using wildfires for resource objectives in wilderness and wildland-urban interface. This limits the use of fire as a tool to restore grassland conditions.

Table 40. Analysis summary for ferruginous hawk and beaver

Habitat	Species	Alternative A		Alternatives B (modified), C, and D	
		Likelihood habitat is limiting	Likelihood species is limited by habitat	Likelihood habitat is limiting	Likelihood species is limited by habitat
Semi-desert Grassland	Ferruginous hawk	H	M-H	H	M-H
Great Basin Grassland	Ferruginous hawk	Short term: L Long term: M	Short term: L, Long term: M	L	L
Montane/Subalpine Grassland	Ferruginous hawk	Short term: L Long term: M	Short term: L, Long term: M	L	L
Cottonwood Willow Riparian Forest	Beaver	H	M-H	M	M
Mixed Broadleaf Deciduous Riparian Forest	Beaver	Moderate except H in localized areas	M	Moderate except H in localized areas	M
Montane Willow Riparian Forest	Beaver	Moderate except H in localized areas	M	M	
Perennial streamcourses	Beaver	H	M-H	H	M-H

Habitat quality is projected to remain poor under the other alternatives as well. However, a plan treatment objective would move this ERU toward desired conditions at a slightly faster pace than in alternative A in both the short and long term. See analysis on Semi-desert Grassland ERU in the Vegetation and Fire section in volume I of the FEIS. Alternatives B (modified), C, and D contain updated plan language for Semi-desert Grassland and the plan language limitations to managing wildfires for resource objectives in wildland-urban interface and wilderness have been removed, allowing increased opportunities to reduce the risk of uncharacteristic fire and to restore fire-adapted ecosystems.

Under all alternatives, the likelihood that ferruginous hawks would be limited by its habitats is low to moderate-high, depending on the habitat (table 40). The likelihood that this species was limited by its habitat was derived by integrating the likelihood of habitat limitation with the species F Rank. Ferruginous hawks are migratory and have an F3 F Rank which means that it is uncommon in its habitat. An F3 F Rank combined with poor habitat quality results in a high likelihood that ferruginous hawks would be limited by Semi-desert Grassland habitat.

All alternatives have language that would positively contribute to improvements in Semi-desert Grassland habitat, but plan language in alternatives B (modified), C, and D would contribute more to species viability than alternative A. Considering this, plus the cumulative effects for wildlife, fish, and plants and the Coarse Filter: Habitat for the other two habitats used by ferruginous hawks and the Wildlife and Plant Issues and Topics sections, all alternatives would

provide for the viability of ferruginous hawks, although individuals may be impacted by site-specific activities or uses.

Beaver

Beaver are an Other planning species that occupy many of the major streams in Arizona. They are known from many of the tributaries of the Verde River and from East Clear Creek on the forest. There have been documented declines in the state (Hoffmeister 1986). Beavers are associated with perennial streams, Cottonwood Willow Riparian Forest, Mixed Broadleaf Deciduous Riparian Forest, and Montane Willow Riparian Forest. There are no species-specific risk factors for beavers on the forest, and their primary threats are associated with their habitat.

Table 40 shows that for beavers, Cottonwood Willow Riparian Forest and Perennial Streamcourse are the two habitats that exceed low to moderate ratings for likelihood of habitat limitation and likelihood that the species would be limited by its habitat. Low to moderate ratings are what would be expected under normal fluctuations in its environment. The likelihood that habitat would be limiting to the associated species was derived by combining the value for habitat abundance with the value for habitat quality, using the process described in the Species Viability section above.

Under alternative A, the quality of perennial streams is considered poor with a static trend relative to desired conditions. This is because some streams have declining flows; some streams exceed State water quality standards, most streams have invasive or non-native aquatic species, and most streamside vegetation has invasive non-native plants. State water quality standards are exceeded in some areas due to *E.coli* and excessive turbidity, but these two factors are unlikely to affect beavers. Invasive or non-native animal species can remove aquatic vegetation, such as pondweed, which is one of the beaver’s food groups. Invasive non-native plants can utilize more water than native plants and contribute to declining base flows. Furthermore, invasive non-native plants can compete with the beaver’s native food plants like cottonwoods, willows, and alders and reduce the abundance and distribution of these species. Cottonwood Willow Riparian is considered to have poor quality because, even though it is only moderately departed from desired conditions, it has low abundance and is classified as rare.

Continued or increased groundwater pumping on private lands adjacent to the forest may negatively affect the base flow of streams in beaver habitat on the forest. This is especially true for the Verde River, Beaver Creek, West Clear Creek, and Oak Creek because domestic use is high adjacent to these streams. Future droughts and increased demand for groundwater could also exacerbate declining base flows. In other perennial streams on the forest, surface water use is higher than historical conditions because the number of campgrounds has increased and there is increased recreational use. Groundwater pumping on private lands is outside the control of the forest.

In contrast, streamflow has a static to increasing trend along lower Oak Creek (at Sedona and Cornville) and under the current forest plan, flow in Fossil Creek has increased due to the decommissioning of the power plant. Declining flows would still maintain habitat for beavers, but could reduce the amount of habitat available for this semi-aquatic rodent, including water for its lodges and for protection from predators and for the native riparian vegetation on which it feeds. Static to increasing flows would maintain or increase the amount and quality of habitat for beavers.

Instream flow water rights would be maintained and procured at similar levels under all alternatives (1987 Plan, pages 74, 206; FW-Water-G-3). Procurement of instream flow water rights would improve the extent of uninterrupted streamflows across NFS lands, thereby, providing greater aquatic and riparian habitat continuity for beavers.

The Verde River and Fossil Creek contain beaver habitat and portions of both streamcourses are designated wild and scenic rivers. Designated wild and scenic rivers are managed under approved comprehensive river management plans that would protect the free-flowing character and outstandingly remarkable values of the wild and scenic river, and consequently, protect and maintain beaver habitat. The Verde River has a comprehensive river management plan and a corresponding plan for Fossil Creek is under development as of October 2017.

All alternatives address the threat of invasive plants by pointing to the Final Environmental Impact Statement for the Treatment of Noxious or Invasive Weeds (USDA Forest Service 2005). This direction includes best management practices, among other guidance, which would help prevent, mitigate, and reduce the threat of invasive plants. All alternatives prioritize treatments, call for incorporating control measures in project planning and implementation, and emphasize coordination with partners (1987 Plan, pages 23, 69, 70, 182, 206-14, 206-76, 206-101, 201-116, FW-Invas-DC-1 through 3, FW Invas- G- 1, 2, -3, FW-Invas-MgtApp, FW-WFP-DC-10, FW-Graz-MgtApp, FW-RdsFac-G-8 ,FW-Rec-Dev-DC-9, FW-Rec-Dev-G-2, FW-TerrERU-Grass-DC-2).

As described in the Coarse Filter: Habitat section above, alternative A has a focus on keeping an inventory of groundwater and evaluating management practices. This would allow the forest to adaptively manage forest uses and activities to maintain or protect stream baseflows. Alternative A also has language that manages and protects riparian features and functions and manages wildfires to protect riparian habitat. Plan language would avoid or mitigate livestock impacts to Cottonwood Willow and other riparian vegetation by constructing livestock fences where needed; having allowable use not to exceed 20 percent in riparian areas; using salt to achieve proper livestock grazing distribution, and to manage livestock grazing to contribute toward satisfactory riparian conditions.

The quality of perennial streamcourses under alternatives B (modified), C, and D would still be in poor condition, but the trend would slowly improve toward desired conditions, compared to alternative A, which would have a static trend relative to desired conditions. The quality of Cottonwood Willow Riparian would improve to good and also trend toward desired conditions. Guidance under alternatives B (modified), C, and D would protect groundwater by improving water yield and water infiltration, maintaining base flows, protecting water quality, and procuring instream flows. See Watersheds and Water section in volume I of this FEIS. Implementing this guidance would improve the ability of the soil to resist erosion, infiltrate water, and recycle nutrients. Riparian vegetation would improve along streambanks, wetlands, and springs, aiding in the ability to filter sediments; capture bedload; aid floodplain development; and improve flood-water retention, groundwater recharge, and intermittent and perennial streamflow.

Although there are three recommended wildernesses in alternative B (modified), only the Davey's recommended wilderness area connects to perennial water. Fossil Creek. Guidelines for recommended wilderness would lessen the effects of roads by restricting motorized use except for limited permitted and administrative use and promoting trails for mechanized and non-motorized use (SA-RWild-G-3, 5). This is beneficial for connected waters and habitat for these species, because roads can alter natural water flow patterns and natural sediment levels. Alternative C has

the same effects as alternative B (modified) except there are 233 acres of Cottonwood Willow Riparian Forest, 662 acres of Mixed Broadleaf Deciduous Riparian Forest, and 438 acres of Montane Willow Riparian Forest in 8 recommended wildernesses: Barbershop, Black Mountain, Cedar Bench, Cimarron-Boulder, Davey's, Deadwood Draw, East Clear Creek, and Hackberry. Alternative D is the same as alternative B (modified), except there is no recommended wilderness. The effects associated with managing those areas as recommended wilderness would not occur. These areas would still be managed by the other forestwide, management area, and special area direction in alternative B (modified) with the corresponding effects discussed above in the alternative B (modified) section. This difference between the alternatives would not result in a change in the condition or trend of the riparian habitats from those provided by alternative B (modified) for this species.

Under all alternatives, the likelihood that beavers would be limited by their habitat is low to moderate-high, depending on the habitat. The likelihood that beavers are limited by habitat was derived by integrating the likelihood of habitat limitation with the beaver's F Rank of F3, which means that it is uncommon in its habitat. An F3 F Rank combined with poor habitat quality results in a moderate-high likelihood that beavers would be limited by perennial streamcourses in all alternatives and by Cottonwood Willow Riparian habitat in alternative A. There would be a moderate likelihood that beavers would be limited by Cottonwood Willow Riparian habitat in alternatives B (modified), C, and D.

As described above, all alternatives have language that would maintain or protect beaver habitat even in spite of groundwater pumping outside of Forest Service control. Considering the cumulative effects for wildlife, fish, and plants, and the analyses under the Wildlife and Plant Issues and Topics and the Coarse Filter: Habitat for Mixed Broadleaf Deciduous and Montane Willow (the other two habitats used by beavers) sections, all alternatives would provide for the viability of beavers although individuals animals may be impacted by site-specific activities or uses. Plan language in alternatives B (modified), C, and D would contribute more to species viability than alternative A.

High-elevation Species

Alberta arctic, Colorado blue columbine, Corkbark fir, Evening grosbeak, Golden-crowned kinglet, Hall's milkweed, MacGillivray's warbler, Swainson's thrush, and Three-toed woodpecker

These species are grouped together because they share similar high-elevation habitats. Mixed Conifer with Frequent Fire, Mixed Conifer with Infrequent Fire, Spruce-Fir, Montane/Subalpine ERUs, Aspen, Mixed Broadleaf Riparian Forests, Montane Willow Riparian Forests, and Springs are more fully evaluated in the Coarse Filter: Habitat section. All of these species are classified as Other planning species.

Alberta arctic occurs in isolated populations on sky island peaks in Arizona. The population of this butterfly on the San Francisco Peaks, including Schultz Pass, is locally common during its spring to early summer flight. Alberta arctic occurs between 8,000 to 9,500 feet and is generally restricted to grasslands and aspen stands, especially moist wet meadows. The larvae feed on various grasses. It is associated with Montane/Subalpine Grassland ERU, Mixed Conifer with Infrequent Fire ERU, Aspen, and Springs.

Colorado blue columbine has been collected on the San Francisco Peaks and Schultz Pass areas on the Coconino NF and on the North Kaibab Ranger District of the Kaibab NF. Colorado blue columbine is associated with Mixed Conifer with Infrequent Fire and Spruce Fir ERUs.

Corkbark fir, distinguished by its whitish corky bark, is restricted to the Rocky Mountains of southern Colorado and the Southwest. Its distribution on the Coconino NF is on the San Francisco Peaks. Corkbark fir is associated with the Spruce Fir ERU, which on the Coconino NF is only found on the San Francisco Peaks.

Evening grosbeak has a wide range across the United States and Canada. Arizona is at the southern edge of the range for evening grosbeaks (Cornell Lab of Ornithology 2017a). The Coconino NF is one of the few places in Arizona where it breeds. They are uncommon and erratic summer residents in areas including and between the San Francisco Peaks, Kendrick Mountain, and Flagstaff. Evening grosbeak is a migratory bird associated with the deciduous tree component in Mixed Conifer with Frequent Fire, Mixed Conifer with Infrequent Fire, and Spruce Fir ERUs. Evening grosbeaks are dependent on deciduous trees such as aspen, big tooth maple, and Gambel oak, and breed in low densities.

Golden-crowned kinglet has a wide range across North America, extending from Canada to Mexico (Cornell Lab of Ornithology 2017b). The highest densities in Arizona for golden-crowned kinglets are found in the White Mountains and San Francisco Peaks areas. Surveys for the Arizona Breeding Bird Atlas (Corman and Wise-Gervais 2005) found this bird throughout their previously described range. Golden-crowned kinglet is a migratory bird associated with Mixed Conifer with Frequent Fire, Mixed Conifer with Infrequent Fire, and Spruce Fir ERUs. These insectivorous birds occur in cool and often moist forests with closed canopies, often at the edges of clearings. They prefer dense old-growth trees. They also nest in cool montane or snowmelt drainages frequently containing various pines, firs, maples, oak, and aspen.

Hall’s milkweed is known from southern Wyoming; portions of Colorado, New Mexico, Utah, Nevada; and northern Arizona, where it occurs sporadically throughout its range (Cronquist et al. 1984). It has been collected in the Hart Prairie area and on Kendrick Mountain. Hall’s milkweed occurs in the Montane/Subalpine Grassland and in Mixed Conifer Infrequent Fire ERUs.

MacGillivray’s warbler occurs in western Canada, the western United States, and Mexico. Arizona is at the southern edge of its breeding range (Corman and Wise-Gervais 2005). They occur at low densities with isolated populations in Arizona. Occupied sites include: Inner Basin of the San Francisco Peaks, side drainages of upper Oak Creek including West Fork of Oak Creek, and possibly near Happy Jack. Researchers have documented local extinctions along the Mogollon Rim, possibly due to a combination of factors leading to the decline in deciduous vegetation such as aspen, maple, and oak. Potential causes are drought, heavy elk browsing, and missed fire return intervals, resulting in a lack of early seral vegetation (Corman and Wise-Gervaise 2005). MacGillivray’s warblers are most frequently found nesting along or near mountain drainages, springs, or slopes with a mixture of deciduous and coniferous trees and shrubs. This migratory bird feeds and nests in short dense vegetation and is rarely found above the shrub layer. It is associated with the Mixed Broadleaf Deciduous and Montane Willow Riparian Forests and the Mixed Conifer with Frequent Fire, Mixed Conifer with Infrequent Fire, and Spruce Fir ERUs.

Swainson's thrush is a migratory bird that breeds in numerous locations in North America and winters mostly in Mexico and northern South America. The Coconino NF is one of the few places in Arizona where Swainson's thrush breeds. Swainson's thrush occur in cool moist locations in the Spruce-fir ERU on the San Francisco Peaks. This species needs dense clumps of trees punctuated by openings that support low light tolerant plants. They prefer edges that have dense ground and understory vegetation. They nest in shrubs, low in coniferous trees or thickets of deciduous shrubs or conifer saplings.

Three-toed woodpeckers occur year-round across Canada and Alaska, as well as the mountainous areas of much of the western United States. This species has limited distribution in Arizona, where it is at near the southernmost extent of their range. In Arizona, these woodpecker populations appear to be fairly stable with no obvious loss in distribution in the state. The Coconino NF is one of the few places in Arizona where they breed. Three-toed woodpeckers reach their highest abundance in forests dominated by Engelmann spruce, blue spruce, and subalpine fir (Spruce-Fir ERU) and also use Mixed Conifer with Frequent Fire and Mixed Conifer with Infrequent Fire ERUs and conifer drainages. They are primary cavity nesters, preferring snags over live trees.

There are no species-specific risk factors for these species. The threats to the species are the same as the threats to the habitat.

The bold faced items in table 41 are areas of potential viability concern for high-elevation coarse filter species. These items exceed low to moderate ratings for likelihoods that the species would be limited by its habitat and are discussed below. These ratings are influenced by the rarity of the species, rarity of the habitat, as well as the quality of the habitat. The likelihoods that habitat would be limiting to specific species were derived by combining the species F Rank with the value for likelihood that the habitat would be limiting, using the process described in the Species Viability section above. Low to moderate ratings indicate that the alternatives would result in effects no more substantial than normal variability in the habitats for the respective species. Consequently, there is no risk to viability and viability is assured.

Table 41. Analysis summary for high-elevation species

Species, status, and F Rank	Habitat	Alternative A		Alternatives B (modified), C, and D	
		Condition and habitat trend relative to desired conditions	Likelihood species is limited	Condition and habitat trend relative to desired conditions	Likelihood species is limited
Alberta arctic (Other) F Rank = F2*	MSG	Good at short term then fair, away	Short term: M **Long term: M-H**	Good, toward	M
	MCIF	Fair, trending away at short term then poor trending away at long term	**Short term: M-H** **Long term: H**	Fair, static	**M-H**
	Aspen	Poor, away	**H**	Poor, Away	**H**
	Springs	Fair**, static	**M-H**	Fair**, static	**M-H**

Species, status, and F Rank	Habitat	Alternative A		Alternatives B (modified), C, and D	
		Condition and habitat trend relative to desired conditions	**Likelihood species is limited**	**Condition and habitat trend relative to desired conditions**	**Likelihood species is limited**
Colorado blue columbine Swainson's thrush (Other) F Rank = F1*	MCIF	Fair, trending away at short term then poor trending away at long term	**Short term: H** **Long term: VH**	Fair, static	**H**
	SF	Fair, toward	**VH**	Fair, toward	**VH**
Hall's milkweed (Other) F Rank = F1*	MSG	Good at short term then fair, away	Short term: M **Long term: H**	Good, toward	M
	MCIF	Fair, trending away at short term then poor trending away at long term	**Short term: H** **Long term: VH**	Fair, static	**H**
Corkbark fir (Other) F Rank = F3*	SF	Fair, toward	**M-H**	Fair, toward	**M-H**
Evening grosbeak (Other) F Rank = F3*	MCFF	Fair, trending toward at short term then static at long term	M	Low objective: Fair, toward then static High objective: Good, toward then static	Low objective: M High Objective: L
	MCIF	Fair, trending away at short term then poor trending away at long term	Short term: M **Long term: M-H**	Fair, static	M
	SF	Fair, toward	**M-H**	Fair, toward	**M-H**
	Aspen	Poor, away	**M-H**	Poor, Away	**M-H**
Golden-crowned kinglet Three-toed woodpecker (Other) F Rank = F3*	MCFF	Fair, trending toward at short term then static at long term	M	Low objective: Fair, toward then static High objective: Good, toward then static	Low objective: M High Objective: L
	MCIF	Fair, trending away at short term then poor trending away at long term	Short term: M **Long term: M-H**	Fair, static	M
	SF	Fair, toward	**M-H**	Fair, toward	**M-H**

Species, status, and F Rank	Habitat	Alternative A		Alternatives B (modified), C, and D	
		Condition and habitat trend relative to desired conditions	Likelihood species is limited	Condition and habitat trend relative to desired conditions	Likelihood species is limited
MacGillivray's warbler (Other) F Rank = F4*	MBDRF	Good, static to slowly toward	L-M	Good, slowly toward	L-M
	MWRF	Good, static to slowly toward	L-M	Good, static to slowly toward	L-M
	MCFF	Fair, trending toward at short term then static at long term	L-M	Low objective: Fair, toward then static High objective: Good, toward then static	Low objective: L-M High Objective: L
	MCIF	Fair, trending away at short term then poor trending away at long term	Short term: L-M Long term: M	Fair, static	L-M
	SF	Fair, toward	M	Fair, toward	M

Management Effect	Springs and SF = 4: Decline in habitat quality as a result of management or lack of management that result from plan components. Plan components may not exist or may be few. MCFF, MCIF, SF, MSG, Aspen, MBDRF, and MWRF = 3: Plan components maintain or improve protection and management for some habitat occurrences in the plan area. Quality of habitat or habitat elements is maintained or improved by providing protection, maintenance, and restoration to some occurrences.	All habitats = 2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.

*F1 = Very rare on the forest within its habitat – occupies a very small portion of its habitat. F2 = Rare on the forest within its habitat - occupies a small portion of its habitat. F3 = Uncommon on the forest within its habitat. F4 = Common on the forest within its habitat.

**For analysis, springs were considered in fair condition. However, some springs could be in poor or good condition depending on accessibility, protection, or degree of development.

Under alternative A, Montane/Subalpine Grassland and Mixed Conifer with Infrequent Fire ERUs transition from good (Montane/Subalpine Grassland) and fair (Mixed Conifer with Infrequent Fire) quality in the short term to fair (Montane/Subalpine Grasslands) and poor (Mixed Conifer with Infrequent Fire) quality in the long term because fire exclusion is expected to continue. Aspen would be in poor condition due to widespread death of mature aspen trees, chronic browsing by ungulates, and advanced conifer reproduction due to fire exclusion. Death of aspen trees was due to a combination of a significant drought event, a long-term drought, and bouts of defoliation from western tent caterpillars.

Lack of fire in fire-adapted ERUs adjacent to Montane/Subalpine Grassland would allow trees and shrubs to continue to encroach on the edges of the grassland. Lack of fire would contribute to an increase in canopy cover in Mixed Conifer with Infrequent Fire. This could be limiting to the associated species including aspen because there would be a corresponding decline in openings, less understory, and fewer herbaceous or shrub species. This could reduce but not eliminate habitat for herbaceous species such as Hall’s milkweed, Colorado blue columbine, or grasses that are essential for Alberta arctic butterflies because they are the larval host plants. The understory also provides feeding and nesting habitat for Swainson’s thrush and feeding habitat for golden-crowned kinglets. Lack of fire in Spruce-Fir would result in low amounts of early seral species like aspen, high tree density, and low amounts of herbaceous vegetation but Spruce-Fir would still trend toward desired conditions because its natural fire regime is high-severity infrequent fire, so these characteristics would be expected. Snags preferred by three-toed woodpeckers would be expected to occur throughout the ERU due to density-related mortality.

The Coarse Filter: Habitat analyses above point out that fire exclusion could continue in some places under alternative A. Prescribed fire and wildfires managed for resource objectives may be used in Montane/Subalpine Grassland, Aspen, Mixed Conifer with Infrequent Fire, and Spruce-Fir but there is no provision for using wildfires managed for resource objectives in the wildland-urban interface (1987 Plan, pages 92, 155, and 165) and the language to manage wildfires for resource objectives in wilderness impedes the use of this tool (1987 Plan, pages 111 to 112). This plan language limits the restoration of fire as a natural process in the wildland-urban interface and in wilderness, and tree and shrub density would be expected to increase in these areas. There would also be increased potential for uncharacteristic fire in the wildland-urban interface and wilderness portions of these ERUs, which could damage or remove habitats for these species. However, where applied, the use of prescribed or wildfire would maintain grassland conditions, aspen, or small openings in forested ecosystems, and benefit habitat for the associated species.

Alternatives B (modified), C and D remove the plan language limitations that restrict the use of wildfire managed for resource benefits in designated wilderness allowing wildfire to play its natural role in wilderness where it is feasible to do so (SA-Wild-DC-4). In contrast to alternative A, these alternatives remove the restrictions that prohibit the use of wildfires managed for resource benefits in the wildland-urban interface. This could facilitate the use of fire for restoration or fuels reduction and would help maintain openings, improve resilience, and reduce vulnerability to uncharacteristic fire in these areas. In addition, alternatives B (modified), C, and D promote characteristic disturbances as mechanisms that shape mixed conifer (FW-TerrERU-MC-All-DC-1; FW-TerrERU-MC-MCIF-DC-1, 2, 4, 5, 6, 7, 10). Consequently, the trend for Mixed Conifer with Infrequent Fire improves from away from desired conditions in alternative A to a static trend relative to desired conditions. This would contribute to the viability of the associated species by maintaining the habitat within expected natural fluctuations. In contrast to alternative A, alternatives B (modified), C, and D have desired conditions for two mixed conifer types, recognizing that the natural disturbances and distribution of these types vary and result in distinct composition and structures. Plan components support fire regimes that would maintain and support aspen in Mixed Conifer Frequent Fire and Mixed Conifer with Infrequent Fire (FW-TerrERU-MC-MCFF-DC-5; FW-TerrERU-MC-MCIF-DC-4, 5). The condition and trend for Spruce-Fir remains similar to alternative A because there are no treatment objectives and most of the ERU is within wilderness, in which treatments are not expected to occur. In the absence of large-scale fire, aspen and understory vegetation is expected to remain deficit except in areas where small-scale disturbances occur.

About 81 percent of Spruce-Fir ERU occurs within designated wilderness. All alternatives recognize wilderness and incorporate appropriate direction (1987 Plan, pages 105 to 112; SA-Wild-DC-1 to 8; SA-Wild-S-1, 2; SA-Wild-G-1 to 7). Wilderness direction provides an added layer of protection for the Spruce-Fir ERU, such as prohibiting motorized and mechanized travel, which would reduce accelerated erosion. Management would emphasize wilderness recreation and watershed condition while maintaining wilderness resource values. Livestock grazing would be managed under congressional guidelines for grazing in wilderness (1987 Plan, page 105; FSM 2323.22), and therefore, could still occur if approved under site-specific environmental analysis. Corrective measures would be taken if overuse causes unacceptable resource damage and the Kachina Peaks Wilderness would be closely monitored to determine whether corrective measures are needed (1987 Plan, page 105; SA-Wild-DC-1; SA-Wild-G-1, 2). For fire management in the Kachina Peaks Wilderness, the objective is to hold fires to 10 acres or less while choosing suppression tactics that minimize damage to soil and water resources (1987 Plan, page 112). This is repeated for the Inner Basin MA (1987 Plan, page 192). This guidance does not acknowledge the reference condition within the Spruce-Fir ERU where infrequent, high-severity stand-replacing fire was within the historic range of variability. The acreage limits would be difficult to obtain, especially with the presence of wilderness that limits suppression options, departed conditions, and stand structure, and thus, would not be beneficial for this ERU.

The Spruce-Fir ERU occurs within the Inner Basin Management Area for all alternatives. Soil and vegetation conditions would be maintained or improved through the following plan direction: Recreation in the Inner Basin is restricted to day use (1987 Plan page 192; MA-InBsn-G-7); grazing is not allowed and the area is not part of any grazing allotment (1987 Plan, page 192; Chapter 4 of Revised Plan, Grazing Suitability, table 12); and the use of recreational livestock is prohibited above Doyle Saddle and above the watershed cabin (1987 Plan, page 192; MA-Peaks-S-1; MA-InBsn-S-1). As described in the Coarse Filter: Habitat analysis for the Spruce-fir ERU, alternatives B (modified), C, and D have desired conditions for Spruce-Fir which would promote structure and species composition that both reflect and support natural disturbance regimes and consist of multiple species (including aspen and corkbark fir), in a variety of age classes.

The Coarse Filter: Habitat analyses for the grassland ERUs point out that alternative A provides guidance to maintain and improve grasslands, including removing invading overstory, stabilizing gullies, scarifying soils, appropriate seeding, controlling livestock, raising the water table, reducing road and motorized use impacts, and re-introducing fire (1987 Plan, pages 159, 160, 164, 206-87 to 206-88). There are guidelines regarding relocation, obliteration, or closure of roads that are damaging or could damage meadows (1987 Plan, pages 206-70, 206-77, 78, 206-116). Alternatives B (modified), C, and D clearly distinguish between different grassland types. Grassland direction would provide for a variety of native species with varying seral stages in natural patterns of abundance and distribution that support natural disturbances (FW-TerrERU-Grass-DC-1, 2, 3, 4, 6,7, 8). A guideline would require managers to protect or enhance grassland composition, structure, and productivity, and soil function (FW-TerrERU-Grass-G- 2). Implementation of plan language in all four alternatives would maintain and improve grassland habitat, which would also contribute to the viability of Hall’s milkweed and Alberta arctic.

All alternatives provide guidance for the management of aspen, which is an early seral species in Ponderosa Pine, Mixed Conifer Frequent Fire, Mixed Conifer Infrequent Fire, and Spruce-Fir ERUs. The intent of the guidance for all alternatives is to promote and protect aspen regeneration and emphasize age class diversity (1987 Plan, pages 141 to 144; FW-TerrERU-AspMpl-DC-1 to 3; FW-TerrERU-AspMpl-G-1).

All alternatives have plan direction for the Inner Basin and West Fork of Oak Creek, habitat for MacGillivray's warblers. All alternatives would contribute to the viability of this species by limiting dispersed recreation use to day use by foot or bicycles only; not allowing use by livestock or recreational livestock, and limiting vehicle access (1987 Plan, page 192; MA-InBsn-S-1, MA-InBsn-G-5, 7). All alternatives would not allow horse and pack stock except for limited administrative use on the West Fork of Oak Creek (1987 Plan, page 90; MA-RedRock-S-9). These are popular recreation areas and dispersed recreation use is substantial. Grazing by livestock, horses and packstock can reduce the abundance or vigor of vegetation. Dispersed recreation and motorized use can result in localized areas of accelerated soil erosion and vegetation damage, which could reduce regeneration potential of understory species. These limitations would reduce impacts to and could promote the growth of the thick shrub layer or thickets MacGillivray's warblers and Swainson's thrushes need for nesting; and grasses needed by the larvae for Alberta arctic.

Springs are one of the habitats for Alberta arctic. Springs would provide moist meadow environments and grasses preferred by this high-elevation species. Highly developed or accessible springs would be unlikely to provide these conditions, so only good or fair quality springs would provide habitat. The Coarse Filter: Habitat analysis for springs points out that alternative A emphasizes riparian recovery, protection of riparian regeneration, and some restrictions on utility lines or roads to minimize the extent of and magnitude of riparian impact, but lacks focus or emphasis on springs. Alternative A would have less potential for improvement to the functional condition of springs than the other alternatives. The other alternatives contribute more to the maintenance and sustainability of the springs and the viability of the associated species than alternative A because plan components address spring composition, function, and processes and non-native or invasive animals and plants, which can negatively affect plant diversity, abundance, and vigor. Springs would have a static trend under all alternatives.

Considering the cumulative effects for wildlife, fish, and plants, and the analyses under the Coarse Filter: Habitat and Wildlife and Plant Issues and Topics sections, all alternatives would provide for the viability of the high-elevation species, although individuals may be impacted by site-specific activities or uses, for the following reasons. All alternatives generally maintain fair and good quality habitats for the high-elevation species except aspen and the long-term condition in Mixed Conifer with Infrequent Fire. Fair and good quality habitats maintain composition, structure, and function, and contribute to the viability of the associated species. Fire exclusion and the lack of characteristic disturbances are the primary factors in departures of these high-elevation habitats (except for springs). Plan language in alternative A allows the use of wildfire managed for resource benefits in areas outside the wildland-urban interface, and does not limit its use outside of wilderness; however, plan language in the other alternatives removes the limiting language. This plan language allows the use of wildfire managed for resource benefits in more areas of the landscape than alternative A and would promote aspen, grasslands, herbaceous and shrubby understory, and openings in more areas than alternative A.

Alternatives B (modified), C, and D contribute more to the viability of high-elevation species than alternative A, primarily because plan components would shift condition and trend for Mixed Conifer with Infrequent Fire ERU from fair and away from desired conditions to fair and static relative to desired conditions; there are specific plan components for Montane/Subalpine Grassland ERU, Mixed Conifer with Infrequent Fire ERU, and Springs; and there is updated plan language for Mixed Conifer with Infrequent Fire, which better provides for aspen. The two mixed conifer ERUs are separated based on slope in alternative A, rather than ecological differences

such as composition and fire return intervals as in the other alternatives. Alternative A combines different grasslands, whereas the other alternatives provide plan components for three unique grassland ERUs. Alternative A has one management area that combines all riparian areas, whereas the other alternatives have riparian area-specific direction including for springs.

Navajo Mogollon vole

Affected Environment

Distribution

Hoffmeister (1986) has delineated the range for this vole from Navajo Mountain southward to the western part of the Mogollon Plateau from near Mormon Lake westward to the vicinity of Williams. Locations have been reported from 3,800 to 9,700 feet in elevation, with a number of locations around the San Francisco Peaks area and also in Garland and Government prairies on the Kaibab NF (Ganey and Chambers 2011). Occupied sites include the San Francisco Peaks, Sawmill Springs, Long Valley Ranger Station, Pivot Rock Spring, Lee Johnson Springs, and Kehl Spring Campground.

Habitat Quality

The Navajo Mogollon vole is associated with the Ponderosa Pine, Mixed Conifer with Frequent Fire, Mixed Conifer with Infrequent Fire, and Pinyon Juniper Woodland ERUs. There is an estimated 959,348 acres of these ERUs on the forest. It inhabits grassy areas in these ERUs and prefers a dense understory. It is positively associated with shrub cover and combined cover of live and dead vegetation, and negatively associated with bare ground (Ganey and Chambers 2011).

Risk Factors

There are no known species threats. Threats to the species are equivalent to threats to the habitat.

Environmental Consequences

Table 42 summarizes the viability analysis for Navajo Mogollon vole. This table was developed using the analysis process described under the Species Viability section above. It includes information on the status, F Rank, habitat, habitat condition and trend, likelihood that this species is limited by its habitat, and the projected management effect, by alternative. Management effect categorizes the relative expected outcome of plan language in each alternative in terms of minimizing species viability risk and are the result of plan decisions, including plan objectives. Management effect category values are 1, 2, 3, and 4. The lower the management effects rating for a species' associated habitat, the more effective the alternative is for that species viability. Additional information on the associated ERUs can be found above in the Coarse Filter: Habitat section.

Table 42. Analysis summary for Navajo Mogollon vole

Species, status, and F Rank	Habitat	Alternative A		Alternatives B (modified), C, D	
		Habitat condition and trend relative to desired conditions	**Likelihood species is limited**	**Habitat condition and trend relative to desired conditions**	**Likelihood species is limited**
Navajo Mogollon vole F Rank = F2*	PP	Low objective: Poor, toward at short term then Fair, toward at long term High objective: Fair, toward	Low objective short term: M-H Low objective long term: M-H High objective: M-H	Low objective: Poor, toward at short term then Fair, toward at long term High objective: Fair, toward	Low objective short term: Low objective long term: M-H High objective: M-H
	MCFF	Fair, toward at short term then Fair, static at long term	M-H	Low objective: Fair, toward at short term then Fair, static High objective: Good, toward in short term then Good, static	Low objective: M-H High objective: M
	MCIF	Fair, away at short term then Poor, away at long term	Short term: M-H Long term: H	Fair, Static	M-H
	Openings in PJW	Good, Static	M	Good, Static	M
Management Effect		All habitats = 3: Plan components maintain or improve protection and management for some habitat occurrences in the plan area. Quality of habitat is maintained or improved by providing protection, maintenance, and restoration to some occurrences.		All habitats = 2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.	

*F2 = Rare on the forest within its habitat – occupies a small portion of its habitat.

Common to All Alternatives

About 43,035 acres of habitat for voles occurs in eight designated wildernesses: Fossil Springs Wilderness (4,601 acres), Kachina Peaks Wilderness (6,166 acres), Munds Mountain Wilderness (678 acres), Red Rock-Secret Mountain Wilderness (13,504 acres), Strawberry Crater Wilderness (6,030 acres), Sycamore Canyon Wilderness (5,998 acres), West Clear Creek Wilderness (5,923 acres), and Wet Beaver (135 acres). Table 43 displays which Navajo Mogollon vole habitat is present in each of these wilderness areas.

Table 43. Vole habitat in designated wilderness (acres)

Wilderness name	ERU				Total
	Ponderosa Pine	Mixed Conifer Frequent Fire	Mixed Conifer Infrequent Fire	Pinyon Juniper Woodland	
Fossil Springs	4,589			12	4,601
Kachina Peaks	114		6,052		6,166
Munds Mountain	328			350	678
Red Rock-Secret Mountain	12,341	598		565	13,504
Strawberry Crater	2,515			3,515	6,030
Sycamore Canyon	5,580	180		238	5,998
West Clear Creek	5,479			444	5,923
Wet Beaver	59			76	135
Total	31,005	778	6,052	5,200	43,035

Designated wilderness areas would be managed according to applicable laws, policy, and Forest Plan direction to preserve wilderness resource values and wilderness quality, and to emphasize wilderness recreation (1987 Plan, pages 105 to 112; SA-Wild-DC-1 to 11; SA-Wild-DC-S-1, 2; SA-Wild-DC-G-1 to 7). Wilderness designation limits most active vegetation management because motorized and mechanized use is not allowed. Motorized and mechanized access can kill or damage plants, can degrade the habitat through soil compaction and soil loss, and can introduce non-native species that compete with native plants for resources. This can negatively affect the reproduction and survival of individual plants or populations. Ground-disturbing activities are primarily confined to main trails, trailheads, and key points of interest at which invasive species introduction and establishment, or accelerated erosion could occur depending on the level of use. The lack of ground-disturbing activities elsewhere would be beneficial by reducing the risk of invasive plant introduction and dispersal by motorized or mechanized use. However, limited access associated with designated wilderness could preclude restoration treatments that require motorized equipment for treatments or for safety or make them harder to do logistically. Lack of restoration treatments could result in missed fire return intervals, an unnatural increase in fuels, increased density of shrubs and trees, or establishment and spread of invasive or non-native species. This could slow the trend toward desired conditions or increase the risk of uncharacteristic fires in localized areas more so than in the other alternatives. Uncharacteristic fire could facilitate the spread or establishment of invasive or non-native species, which could then alter area hydrology, fire regime, and biodiversity.

Alternative A

Table 42 shows that Ponderosa Pine would remain in poor condition in the short term at the low treatment objectives (50,000 acres mechanical, 100,000 acres prescribed burn), then improve to fair condition and trend toward desired conditions under all alternatives. The improved vegetation structure and composition would reduce the risk of uncharacteristic fire. Under the high treatment objectives (260,500 acres mechanical, 200,000 acres prescribed burn), vegetation quality would improve faster (than the low objective) over existing condition because more acres would be treated. It would be in fair condition and trending toward desired conditions in both the short and long term.

Mixed Conifer with Frequent Fire would remain in fair condition and trend toward desired conditions in the short term. In the long term, the trend would become static as treatment levels would not be able to keep up with growth and regeneration; seedlings and saplings would make gains through excess regeneration where openings are created, and medium and large trees would lose ground in open stands as canopy gaps are filled in. Understory diversity and abundance would increase in open areas created by treatments, providing additional food and cover for Navajo Mogollon voles.

Mixed Conifer with Infrequent Fire would transition from fair condition with a trend away from desired conditions in the short term to poor condition with a trend away from desired conditions in the long term because fire exclusion is expected to continue. This would result in increasing tree density and canopy cover with a corresponding decline in openings and herbaceous and shrubby understory that provides food and cover for Navajo Mogollon voles.

Pinyon Juniper Woodland would remain in good condition, maintain a static trend relative to desired conditions, and maintain habitat for voles.

Table 42 also shows that the likelihood that habitat would be a limiting factor for Navajo Mogollon voles would range from moderate to high depending on the habitat. These likelihoods were derived by using the process in table 9 and combining the species' F Rank of F2 with the likelihood of habitat limitation variables for each ERU: PP (moderate in the short term and low-moderate in the long term for the low treatment objective; low-moderate for high treatment objective), MCFF (moderate), MCIF (moderate in short term, high in the long term), and PJW (low) (see Coarse Filter Habitat Findings above). Low to moderate ratings are considered to be within the natural range of fluctuations for the habitat.

The management effect rows show the relative expected outcome of plan language in terms of minimizing species viability risk. The management effect is classified as a 3 for Ponderosa Pine, Mixed Conifer with Infrequent Fire, Mixed Conifer with Frequent Fire, and Pinyon Juniper Woodland, which means that plan components in alternative A maintain or improve protection and management for some habitat occurrences in the plan area, and thus, contribute less to the viability of this species than the other alternatives.

Plan objectives in Ponderosa Pine and Mixed Conifer with Frequent Fire would move treated areas toward more open conditions, which would increase the abundance, vigor and variety of herbaceous understory species, and consequently, improve food and cover conditions.

For Pinyon Juniper Woodland, alternative A does not distinguish between Pinyon Juniper types, which differ from each other in composition, structure, and processes. Alternative A provides little direction on desired conditions for these ERUs, lumped them instead into two Pinyon Juniper management areas (Management Areas 7 and 8), with plan direction varying by slope. Consequently, vegetation structure may not be distributed across the landscape in natural patterns of abundance which could negatively affect the distribution of suitable vole habitat.

Prescribed fire and wildfires managed for resource objectives may be used in vole habitat, but there is no provision for using wildfires managed for resource objectives in the wildland-urban interface (1987 Plan, pages 92, 155, and 165) and the language to manage wildfires for resource objectives in wilderness impedes the use of this tool (1987 Plan, pages 111–112). This would limit the restoration of fire as a natural process in the wildland-urban interface and in wilderness, and canopy cover and shrub and tree density would be expected to increase in these areas. There

would also be increased potential for uncharacteristic fire in the wildland-urban interface and wilderness portions of these ERUs. This would decrease the abundance and quality of habitat for voles.

In addition to the above, habitat for Navajo Mogollon voles could be negatively impacted by the removal of grassy understory due to excessive livestock grazing. It was assumed that their habitats are adapted to natural background levels of herbivory. The negative impact would be under the conditions outside the range of variation to which the vole is adapted. Consequently, food resources could be negatively impacted. Substantial amounts of understory removal could increase the amount of bare ground and increase the likelihood that voles would be detected by predators.

Allowable use guidelines are established with allotment-specific environmental analysis or with the use of a table based on range condition and management strategy (1987 Plan, page 66-1). However, the range condition classes in the table are no longer used and the currently used overall approach for grazing utilization is adaptive management based on objectives established in site-specific environmental analysis. Problem areas would be addressed through the allotment management plan process or monitoring. Permitted use and capacities would be balanced by increasing or decreasing livestock numbers, changing management intensity levels, initiating changes in livestock class, season of use, and rotation patterns (1987 Plan, page 67). Alternative A uses outdated language such as full capacity range and has less of an ecological approach to understory conditions than the other alternatives (1987 Plan, page 67).

Alternative B (modified)

Table 42 shows that the vegetation condition and trends for Ponderosa Pine and Pinyon Juniper Woodland are the same as in alternative A. The low treatment objective in Mixed Conifer with Frequent Fire would result in the same condition and trend as in alternative A, but as more acres are treated under the high treatment objective, the condition would improve to good, with a slow trend toward desired conditions. Mixed Conifer with Infrequent Fire remains in fair condition in all alternatives, but the static trend is an improvement compared to the away trend in alternative A.

The likelihood that the Navajo Mogollon voles would be limited by habitat ranges from moderate to moderate-high, an improvement over alternative A. These likelihoods were derived by using the process in table 9 and combining the species' F Rank of F2 with the likelihood of habitat limitation variables for each ERU: PP (moderate in the short term and low-moderate in the long term for the low treatment objective; low-moderate for high treatment objective), Mixed Conifer with Frequent Fire (moderate for low objective, low for high objective), Mixed Conifer with Infrequent Fire (moderate), and Pinyon Juniper Woodland (low) (see Coarse Filter Habitat Findings above). Low to moderate ratings are considered to be within the natural range of fluctuations for the habitat. The management effect rows show the relative expected outcome of plan language in terms of minimizing species viability risk.

The management effect is classified as 2 for all the habitats associated with Navajo Mogollon vole. This means that plan components in alternative B (modified) maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.

The plan language that limits the use of wildfires managed for resource objectives in wilderness and wildland-urban interface in alternative A is eliminated in alternative B (modified). Consequently, this would be beneficial for voles because they live in a fire-adapted ecosystem and the elimination of this language restores one management tool that could maintain openings in these portions of vole habitat.

Alternative B (modified) has updated language and provisions under Livestock Grazing that would reduce impacts to the understory from excessive grazing. Plan components promote permitted livestock grazing that is consistent with the desired conditions of other resources, but recognizes that conditions adjacent to livestock concentration areas may have lower levels of vegetation and higher levels of soil compaction (FW-Graz-DC-2 and 3, FW-Graz-G-2). The localized areas where this guideline would apply would be of lower habitat quality compared to areas farther from livestock concentration areas and could make the voles easier for predators to detect due to lower cover. Guidelines promote herbivory by permitted livestock and wildlife in balance with available forage (FW-Graz-G-1), sufficient rest from livestock grazing in burned or mechanically treated areas to ensure plant recovery and vigor and to ensure that perennial plants would not be permanently damaged by grazing (FW-Graz-G-3), and promote structural range improvements and salt and other supplements be located and used in a manner that sensitive resources (which include sensitive species) are protected from excessive trampling, compaction and other impacts (FW-Graz-G-4 and 5). These guidelines would contribute to the viability of this species by promoting conditions that provide food and cover.

In addition to the 43,033 acres of vole habitat in designated wilderness, there are an additional 1,911 acres in recommended wilderness: Abineau (415 acres), Strawberry Crater addition (634 acres), and Davey's (863 acres). Recommended wilderness would be managed to maintain or enhance primitive and undeveloped characteristics; to preserve native species and unique features; to reduce evidence of modern human control and manipulations; and motor vehicle uses should only occur for limited administrative and permitted activities to be consistent with wilderness character (FW- RWild-DC-1, 2, 3, FW- RWild-G-3). This would protect Navajo Mogollon vole habitat by reducing some ground disturbance that could occur as result of management activities or permitted uses. Recommended wilderness would not prohibit prescribed or managed wildfires, but could make them more challenging to implement because vehicle use needed to manage fire should be consistent with wilderness character and depending on site-specific conditions, this may not always be possible. Active vegetative management and vehicle use would be limited or prohibited (vehicle use) if recommended wildernesses become designated. Designation could restrict the use of vegetative treatments or fire to reach the desired conditions for these ERUs. The magnitude of the effect on potential habitat depends on what needs to be restored in these recommended wilderness areas, what tools might be needed for restoration, and whether access in the areas adjacent to the recommended wilderness areas is sufficient to allow for safe use of prescribed or managed fire if needed.

Alternative C

Alternative C is the same as alternative B (modified) except there are additional acres of recommended wilderness that contain habitat for this species. In addition to the 43,033 acres of vole habitat for designated wilderness, there are a total of 18,692 acres in recommended wilderness: Abineau (415 acres), Strawberry Crater addition (634 acres), Davey's (863 acres), Barbershop (1,132 acres), Black Mountain (947 acres), Cedar Bench (1,053 acres), Cimarron-Boulder (3,432 acres), Deadwood Draw (1,167 acres), East Clear Creek (1,727 acres), Hackberry

(4,200 acres), Railroad Draw (1,205 acres), Tin Can (1,253 acres), and Walker Mountain (665 acres).

Alternative D

Alternative D is the same as alternative B (modified) except there is no recommended wilderness. The area covered by recommended wilderness in alternative B (modified) would be managed under the forestwide and management area direction applicable to the area in alternative D.

Findings

Considering cumulative effects for wildlife, fish, and plants and the analyses under the Coarse Filter: Habitat and Plant Issues and Topics sections, all alternatives would provide for the viability of Navajo Mogollon vole, although individuals may be impacted by site-specific activities or uses. Consequently, none of the alternatives would lead to a trend toward Federal listing for Navajo Mogollon vole, which is a Forest Service sensitive species. Favorable habitat conditions for voles (i.e., fair to good conditions, improving conditions, static trends or trends toward desired conditions) would prevail in Ponderosa Pine, Mixed Conifer with Frequent Fire, and Pinyon Juniper Woodland under all alternatives. All alternatives have plan language that would balance permitted livestock numbers with range capacity, but the action alternatives have updated language that would consider food and cover for a variety of wildlife species. Alternatives B (modified), C, and D better provide for the viability of this species than alternative A, primarily because plan components would improve the habitat trend for Mixed Conifer with Infrequent Fire ERU from away to static, improve Mixed Conifer with Frequent Fire ERU under the high treatment objectives, has updated language for understory and range management, and has plan components for the two mixed conifer and the pinyon juniper ERUs. The two mixed conifer and three pinyon juniper ERUs are separated based on slope in alternative A rather than ecological differences, such as composition and fire return intervals, as in the other alternatives. Alternative A would allow wildland fire managed for resource objectives in areas outside of wildland-urban interface and in areas outside of wilderness without limitation. When conditions allow, use of this tool could reduce the increased canopy cover and stand density and reduced amount of openings that result from fire exclusion. In contrast to alternative A, alternatives B (modified), C, and D increase the area in which wildfires could be managed improve the capability of managers to manage wildfires for resource objectives by removing plan language that limits its use in wildland-urban interface and in wilderness when conditions allow.

Fine Filter: Introduction

The previous Coarse Filter Species Findings section addressed those species whose needs and threats were addressed through habitat-related plan components. However, these general plan components do not address all the needs or threats for all species. The following section analyzes the remaining species that require additional fine filter plan components (in addition to the coarse filter plan components) to meet their specific needs. The analysis of alternatives for threatened, endangered, sensitive, and other planning species focuses on the most relevant threats and programs areas, that is, those risks and program areas that are expected to have the greatest impact on each species or species group.

This section applies the fine filter analysis process that is described above in the Analysis subsection of the Species Viability section. Of particular importance, the Analysis subsection provides detailed information and definitions on the factors and ratings (e.g., likelihood that the species is limited by its habitat and management effect) that are used in the fine filter analysis for every species. See tables Table 6, Table 7, Table 8, Table 9, and Table 10 for an explanation of the factors and ratings that are used to develop the analysis summary tables in this section.

Fine Filter: Threatened and Endangered Species

Detailed information for the habitats is located in volume I of this FEIS by resource, and in the Coarse Filter: Habitat section above.

This section discloses and compares the effects of four different alternatives on federally listed species (threatened and endangered) as well as proposed or candidate species, and assesses how species viability would be maintained under each alternative. Viability is already a concern for these species as indicated by their listing under the Endangered Species Act.

All alternatives will follow guidance from approved recovery plans, strive toward implementation of conservation actions under 7(a)(1), and will continue to consult with the Fish and Wildlife Service to resolve conflicts with listed species during project design and implementation (see At Risk Species topic in the section on Wildlife and Plant Issues and Topics). The Biological Assessment provides an in-depth analysis of these effects on all species and their critical habitat, where applicable (USDA Forest Service 2017c).

<u>Alternative A Findings – Analysis Process</u>

The existing Forest Plan has been consulted on several times since the initial plan was signed in 1987. Most recently, a Biological Assessment (BA) was prepared in May of 2011, and the Fish and Wildlife Service responded with a Biological Opinion (BO) in March of 2012. Because of the similarity of approach, the 2012 BO incorporated by reference the previous consultation on the LRMP completed in 2005. The BA for that consultation had been completed in 2004, and the resulting BO was issued in June 2005.

Since the 2011/2012 consultation was concluded, the Coconino LRMP has been amended twice. A decision to amend the LRMP for the Travel Management Rule (TMR) was made in November 2011. While this amendment occurred before the 2012 BO was issued, the 2011 BA was completed earlier and did not include an analysis for the Travel Management Rule project. The TMR project decision designated a motorized system of roads and trails, identified areas where off-road vehicle use for motorized big game retrieval would be allowed, and identified dispersed

camping areas where motor vehicle use is allowed within 300 feet along one or both sides of designated roads.

The second LRMP amendment addressed cultural resource protection and was completed in November of 2015. This amendment removed two standards and guidelines relating to inventory of cultural resource sites. This administrative decision would have no effects to any listed species.

For each of the listed species in the following sections, changes made to the LRMP from the TMR decision are evaluated to determine if the findings for species made in the 2011 BA are still valid.

Threatened and Endangered: Amphibians and Birds

Chiricahua Leopard Frog (CLF)

Affected Environment

Since the Chiricahua leopard frog was listed in 2002, the forest has taken a number of actions to contribute toward recovery of the species. For range allotment environmental analysis and any other projects within the range of the frog, the forest considers needs for the species in project design, analyzes effects of the project, and consults with the Fish and Wildlife Service as needed. Site-specific actions have usually been done in cooperation with the Fish and Wildlife Service and the Arizona Game and Fish Department. For example, drought emergency response was initiated in 2002, which included: hauling water to occupied sites that were drying up, assisting Fish and Wildlife Service with salvage of frogs that were taken in to captivity, and, temporary removal of livestock from the Fossil Allotment in 2002 and several years following. Other actions included: deepening tanks in 2004 so they hold water longer during drought years; constructing and maintaining ungulate exclosure fences in a portion of 5 Chiricahua leopard frog breeding sites in 2005, 2013, and 2014; controlling crayfish, predators, and non-native fish in 2005; controlling erosion in core breeding sites in 2006 and 2014 and at two earthen stock tanks in 2005 and 2008, respectively; earthen stock tank cleaning and maintenance in various years; establishing photographic monitoring sites before and after livestock use in 2015 for tanks and movement corridors within critical habitat; and conducting annual monitoring and survey of potential Chiricahua leopard frog sites. The forest would continue to implement these types of actions in the future.

Distribution

Chiricahua leopard frog populations are known to be in only a portion of their former range on the forest. They historically occupied various locations in the Fossil Creek-Lower Verde River, West Clear Creek, and Upper Clear Creek 5th code watersheds. Since 2008, the Fish and Wildlife Service and Arizona Game and Fish Department have been reintroducing Chiricahua leopard frogs to the Buckskin Hills area. As of the end of 2015, four stock tanks within the Buckskin Hills area were occupied. All are within Pinyon Juniper Evergreen Shrub and Pinyon Juniper Woodland ERUs. All historical and current Chiricahua leopard frog sites are within Recovery Unit 5 (USDI Fish and Wildlife Service 2007a). There are 566,548 acres of Recovery Unit 5 on the forest. Within recovery units, the Fish and Wildlife Service delineated management areas around extant populations and high potential recovery sites, based on watershed boundaries. There are two management areas delineated on the forest (USDI Fish and Wildlife Service 2007a). The West Mogollon Management Area includes currently occupied sites and critical

habitat in the Buckskin Hills area. The East Clear Creek Management Area has the potential to support a metapopulation and contains historically occupied habitat.

Habitat

These frogs breed in slack waters in a variety of natural and manmade aquatic systems. Habitat includes perennial streams and springs and the following riparian areas: Wetlands and Mixed Broadleaf Deciduous and Montane Willow Riparian Forests. Although there are 9 acres of Cottonwood Willow within the East Clear Creek MA, this riparian forest type is lower in elevation than current and historical habitat on the forest, and therefore, is not considered potential habitat on the forest.

Table 44. Acreages of aquatic/riparian and terrestrial ERUs within Chiricahua leopard frog management areas on the Coconino NF

ERU	West Mogollon MA Acres	East Clear MA Acres
Aquatic/Riparian:		
Cottonwood Willow Riparian Forest*	0	9
Mixed Broadleaf Deciduous Riparian Forest	625	0
Montane Willow Riparian Forest	57	1,895
Wetland/Cienega/Lakes	8	376
Terrestrial:		
Interior Chaparral	301	0
Mixed Conifer with Frequent Fire	0	37,315
Montane Subalpine Grassland	0	706
Pinyon Juniper with Grass	0	1,540
Pinyon Juniper Evergreen Shrub	55,913	0
Pinyon Juniper Woodland (Persistent)	8,103	2,036
Ponderosa Pine	33,403	69,210
Total MA Acres:	98,402	113,278

*Not considered potential habitat for the CLF.

Critical Habitat: The Fish and Wildlife Service proposed critical habitat for the Chiricahua leopard frog in March 2011, and final critical habitat became effective on April 19, 2012 (USDI Fish and Wildlife Service 2012a). The 232 acres of critical habitat on the forest are within Pinyon Juniper Evergreen Shrub and Pinyon Juniper Woodland ERUs.

Primary constituent elements (PCEs) for critical habitat include breeding and dispersal habitat. The following are PCEs for breeding habitat: perennial water or pools with specific pH and salinity; no to low pollutants; emergent vegetation and other substrates that do not completely cover water surface; absence of disease (chytridiomycosis); and adjacent uplands for foraging and basking. In addition, non-native introduced predators are absent or do not preclude this species.

Dispersal and nonbreeding habitat consists of areas with ephemeral, intermittent, or perennial water that are generally not suitable for breeding, and associated upland or riparian habitat that provides movement corridors, either overland or along wetted drainages, between breeding sites in a metapopulation. These areas have three main characteristics. First, they are not more than 1 mile overland, 3 miles along ephemeral or intermittent drainages, 5 miles along perennial

drainages, or some combination thereof not to exceed 5 miles. Secondly, overland and nonwetted corridors provide some vegetation cover or structural features for shelter, forage, and protection from predators. Wetted corridors provide some ephemeral, intermittent, or perennial aquatic habitat. Thirdly, corridors are free of barriers that block movement by Chiricahua leopard frogs, including, but not limited to development, reservoirs that contain predatory non-native fish, bullfrogs, or crayfish, and highways; walls; major dams; or other structures that physically block movement.

Risk Factors

The final listing rule (USDI Fish and Wildlife Service 2002a) describes primary threats to the species and habitat. The Recovery Plan (USDI Fish and Wildlife Service 2007) identifies threats associated with disease and predation as most important.

Primary habitat threats under Forest Service control include degradation and loss of habitat, disruption of metapopulation dynamics, and environmental contamination. Habitat degradation includes: livestock grazing, dams and reservoirs, mining, altered fire regimes and increased likelihood of crown fires; and factors that disrupt metapopulation dynamics such as disease, contaminants, and rarity.

Managed livestock grazing could remove vegetation on which egg masses are attached and that provide cover to tadpoles and frogs from predators in any of their riparian and aquatic habitats including stock tanks and ephemeral drainages. Range improvements such as fences, troughs, pipelines, or new water developments can modify riparian function or alter the hydrology of streams. Supplements used for livestock management, such as salt and minerals, can concentrate cattle in riparian or other areas that would increase sediment discharge into connected waters during a precipitation event. Livestock could also step on eggs, tadpoles, or frogs. In the southeastern portion of Recovery Unit 5 on the forest, 24,120 acres in the Buck Springs allotment were closed to grazing in 2003. This area contains shallow drainages and headwater meadows that could be Chiricahua leopard frog habitat.

There are potentially three different kinds of mineral resources on the forest—locatable (manganese and flagstone), common variety mineral materials (cinders, river rock), and leasable (geothermal) all of which are subject to Federal, State, and local laws and regulations. The only current mineral withdrawal in Chiricahua leopard frog habitat is the Fossil Springs Wilderness.

Fire exclusion has resulted in altered fire regimes in the ERUs within the management areas and has increased the vulnerability of these ERUs to uncharacteristic fire. Uncharacteristic fire could burn hotter and in larger patches than what would have occurred historically, which in turn could result in the movement of sediments and ash into connected waters. This could degrade breeding and dispersal habitat, unoccupied potential habitat, or kill frogs.

Disruption of metapopulation dynamics includes introduction of chytrid fungus that moves between individual sites, and factors that alter the suitability of dispersal habitat. Non-mining-related contaminants include: variety of chemicals, pesticides, herbicides, insecticides, piscicides, metals, fire retardants, and suppressants. There is also an increased chance of extirpation by virtue of this species' small population size and the precipitation-dependent nature of their habitats.

Environmental Consequences

The scope of the analysis for the Chiricahua leopard frog includes habitat within the Buckskin Hills and East Clear Creek Management Areas. The West Mogollon MA contains the only occupied habitat on the forest, and the two management areas are the only areas likely to support a metapopulation. The analysis below focuses on those risk factors and resource areas that would be most consequential in terms of contributing to the viability of Chiricahua leopard frog, based on its current or potential distribution. See the Biological Assessment for a detailed analysis of all plan components that could potentially affect Chiricahua leopard frog (USDA Forest Service 2017c).

Table 45 summarizes the viability analysis for Chiricahua leopard frog. This table was developed using the analysis process described under the Species Viability section above. It includes information on the status, F Rank, habitat, habitat condition and trend, likelihood that this species is limited by its habitat, and the projected management effect, by alternative. Management effect categorizes the relative expected outcome of plan language in each alternative in terms of minimizing species viability risk and are the result of plan decisions, including plan objectives. Management effect category values are 1, 2, 3, and 4. The lower the management effects rating for a species' associated habitat, the more effective the alternative is for that species viability. These topics and the effects of the alternatives are explained in greater detail in the discussions on the alternatives that follow.

Table 45. Analysis summary for the Chiricahua leopard frog

Species and status	Habitat	Alternative A		Alternatives B (modified), C, D	
		Habitat condition and trend relative to desired conditions	Likelihood species is limited	Habitat condition and trend relative to desired conditions	Likelihood species is limited
Chiricahua leopard frog (Threatened, endemic)	MBDRF	Good, majority is static to slowly toward	H	Good, slowly toward	H
	MWRF	Good, static to slowly toward	H	Good, static to slowly toward	H
F Rank = F1*	Wetlands	Good, toward	H	Good, toward	H
	Springs	Fair**, slowly toward	H	Fair**, slowly toward	H
	Streams	Poor, static	VH	Poor, toward	VH
	Intermittent Streamcourses	Poor, static	Accessible: VH Inaccessible: H	Poor, slowly toward	VH
Management effect		MBDRF, MWRF, Wetlands, Streams, Intermittent Streamcourses = 3: Plan components maintain or improve protection and management for some habitat occurrences in the plan area. Quality of habitat or habitat elements is maintained or improved by providing protection, maintenance, and restoration to some occurrences. Springs = 4: Decline in habitat quality as a result of management or lack of management that result from plan components. Plan components may not exist or may be few.		All habitats = 2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.	

* F1: Very rare on the forest within its habitat – occupies a very small portion of its habitat.
** For analysis, springs were considered in fair condition. However, some springs could be in poor or good condition depending on accessibility, protection, or degree of development.

Common to All Alternatives

Plan components in all alternatives contribute to species viability by managing for sustainable populations of native species and improving and protecting habitat for threatened, endangered, and sensitive species (1987 Plan, pages 22-1, 23, 64, 64-1, 66, 95, 108-2, 180, 187, 206-9, 206-11, 206-12, 206-13, 206-23, 206-30, 206-32, 206-66, 206-67, 206-71, 206-72, 206-79, 206-87, 206-89, 206-98, 206-103, 206-105, 206-108, 206-109, 206-114; FW-WFP-DC-1, 2, 3, 4, 5, 6, 8, and FW-Eco-DC-1). See At-risk Species in the Wildlife and Plant Issues and Topics section above for more information.

Chiricahua leopard frog could be inadvertently harmed by improper application of pesticides or herbicides. Pesticides could kill tadpoles, frogs, or prey species. Herbicides can negatively impact frog habitat by temporarily removing or reducing shoreline vegetation used for cover and protection from predators. All alternatives point to guidelines using the “Design Features, Best Management Practices, Required Protection Measures, and Mitigation Measures” in the “Final Environmental Impact Statement for Integrated Treatment of Noxious or Invasive Weeds on the Coconino, Kaibab, and Prescott” (USDA Forest Service 2005a). This section contains required protection measures from Section 7 consultation on Integrated Treatments of Noxious or Invasive Weeds (Endangered Species Act, 1987 Plan, page 69; FW-Invas-G-2) which must be followed for use of pesticide applications that would reduce potential impacts to the Chiricahua leopard frog. With respect to the use of regulated chemicals, all alternatives are equally guided by laws above and beyond the forest plan.

All activities in and around water sources are regulated by the Clean Water Act and associated regulations and are monitored by Arizona Department of Environmental Quality. This does not include earthen stock tanks.

All alternatives have language to meet Arizona water quality standards (1987 Plan, page 28, FW-Water-DC-7 and FW-Water-G-5) and for ground-disturbing activities including trail maintenance, temporary road construction, and trail construction, implementation of best management practices (FSH 2509.25 and 2509.22) per plan guidelines would be effective in reducing sediment and improving watershed conditions ((1987 Plan, page 71; FW-Water-G-4). The concept of filter strips in alternative A is replaced with the newer concept of aquatic management zones in alternative B (modified). Filter strips and aquatic management zones are best management practices that reduce sedimentation, soil compaction, and loss of vegetative cover from ground-disturbing management activities on soils, water quality, and riparian vegetation.

Alternative A

<u>Prior consultations under the Endangered Species Act</u>

A biological assessment (BA) for the continued implementation of forest LRMPs across the region was prepared in 2004 (USDA Forest Service 2004d). The BA found that the Coconino Land Management Plan was “likely to adversely affect” the Chiricahua leopard frog. No critical habitat had been proposed or designated at that time. Some of the reasons for the adverse effect finding were related to the potential spread of chytrid fungus being aggravated by the presence of roads and impacts from fire and livestock grazing activities.

The 2005 Biological Opinion (BO) determined that the majority of the applicable standards and guidelines in the Coconino’s LRMP would likely result in beneficial effects, but that some of the guidance would cause negative effects (USDI Fish and Wildlife Service 2005a). Overall, the BO determined that the effects of the proposed action “is not likely to jeopardize the continued existence of the Chiricahua leopard frog.” The BO found that incidental take would be reasonably certain to occur as a result of continued implementation of the LRMP, and would be considered to be exceeded if, after a period of two consecutive years, there was a decrease in the total number of occupied sites as a result of the proposed action.

Another BA for the continued implementation of forest LRMPs across the region was prepared in 2011, due to new information on species and/or critical habitat (USDA Forest Service 2011f). The finding for the Chiricahua leopard frog in the 2011 BA for the continued implementation of the

Coconino LRMP was “may affect, likely to adversely affect” for the species. This was based on the determination that there have been no changes in Forest policy or programs that would change the 2004 finding. Critical habitat was proposed for the Chiricahua leopard frog in 2011. The BA found that many standards and guidelines were in place to restrict impacts from programs to proposed critical habitat, but that some of the guidance would cause negative effects, from programs such as roads, livestock grazing and timber harvesting, resulting in a finding of “may affect, likely to adversely affect.”

The 2012 BO concluded that incidental take would be reasonably certain to occur as a result of continued implementation of the Coconino NF LRMP, and would be considered to be exceeded is there was a net loss of any one of the currently occupied stock tanks for one year as a result of the implementation of the LRMP (USDI Fish and Wildlife Service 2012d). Additionally, the 2012 BO concluded that the continued implementation of the LRMP would not destroy or adversely modify proposed critical habitat.

Between the time when the 2011 BA was submitted, and the 2012 BO was received from the Fish and Wildlife Service, critical habitat was designated for the Chiricahua leopard frog. The Coconino NF requested that the conference opinion for proposed critical habitat to be confirmed as a biological opinion, and the Fish and Wildlife Service determined that it was appropriate to do so, since there were no significant changes made to the project.

The BA for the TMR project determined that the decision would largely benefit Chiricahua leopard frog sites by eliminating cross-country travel, not designating camping corridors within 1 mile of occupied sites, and closing over 50 percent of roads within a 1 mile of sites (USDA Forest Service 2010d). Some negative effects were disclosed from designation of camping corridors within 1 mile of historic sites, and the potential for other camping activities near habitat. The amended BA for motorized big game retrieval (MBGR) (USDA Forest Service 2011m) found that there would be an increase in MBGR within proposed critical habitat and occupied sites, but that adverse effects were not likely. The finding remained “may affect, not likely to adversely affect” for the frog, its habitat, and its proposed critical habitat. The Fish and Wildlife Service concurred with these findings (USDI Fish and Wildlife Service 2011e, 2011f).

In summary, taking into account the TMR project and its resulting LRMP amendment, the findings from the 2011 BA of “may affect, likely to adversely affect” the Chiricahua leopard frog and its proposed critical habitat would remain appropriate for this current analysis.

<u>Viability</u>

Table 45 summarizes and compares the analyses for Chiricahua leopard frog. This table shows that under alternative A, Mixed Broadleaf Deciduous Riparian Forest and Montane Willow Riparian Forest would remain in good condition with a static trend or slow trend toward desired conditions. In Mixed Broadleaf Deciduous Riparian Forest, static trends are associated with the Oak Creek 5th code HUC, which is not Chiricahua leopard frog habitat; trends that are slowly toward desired conditions are associated with the Beaver Creek 5th code HUC (little of which is Chiricahua leopard frog habitat); and portions of Fossil Creek are trending away from desired conditions where recreation impacts occur. In Montane Willow Riparian Forest, the Upper Clear Creek 5th code HUC is trending toward desired conditions. Wetlands would remain in good condition and trend toward desired conditions. Springs overall would be considered in fair condition with a trend slowly toward desired conditions. However, accessible, unprotected, and highly developed springs would remain in poor condition while inaccessible springs or springs

that are protected and undeveloped would remain in good condition. Intermittent streamcourses that are intersected by roads and are accessible would remain in poor condition with a static trend. Perennial streamcourses would be poor condition with a static trend because the majority of streams have invasive or non-native species.

The likelihood that habitat on the forest would be a limiting factor for Chiricahua leopard frog is high to very high and varies slightly by habitat as shown in table 45. These likelihoods were derived by combining the Chiricahua leopard frog's F Rank of F1 with the likelihood of habitat limitation variables for each ERU: Mixed Broadleaf Deciduous Riparian Forest (moderate), Montane Willow Riparian Forest (moderate, except the Upper Clear Creek 5th code HUC is high), wetlands (moderate if measured by acres, high if measured by number of wetlands), springs (moderate), perennial streams (high), and intermittent streamcourses (high if accessible, moderate if inaccessible) (table 9). Low to moderate ratings are considered to be within the natural range of fluctuations for the habitat.

The management effect row in table 45 shows the relative expected outcome of plan language in terms of minimizing species viability risk. The management effect is classified as a 3 for Mixed Broadleaf Deciduous Riparian Forest, Montane Willow Riparian Forest, wetlands, perennial streams, and intermittent streamcourses, which means that plan components in alternative A maintain or improve protection and management for some habitat occurrences in the plan area, and thus, contribute less to the viability of this species than the other alternatives. Alternative A does not distinguish riparian forest types from other riparian areas and does not address invasive animals and plants that can alter the composition, structure, and function of riparian areas. For Mixed Broadleaf Deciduous Riparian Forest, Montane Willow Riparian Forest, and wetlands, this is primarily because alternative A has minimal plan components for riparian areas and has few plan components relative to composition, structure, and function. In addition, this alternative has the least potential for improvement to riparian condition compared to the other alternatives. This is because impaired or unsatisfactory soil condition and not attaining or functional-at-risk riparian function are less likely to be improved as quickly as in alternatives B (modified), C, and D.

The management effect is classified as a 4 for springs, which means there is a decline in habitat quality as a result of management or lack of management that result from plan components. Plan components may not exist or may be few. In alternative A, spring management and restoration direction is nonexistent or vague and does not provide clear direction to maintain or restore toward desired condition of properly functioning, resilient spring riparian areas (USDA Forest Service 2016b). Alternative A lacks emphasis on or objectives for spring restoration and would result in little to no improvement of riparian function of springs and would probably not move as many springs to the desired condition of properly functioning, resilient riparian areas as quickly as alternatives B (modified), C, and D.

Overall watershed condition is expected to remain similar to current condition and the trend is expected to remain static under implementation of the current plan. Alternative A does not contain specific desired conditions for watershed condition. It emphasizes watershed condition in a general sense by management area and special area (1987 Plan, pages 75, 85, 139, 145, 148, 162, 169, 172, 191, 194, 197, 206-84, 206-88, 206-100). Plan language is outdated and lacks focus on soil and riparian function or overall watershed condition (1987 Plan, pages 23, 72) and lacks objectives related to proper functioning condition. There is forestwide direction to maintain current satisfactory watershed conditions, improve any unsatisfactory conditions to satisfactory by 2020, and evaluate watershed condition for its effect on turbidity (1987 Plan, pages 23, 72, 73,

74). Alternative A also includes several standards and guidelines related to protecting water resources and stream riparian areas that would support Chiricahua leopard frog dispersal habitat. These include: procurement of instream flow water rights; protection of riparian areas though filter strips; and maintaining 80 percent crown cover, 80 percent emergent vegetation cover, and three age classes of woody riparian species (1987 Plan, page 174). There are no specific objectives for riparian habitat, but rather broadly defined goals for 80 percent riparian recovery by 2030 (1987 Plan, page 28), likely unachievable, given the current rate of implementation on the forest. The existing plan includes standards and guidelines that emphasize maintenance and restoration of healthy riparian ecosystems (1987 Plan, page 65-5), that management strategies should move degraded riparian vegetation toward good condition as soon as possible and damage to riparian vegetation, streambanks, and channels should be prevented (1987 Plan, page 65-5). There are also objectives to construct 10 miles of fences per decade for the first two decades where necessary to protect key wet meadows, wetlands, and riparian regeneration from grazing (1987 Plan, page 175) and prioritize road closures where poorly designed or maintained roads are adjacent to or connected to stream courses where potential for increased runoff or sedimentation is high and where roads within stream courses or wetlands (permanently or intermittently wet) are reducing hydrologic function (1987 Plan, page 206-71). The trend on some portions of stream riparian areas would remain static due to impacts from other resource areas (e.g., recreation, livestock) and lack of specificity with regard to forest plan guidance. Refer to Watershed section, volume I for additional information on Watersheds and Riparian Systems.

The majority of Mixed Broadleaf Deciduous Riparian Forest is found in wilderness (MA 1) and within the amendment 12 area (Sedona/Oak Creek Ecosystem). Plan language associated with wilderness and the Sedona/Oak Creek ecosystem protect this resource because it minimizes or addresses the major threats to the vegetation type, except for those segments of the vegetation type that are found in uplands of the associated watershed or outside of Forest Service control. This means that while direct impacts to the vegetation type would be minimized, there would be little direction to manage indirect effects from activities in the surrounding watershed that could be sources of sedimentation and reduce the presence of free-flowing water for the Chiricahua leopard frog.

Direction under alternative A generally does not distinguish between the three riparian forest types on the forest. Continuing implementation of alternative A would slowly move a small percentage of riparian areas to the desired condition of properly functioning, resilient riparian areas (see table 8, Summary of stream riparian function departure values and trends, under Riparian Forest Types in volume I). Mixed Broadleaf Deciduous Riparian Forest and Montane Willow Riparian Forest are low to moderately departed from reference conditions. Riparian condition and nutrient cycling are expected to improve with the forestwide allowable use guidelines for livestock grazing (1987 Plan, page 66-1). These guidelines are intended to maintain sufficient vegetative ground cover to sustain soil productivity. Projected future litter and vegetation conditions, which affect nutrient cycling and carbon sequestration, should improve and approach sustainable levels under the 1987 plan grazing guidelines, as long as allowable use levels in the plan are met, which would benefit Chiricahua leopard frog. Most of the direction for riparian forested habitat in the current plan is specific to other species like Mexican spotted owl and southwestern willow flycatcher, which could be of benefit Chiricahua leopard frog as well if these habitats overlapped (1987 Plan, pages 65, 65-4, 206-13, and 206-14).

There is no specific section for constructed waters under alternative A. There are some general goals to improve range or wildlife tanks under Forestwide MA direction (1987 Plan, page 61) and

to maintain waterlot fences, which offer some protection from livestock (1987 Plan, page 69). There is very broad direction for stock tank construction to assess soil suitability and water efficiency (1987 Plan, page 69). Guidance that states open storage tanks and drinkers provide entry and escape ramps for wildlife (1987 Plan, page 69) would prevent Chiricahua leopard frog from getting trapped/stuck.

Under the current plan, plan direction for wetlands and springs is minimal, nonexistent, or vague and does not provide clear direction to maintain, restore, or move these systems to the desired condition of properly functioning, resilient riparian areas. As with the riparian forest types below, objectives are lacking with little emphasis on restoration.

Alternative A contains plan components that provide some guidance to manage introductions or occurrences of non-native animal species specifically in the Sedona/Oak Creek Ecosystem and the Flagstaff Lake Mary Ecosystem area (1987 Plan, pages 206-9, 206-38, 206-72, 206-76); however, these areas do not include Chiricahua leopard frog habitat. This topic is analyzed in detail under Non-native or Invasive Species in the Wildlife and Plant Issues and Topics section.

In addition to that described in all alternatives, alternative A has standards and guidelines to ensure that the use of pesticides and herbicides does not cause surface water or groundwater contamination, including during site preparation for new timber stands or insect suppression projects (1987 Plan, pages 70, 73, and 121).

Plan components in alternative A protect and minimize impacts of livestock grazing to riparian areas through management and fencing, but also manage impacts through seeding (1987 Plan, pages 69, 176, and 174). However, it also allows salting in riparian areas to improve livestock management by concentrating cattle in certain areas, a practice that could be detrimental to Chiricahua leopard frogs and their habitat (1987 Plan, pages 68 and 175). This is offset by a standard that requires that forage use be maintained at a level that assures recovery and continued existence of listed species (1987 Plan, pages 66-1 and page 174) and specific objectives that protect riparian areas and allow them to recover in the first 20 years of the plan (1987 Plan, page 175).

The functioning-at-risk areas along the Verde River (Cottonwood Willow Riparian forest type) where cattle have been removed (almost all of Coconino NF along the Verde River) show an upward trend (USDA Forest Service 2009c) and are expected to improve to proper functioning condition where exclusion of livestock grazing continues. Nonfunctional areas should improve over time if plan grazing utilization guidelines are followed. If grazing exceeds plan guidelines, riparian conditions would remain static or could even trend away from desired condition.

Forest Service response to wildfires is considered an emergency action and is guided by law, regulation, and policy. Chemicals used in fire suppression and prescribed fires (such as fire retardant and foam) can harm this species. Although alternative A lacks language that specifically addresses the use of such chemicals in threatened, endangered, and sensitive species habitat during fire suppression, it does have the following plan direction to address species needs: goals (or desired conditions) to maintain the viability of wildlife species on the forest (1987 Plan, page 22-1); to follow existing recovery plans (1987 Plan, page 64); and to provide appropriate protection or enhancement for threatened, endangered, and sensitive species (1987 Plan, page 64-1), which would be applicable when using the Wildland Fire Decision Support System process during wildfires with resource objectives. Fire suppression has a positive impact by preventing or

reducing catastrophic loss of habitat in riparian areas or in the associated watersheds. Uncharacteristic fire can result in uncharacteristic waterflows or increases in sedimentation that degrade or remove primary constituent elements in habitat (such as perennial water with specific pH and salinity and water with no to low pollutants) and can kill species. Fire retardant used as a tool in fire suppression can harm aquatic wildlife. Existing policies and guidance reduce or remove the impacts from fire retardant to affected species (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011b).

Under alternative A, plan direction includes fire suppression objectives (1987 Plan, pages 93 to 94) and language that makes it difficult to implement the reintroduction of fire as a natural disturbance across a large part of the forest. As a result, the increase in risk of uncharacteristic fire to adjacent riparian vegetation types would correspondingly increase.

There is low potential for mineral leasing activities in Chiricahua leopard frog habitat. Many of the standards and guidelines in alternative A describe the administrative processes for geology and minerals program management, and would not have an on-the-ground effect to resources. "No surface occupancy" stipulations would protect wildlife and soils at site-specific locations such as where there are federally listed species and slopes greater than 40 percent (1987 Plan, page 76). Alternative A identified research natural areas and other special areas to be withdrawn from locatable mineral entry in the first decade (1987 Plan, page 196). Standards and guidelines manage the adverse effects of leasing in areas of high resource sensitivity (1987 Plan, page 77). Also, mineral material excavation within the riparian zone may be allowed after environmental analysis, and authorized mineral activities would maintain or improve riparian conditions (1987 Plan, page 177). These plan components would protect or mitigate effects to Chiricahua leopard frog habitat.

Movement among and between riparian areas is important for Chiricahua leopard frog dispersal. In alternative A, connectivity of habitats is primarily addressed through area-specific or habitat-specific plan language in the Riparian and Open Water—MA 12 (1987 Plan, page 171), which emphasizes wildlife habitat, wetlands and riparian forests. There is direction to improve riparian habitat, but it is vague (1987 Plan, page 172), and does not focus explicitly on wildlife movement. Refer to the Wildlife and Plant Issues and Topics section on Connectivity (this Volume) for additional information.

Some of the management area direction in alternative A could result in impacts to this species. Riparian and Open Waters Management Area (MA 12) provides the primary direction for managing and protecting riparian features and functions (1987 Plan, pages 171 to 177). While most of the direction in this section supports properly functioning riparian forests, riparian improvement is hindered by standards and guidelines in MA 12 that prohibit precommercial thinning in riparian areas or areas with riparian characteristics (1987 Plan, page 176). Precommercial thinning is a silvicultural tool used to remove young conifers that would otherwise increase the risk of uncharacteristic fire and move understory conditions away from desired conditions.

The Sedona-Oak Creek area (Amendment 12 of the 1987 plan, or MAs 21 to 29) contains riparian forest direction as well. Sedona-Oak Creek ecosystem-wide management direction (1987 Plan, starting on page 206-9) and individual management areas such as Oak Creek (MA 14) and Lower Oak Creek (MA 23) address threats to riparian forests and have some direction to restrict activities that negatively impact water resources. Given this plan direction, current conditions

would likely persist, resulting in natural succession patterns, barring major droughts or uncharacteristic fire.

Alternative B (modified)

A Biological Assessment for the revision of Coconino NF Land Management Plan was prepared in 2017 (USDA Forest Service 2017c). The determination of effect for the Chiricahua leopard frog was “may affect, likely to adversely affect” for both the species and its critical habitat, due to the potential for effects from some programs and activities. In its Biological and Conference Opinion received on September 21, 2017 (USDI Fish and Wildlife Service 2017b), the Fish and Wildlife Service determined that implementation of the Coconino NF’s revised LRMP would not jeopardize the continued existence of the Chiricahua leopard frog, and would not be likely to destroy or adversely modify designated critical habitat. No incidental take was assigned. The Fish and Wildlife Service provided three discretionary conservation recommendations intended to minimize or avoid adverse effects, help implement recovery plans, or develop information.

Table 45 shows that under alternative B (modified) Mixed Broadleaf Deciduous Riparian Forest would remain in good condition and slowly move toward desired conditions except the trend in the West Clear Creek 5th code HUC would improve from static (in alternative A) to slowly toward desired conditions and the trend for the Fossil Creek 5th code HUC would improve from static (in alternative A) to toward desired conditions. Montane Willow Riparian Forest would be the same as alternative A, except the Upper Clear Creek 5th code HUC would improve to good condition and trend toward desired conditions. Wetland functional condition would be good and would also trend toward desired conditions, while spring condition would be the same as alternative A, variable depending on access, protection, and development. Intermittent streamcourses would remain in poor condition where they are accessible or intersected by roads and would trend slowly toward desired conditions, an improvement compared to alternative A. Perennial streams would also remain in poor condition and would trend slowly toward desired conditions, which is also an improvement compared to alternative A.

Similar to alternative A, the likelihood that habitat on the forest would be a limiting factor for Chiricahua leopard frog is high to very high and varies slightly by habitat. See table 45 These likelihoods were derived by combining the Chiricahua leopard frog’s F Rank of F1 with the likelihood of habitat limitation variables for each ERU: Mixed Broadleaf Deciduous Riparian Forest (moderate), Montane Willow Riparian Forest (moderate, except the Upper Clear Creek 5th code HUC is high), wetlands (moderate considering wetland functional condition), springs (moderate), intermittent streamcourse (high if accessible, moderate if inaccessible), and perennial streams (high) (table 9). Low to moderate ratings are considered to be within the natural range of fluctuations for the habitat. Habitat trends for Mixed Broadleaf Deciduous Riparian Forest, perennial streams and intermittent streamcourses improve slightly compared to alternative A, which could slightly improve movement between suitable habitats and survival or reproduction in Mixed Broadleaf Deciduous Riparian Forest.

The management effect row shows the relative expected outcome of plan language in terms of minimizing species viability risk. The management effect is classified as a 2 for all the coarse filter habitats associated with Chiricahua leopard frog. This means that plan components in alternative B (modified) maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area. For Mixed Broadleaf Deciduous Riparian Forest and Montane Willow Riparian Forest, this rating is primarily because there are updated desired conditions and guidelines that distinguish between

the riparian forest types and that support their respective composition, structure, and function (FW-Rip-RipType-DC-1 to 6 FW-Rip-RipType-G-1 to 4). In addition, riparian functional condition would improve faster than alternative A, especially along the Verde River, Towel Creek, Spring Creek, and Dry Beaver Creek.

For all riparian forests, the desired conditions manage for vegetation diversity and riparian function including in priority watersheds (FW-Rip-RipType-DC-1 and 2; FW-Water-G-2; FW-Rip-RipType-O-1). For all riparian, more site-specific aquatic management zone guidelines protect riparian function and water quality (FW-Rip-All-G-3; FW-Rip-Strm-G-2) (USDA Forest Service 2016b). Plan components in the Wildlife, Fish, and Plant section also contribute to the viability of species associated with riparian areas by promoting properly functioning ecosystems that have the necessary physical and biological components to meet the needs of associated native species (FW-WFP-DC-1 and 3).

For wetlands, the management effect rating is primarily because there are updated desired conditions and guidelines that support wetland composition, structure, and function, connectivity between uplands and aquatic and riparian areas, and the maintenance of habitat for species (FW-Rip-Wtlnds-DC-1, 2, FW-Rip-All-DC-1, 3, 5 and G-2, 3, FW-WFP-DC-6). In addition, wetland functional condition would improve faster than alternative A. For springs, this rating is because alternative B (modified) has desired conditions and guidelines to guide spring management on the forest (FW-Rip-Spr-DC-1, 2, 3, 4 and FW-Rip-Spr-G-1, 2, 3, 4). For intermittent streamcourses, this rating is based on language regarding mitigating the effects of roads, connectivity of drainages, connectivity between streamcourses and upland habitats, and earthen stock tank locations (to minimize impacts to sensitive resources) (see FW-ConstWat-G-1 and 2, FW-RdsFac-G-2, 5, 7 and 9 and Connectivity under Wildlife and Plants Topics and Issues). For perennial streams, this rating is because alternative B (modified) addresses non-native or invasive animal species and disease forestwide. This language better addresses frog movement between suitable habitats and threats to the habitat and to frogs (considering non-native species and constructed waters) than alternative A and could potentially increase the chances for survival.

Desired conditions for all ecosystems are generally consistent with maintenance and improvement of Chiricahua leopard frog populations and habitat. Although the presence of desirable non-native species is part of the vision, they are to be in balance with properly functioning ecosystems (FW-Eco-DC-4), and therefore, non-native species shouldn’t be managed for in Chiricahua leopard frog occupied, potential, or critical habitat. Additionally, ecosystems are to provide habitat for native species, and to be resilient to natural and uncharacteristic disturbances (FW-ECO-DC-1, 2, 3).

The desired conditions for the watersheds and water program (FW-Water-DC-1 to 7) are generally consistent with maintenance and improvement of Chiricahua leopard frog populations and habitat, describing watersheds with high geomorphic, hydrologic, and biotic integrity and that are resilient to disturbance. Guidelines for future projects would result in resilient, properly functioning watersheds and procurement of instream flow water rights where needed to provide sufficient flow for aquatic species. Activities would use best management practices that improve water quality, quantity, and timing of flows, while implementing TMDL recommendations that meet or exceed Arizona water quality standards. Water quality, quantity, and timing of flows would also benefit from excess water being allowed to flow into natural channels, springs, and riparian habitat within existing water rights (FW-Water-G-1 to 6). Without specified objectives, activities may be implemented to maintain or improve watershed conditions and water quality,

but they are not anticipated to be a primary focus over the plan timeframe. See Watersheds and Water, volume 1 for additional details.

Following the guidelines in alternatives B (modified) for water quality and quantity at the project level should benefit the Chiricahua leopard frog by management of instream flows and meeting water quality standards (FW-Water-G-3 to 6). These guidelines will help ensure frogs have: water that is sufficient for survival and reproduction; water that is clean enough to support aquatic food sources; and reduced impacts from disease (e.g., Chytridiomycosis).

Although all known populations of the Chiricahua leopard frog are in constructed stock tanks, the guidance in alternatives B (modified) would be beneficial to the Chiricahua leopard frog because it will improve natural wetland habitats for the potential reintroduction of frogs within their historic range on the forest (FW-Rip-Wtlnds-DC-1).

The vision for constructed waters is that they provide for a variety of uses, including wildlife (FW-ConstWat-DC-1), and that earthen stock tanks and constructed wildlife waters remain accessible to wildlife (FW-ConstWat-DC-2). Projects implemented in the future consistent with these desired conditions will be further guided by two guidelines. FW-ConstWat-G-2 states that stock tanks that are important to listed and sensitive species should be managed to maintain water and habitat for those species, consistent with existing water rights. Applied to projects and management of constructed waters, this should reduce the potential impacts of dewatering and vegetation removal from recreation, grazing, tank cleaning, and other activities that could negatively affect frog reproduction or survival. This guideline also supports primary constituent elements for critical habitat for maintaining water in tanks, and for protecting vegetation around tanks. The only other guideline for constructed waters calls for establishing aquatic management zones for new projects and activities around reservoirs (FW-ConstWat-G-1). The Chiricahua leopard frog does not occupy reservoirs on the forest and isn't likely to, since they all contain non-native species and are primarily managed for recreational and municipal water supplies.

There are no objectives or standards for constructed waters and associated activities are not anticipated to be a primary focus over the plan timeframe. Effects from this program are not expected to have adverse effects for the Chiricahua leopard frog and its critical habitat.

The five desired conditions for All Riparian Areas are consistent with maintenance and improvement of Chiricahua leopard frog populations and habitat. Projects implemented in the future to be consistent with desired conditions will be guided by three guidelines. There are no objectives or standards. Guidance for All riparian areas under this alternative (FW-Rip-All-G-1, 2, 3) will ensure that vegetation treatments are balanced with desired conditions for other resources, while promoting healthy water flow, quality, and movement corridors. Because currently occupied sites within critical habitat are stock tanks connected by non-riparian ephemeral drainages, there is no riparian habitat within critical habitat, so the mixture of positive and negative effects would not apply to critical habitat. See Riparian Resources, volume 1 for additional details.

Table 46. Miles and percentage of riparian habitat by riparian condition and Chiricahua leopard frog management area

Riparian Condition	Chiricahua Leopard Frog Management Area		Total Miles
	East Clear Creek	West Mogollon	
PFC	130.2 (65%)	25.6 (92%)	155.8 (68%))
Functional-at-risk	48.3 (24%)	0	48.3 (21%)
Non-functional	21.7 (11%)	0	21.7 (10%)
Unknown	0	2.2 (8%)	2.2 (1%)
Totals:	**200.2**	**27.8**	**228**

Desired conditions for all Stream Ecosystems are generally consistent with maintenance and improvement of Chiricahua leopard frog populations and habitat because they describe conditions supportive of native aquatic species. Emphasis is given to resilient streams and associated flood plains, natural hydrographs, self-sustaining aquatic species, habitat connectivity, minimal impact of non-native species, and recovery of listed species (FW-RipStrm-DC-1 to 4). Implementing projects to meet these desired conditions would benefit the Chiricahua leopard frog. An objective in the section on Wildlife, Fish, and Plants calls for restoring or enhancing at least 70 miles of stream habitat every 10 years for the life of the plan (FW-WFP-O-4). This objective does not specify where treatments would occur; however, they could be supportive of this species if they occur in Chiricahua leopard frog habitat. There are no standards, but there are two guidelines to apply during project development and implementation. The first (FW-Rip-Strm-G-1) emphasizes streambank stability, native vegetation, and riparian and soil function. This would benefit potential Chiricahua leopard frog habitat. With respect to critical habitat, the other guideline (FW-Rip-Strm-G-2) calls for establishment of AMZs adjacent to non-riparian, intermittent streamcourses. While these streamcourses do not provide breeding habitat for the Chiricahua leopard frog, they could be used for dispersal. This guideline would help minimize impacts from projects on dispersing frogs and critical habitat by maintaining vegetative cover for dispersing frogs. And, protection of intermittent streamcourses during project activities could reduce impacts to occupied habitat or critical habitat downstream.

Desired conditions for all Wetlands (FW-Rip-Wtlnds-DC-1, 2) are consistent with maintenance and improvement of Chiricahua leopard frog populations and habitat. There are no standards or guidelines for wetlands. The only objective for wetlands calls for restoring 5 to 10 wetlands that are currently not in proper functioning condition (PFC) during each 10-year period of the plan (FW-Rip-Wtlnds-O-1). Currently, 28 of the 65 known wetlands are not in PFC, and another two wetlands have not been assessed. Specific wetlands to restore will be identified in future projects, and if they occur within one of the two frog MAs, it could provide additional habitat for frogs to disperse to or be transplanted into. Restoration can include activities such as vegetation planting, dredging, and recontouring. While long-term benefits are likely with the goal to improve wetlands, there could be short-term impacts to vegetation and soils, and disturbance to frogs if they are present in the wetland.

There are no wetlands within critical habitat so there would be no effect expected effect to critical habitat from activities to restore wetlands.

Desired conditions for springs are generally consistent with maintenance and improvement of Chiricahua leopard frog populations and habitat. The only objective calls for restoring riparian

function to at least 25 springs during each 10-year period during the life of the plan (FW-Rip-Spr-O-1). Activities to improve springs can include fencing the spring source, piping water away from the spring source, contouring downstream channels, vegetation plantings, etc. The Chiricahua leopard frog does not currently occupy any natural spring habitat, but if restoration occurs within frog MAs, this could benefit these frogs by providing additional habitat for breeding, dispersal or translocation. There are no standards, but the proposed plan has four guidelines to consider for projects and activities. Two guidelines address maintaining or increasing the amount of water (FW-Rip-Spr-G-1, 2). Expanding the extent or permanency of water would be beneficial to frog habitat. The other two guidelines would be applied to projects to maintain or improve soil and riparian conditions (FW-Rip-Spr-G-3, 4), and would also be beneficial to Chiricahua leopard frog habitat. There would be no effect to critical habitat from adoption of this plan language because there are no springs within critical habitat.

Although there is no riparian habitat in occupied or critical habitat, both Chiricahua leopard frog MAs contain riparian forest types. Most of the guidance in the proposed plan applies to all riparian forest types, not just the two that provide potential habitat for the Chiricahua leopard frog: Mixed Broadleaf and Montane Willow. The six desired conditions generally provide a vision for riparian forests that is consistent with maintenance and improvement of Chiricahua leopard frog populations and habitat. Projects implemented in the future to be consistent with desired conditions will be guided by one objective and four guidelines.

The one objective calls for restoring function to 200 to 500 acres of riparian habitat during each 10-year period of the plan. There is a total of 11,018 acres of riparian forest on the Coconino NF, with approximately 3,382 acres (31 percent) not in PFC (USDA Forest Service 2016b). Therefore, implementation of this objective equates to an expected improvement of 6 to 15 percent of riparian acres not currently in PFC. This objective does not specify which riparian forest types the objective will treat. Activities to restore riparian could include weed removal, fencing to exclude ungulate browsing or off-road driving, road improvements or obliterations, and other actions that could have impacts to Chiricahua leopard frog and its habitat. These impacts are expected to be short-term, since the goal of activities within riparian forest types would be to restore functional condition.

Water diversions and groundwater pumping can be deleterious to Chiricahua leopard frog occupied, potential, or critical habitat; however, Guideline FW-Rip-RipType-G-1 states that these activities, if they occur, should not lower the water table. Guideline FW-Rip-RipType-G-3 strives to keep activities within riparian forests to levels that maintain or allow improvement of habitat, but excludes fine-scale activities such as intermittent livestock crossings, water gaps, and facilities and infrastructure. Since livestock use of habitat and the construction or use of facilities in riparian could impact habitat, critical habitat components, and occupied sites, this caveat is not protective for the Chiricahua leopard frog. There is no riparian forest habitat within critical habitat, so there will be no effect to PCEs. Overall, as the revised forest plan is implemented over the next 10 to 15 years, departure from reference conditions for the Mixed Broadleaf and Montane Willow Riparian Forest Types is expected to remain low and the trend for vegetation and soil is expected to be static to slowly toward reference condition (USDA Forest Service 2016b). The slow trend toward reference condition is likely due to the relatively low amount of riparian habitat projected to be treated as expressed through the objective.

Predation and competition from aquatic invasive species such as non-native fish and crayfish are key threats to the Chiricahua leopard frog (USDI Fish and Wildlife Service 2007). While the two

desired conditions accept the presence of invasive species, the stated goals are that species' sustainability is not affected (FW-Invas-DC-1) and that infestations are detected early (FW-Invas-DC-2). Presumably, detecting infestations early would allow for more successful control or elimination. The types of actions that could occur include manual treatments (hand pulling, netting, seining, etc.) and the use of pesticides, piscicides, or herbicides to control or remove invasive species. For the Chiricahua leopard frog, the manual or chemical removal of non-native species from occupied sites could have effects through trampling of banks and shoreline vegetation (PCE 1b, 1e), and loss of individual frogs. Effects will be positive if non-native species that occur upstream from occupied sites are removed. This would remove the threat of spread into occupied sites. If treatments are required in occupied habitat, there could be short-term effects to individual frogs, and long-term positive effects to the habitat and population, particularly PCE 1c for the elimination of non-native predators. The intent of all three guidelines is to prevent, control, contain, or eradicate invasive species to protect native species and to improve watershed condition and ecosystem function (FW-Invas-G-1, 2, 3). See Non-native or Invasive Species in the Wildlife and Plant Issues and Topics section in this volume for additional information.

Fire management can have a positive impact by preventing or reducing catastrophic loss of habitat in riparian areas or in the associated watersheds. Uncharacteristic fire can result in uncharacteristic waterflows or increases in sedimentation that degrade or remove primary constituent elements in habitat (such as perennial water with specific pH and salinity and water with no to low pollutants) and can kill species. Fire retardant used as tool in fire suppression can harm aquatic wildlife. Existing policies and guidance reduce or remove the impacts from fire retardant to affected species (USDA Forest Service 2011b, USDI Fish and Wildlife Service 2011b).

The four desired conditions are generally consistent with maintenance and improvement of Chiricahua leopard frog populations and habitat, particularly FW-Fire-DC-2 and 3. The goals of these two desired conditions are that wildland fires burn within the historic fire regimes and that ecosystem function is not lost. Wildland fires include both planned (prescribed) and unplanned ignitions. Prescribed fires would be planned and implemented to meet these desired conditions and are therefore expected to benefit the Chiricahua leopard frog and its habitats through maintenance of ecosystem function. There are no objectives or standards for Fire Management. One guideline calls for designing fire management activities to be consistent with moving toward desired conditions for other resources (FW-Fire-DC-2). Fuels reduction and fire management activities include thinning, piling, building line by hand or dozer, and other activities. Occupied and critical habitat occurs within pinyon juniper ERUs, where there are no objectives to use prescribed fire (see Terrestrial ERU section). While likely to be limited in occupied, potential, and critical habitat, these activities could result in disturbance or impacts to upland habitat for the Chiricahua leopard frog. But prescribed fires would be designed to meet plan components for protection of listed species, so effects to the species and its critical habitat are not expected to be adverse.

Two of the three desired conditions for livestock grazing are consistent with maintenance and improvement of Chiricahua leopard frog populations and habitats. The third, FW-Graz-DC-2, allows for lower levels of vegetation and higher levels of soil compaction around livestock concentration areas such as earthen stock ponds, springs, and other features. Grazing implemented to meet this desired condition in or near occupied sites, potential habitat, or critical habitat could have adverse effects to the Chiricahua leopard frog, including its critical habitat.

PCEs related to vegetative cover around breeding habitat (1e), and dispersal habitat (2b), could be adversely affected through concentration of livestock eating and trampling vegetation in these areas. Livestock can impact occupied Chiricahua leopard frog tanks by lowering water levels through drinking, and trampling of bank and aquatic vegetation that provides hiding cover and attachments for egg masses. Improvements are considered through allotment-specific analysis or separate analyses for new or individual improvements. The one standard, FW-Graz-1, requires that troughs and uncovered storage tanks have animal escape devices. This would minimize the chance of Chiricahua leopard frogs getting trapped in these water sources. FW-Graz-G-2 call for managing livestock grazing to meet or move toward desired conditions for other resources, including species, so this would be positive for the Chiricahua leopard frog and its habitat. The other guidelines are generally consistent with habitat and populations of the Chiricahua leopard frog. However, FW-Graz-G-7 excludes the protective aspects of the guideline in riparian areas used for livestock crossings and water gaps, and around some infrastructure. Therefore, if livestock crossings, water gaps, and certain infrastructure overlap with occupied, potential, or critical habitat, there could be adverse effects to Chiricahua leopard frog habitat from trampling and eating riparian vegetation. Emergent vegetation (PCE 1a), adjacent upland habitats (PCE 1e), and dispersal habitat (PCE 1b) could be adversely affected in these limited areas.

Activities associated with mineral resources include blasting, drilling, vegetation clearing, and other ground-disturbing activities. Although unlikely to occur directly within occupied, potential or critical habitat, ground-disturbing activities in the vicinity of these habitats could result in indirect effects such as sedimentation. Although mining is identified as an important threat in the final listing rule for the Chiricahua leopard frog (USDI Fish and Wildlife Service 2002a), activities on the forest are limited. There are few locatable mineral resources such as manganese, gypsum, pumice and flagstone, and only a small amount of common variety mineral materials such as cinders, rock and fill dirt, and landscape rock (USDA Forest Service 20160). Relevant plan components include two desired conditions that are consistent with maintenance of Chiricahua leopard frog populations and habitat. There are five guidelines that should be followed for mineral projects. For locatable minerals such as gold and other metals, guideline FW-Minerals-G-1 calls for considering withdrawal of habitat of species with very limited range, which should include the Chiricahua leopard frog. For leasable minerals such as geothermal resources and oil and gas, areas with federally listed species should be considered for “no surface occupancy (FW-Minerals-G-3). And in general for all types of mineral projects, FW-Minerals-G-4, calls for protection of important wildlife habitats using a variety of methods. Together, these desired conditions and guidelines should minimize potential impacts to the Chiricahua leopard frog, its habitat, and its critical habitat.

In contrast to alternative A, plan language in alternatives B (modified) addresses connectivity of habitats forestwide. This alternative addresses interconnected terrestrial, riparian, and aquatic habitats through desired conditions that would promote access to new habitats, facilitate genetic diversity, species movements, dispersal, and migration (FW-Water-DC-4, 6; FW-Rip-All-DC- 1, 2, 3 and G-2; FW-Rip-RipType-G-2);FW-TerrERU-All-DC-3; FW-TerrERU-Grass-DC-3; FW-WFP-DC-6, FW-WFP-G-6; and MA-AMesa-DC-3). This language would maintain or improve habitat permeability and mitigate effects to linkages. Refer to the Wildlife and Plant Issues and Topics: Connectivity, in this volume for additional information.

Of the 18 management areas in the proposed plan, several overlap with the two Chiricahua leopard frog management areas (table 47). The largest percentage of habitat overlap is within the Cragin Watersheds (99 percent) and East Clear Creek (96 percent) MAs. Goals for Cragin focus

on minimizing resource damage from uncharacteristic fire and recreation (MA-CCCrg-DC-1), and that there is low-disturbance to wildlife habitat (MA-CCCrg-DC-2). Desired conditions are reinforced by two guidelines; MA-CCCrg-G-1 calls for managing the MA to reduce the threat of uncharacteristic wildfires, flooding, and sedimentation, and to maintain water quality and quantity. And, in MA-CCCrg-G-2, roads and trails should be maintained to prevent erosion and sedimentation. Both of these guidelines would help protect potential Chiricahua leopard frog habitat. Desired conditions for East Clear Creek emphasize low-intensity recreational opportunities and low disturbance for wildlife habitat (MA-EastClr-DC-1 and 2), which is supportive of goals for recovery of the frog in the recovery MA also named East Clear Creek. A guideline states that dispersed camping opportunities and motorized recreation should be managed to occur outside the vicinity of meadows and riparian areas (MA-EastClr-G-1). This supports the potential for Chiricahua leopard frog recovery in its East Clear Creek MA by minimizing the potential for impacts to potential riparian habitat.

Table 47. Chiricahua leopard frog (CLF) management area acres within proposed plan management areas

Proposed Plan Management Area	Proposed Plan Management Area Acres	CLF West Mogollon MA Acres (% of Proposed Plan MA)	CLF East Clear Creek MA Acres (% of Proposed Plan MA)
Anderson Mesa	272,731	0 (0%)	2,588 (0.9%)
C.C. Cragin Watersheds	45,711	0	45,189 (99%)
East Clear Creek	53,124	0	51,615 (96%)
Long Valley	164,055	5,785 (4%)	5,416 (3%)
Pine Belt	426,832	38,573 (9%)	8,445 (2%)
Verde Valley	323,455	54,044 (17%)	0

Although currently occupied sites and critical habitat do not occur in designated wilderness areas, the Chiricahua leopard frog's West Mogollon MA overlaps with two: Fossil Springs, and West Clear Creek Wilderness. Overall, direction for the Chiricahua leopard frog within designated wilderness areas is sparsely and indirectly described. However, other guidance in the plan would apply, such as direction to apply habitat management objectives and species protection measures from recovery plans when activities are being planned (FW-WFP-G-1). Activities that are anticipated in wilderness areas include managed fire, trail building and maintenance, dispersed recreation. Alternative B (modified) would retain the 10 existing wilderness areas, and would recommend three additional wilderness areas: Of the three areas are being recommended for wilderness designation—Abineau, Strawberry Crater, and Davey's—only Davey's contains potential Chiricahua leopard frog habitat. About 42 percent (737 acres) of Davey's recommended wilderness acreage (1,739 acres) is within the Chiricahua leopard frog West Mogollon MA. An additional 1,002 acres of the recommended wilderness is within Recovery Unit 5, but outside of the West Mogollon MA. There is no critical habitat within any recommended wilderness. Total acres of designated wilderness, recommended wilderness, and areas classified as Primitive ROS would be 165,107 acres, about 9 percent of the Coconino NF. A goal that supports management of federally listed species is reflected in the desired condition that calls for preserving native species (SA-RWild-DC-3). The other five desired conditions describe goals to maintain the undeveloped character and to emphasize scenery and recreation. Five guidelines will provide sideboards to managing activities in recommended wilderness areas, but are not specific to managing wildlife or federally listed species. Overall, direction that could apply to potential Chiricahua leopard frog

habitat within Davey's is minimal. As with designated wilderness (see above), other plan guidance would apply.

Alternative C

Alternative C would have similar effects to alternative B (modified), but there are a few meaningful differences.

Eight additional management areas are proposed to emphasize reduced human-related disturbance and all occur in Recovery Unit 5. Four of these management areas contain potential or historic habitat for Chiricahua leopard frog (East Clear Creek, Hospital Ridge, Knoll Lake, and Limestone Pasture). These four are within the East Clear Creek Management Area and contain 30 percent of the Montane Willow Riparian Forest habitat on the forest. The proposed Second Chance Management Area is within historic range, but does not contain any riparian habitat. None of these management areas are within occupied Chiricahua leopard frog critical habitat or the West Mogollon Management Area, so there would be no anticipated difference between alternatives B (modified), C, and D on occupied habitat.

Guidelines for these management areas would reduce disturbance from motorized dispersed camping and motor vehicle use in 30 percent of the Montane Willow Riparian Forest compared to alternatives A, B (modified), and D. This could positively affect Chiricahua leopard frog by reducing riparian vegetation impacts (i.e., loss of hiding cover and habitat to which egg masses could be attached) from disturbance to the frog from recreational and motorized uses of the area.

While desired conditions and guidelines in both alternative B (modified) and C support the potential for Chiricahua leopard frog recovery by minimizing the potential for impacts to potential riparian habitat, Alternative C has more focus on managing for ecological conditions and managing specifically for the Chiricahua leopard frog. Those that have the potential to be most consequential include MA-EastClr-DC-3, which envisions protection and restoration of springs, streams, and wetlands, and MA-EastClr-DC-5, which calls for properly functioning wildlife habitats. Particularly, provision of habitat for the Chiricahua leopard frog is emphasized in MA-EastClr-DC-9. In addition, for the Hospital Ridge, Knoll Lake, Limestone Pasture, and Second Chance MAs, there are desired conditions that call for ecological integrity of watersheds, headwater environments, native vegetation, and soils, envision protection and restoration of springs, streams, and wetlands, and DC-5 call for properly functioning wildlife habitats (Appendix F, MA-HospRdg-DC-1, 3, 5, 10, 12, MA-KnollLake-DC-1, 3, 5, 10, and 12, MA-Limestone-DC-1, 3, 5, 10, 12, MA-ScndChnc-DC, 1, 3, 5, 10, 11). Each of these four management areas also have three guidelines. They provide guidance to have no net increase in motorized dispersed camping corridors (G-1), to limit roads that provide motorized access (G-2), and to not allow large group recreation events and commercial tours (Appendix F, MA-HospRdg-G-1, 2, 3, MA-KnollLake-G-1, 2, 3, MA-Limestone-G-1, 2, 3, MA-ScndChnc-G-1, 2, 3). Collectively, these are expected to contribute positively to riparian and wetland habitats, which would provide better potential habitat for the Chiricahua leopard frog. Like alternative B (modified), there are no objectives.

The primary difference in plan direction and potential effects between alternative B (modified) and alternative C is within the direction for the Blue Ridge and East Clear Creek MAs. In alternative C, management area direction is more focused on ecological conditions, and emphasizes managing habitat for the Chiricahua leopard frog (Appendix F, MA-EastClr-DC-9 and MA-BlueRidge-DC-13) The East Clear Creek MA, established as an area where recovery

efforts could receive an emphasis, overlaps with these two alternative C management areas. This added emphasis would benefit Chiricahua leopard frog recovery potential, making alternative C a slightly better alternative than B (modified) for the species. There is no difference between alternative B (modified) and C for Chiricahua leopard frog critical habitat.

Alternative C (like alternative B (modified)) would retain the 10 existing wilderness areas and recommend 3 additional wilderness areas: Abineau, Davey's, and Strawberry Crater. Alternative C also includes 10 additional recommended wilderness areas in Recovery unit 5: Barbershop (1,305 acres), Black Mountain (9,715 acres), Cedar Bench (5,782 acres), Cimarron-Boulder (15,124 acres), Deadwood Draw (11,775 acres), East Clear Creek (1,986 acres), Hackberry (25,836 acres), Railroad Draw (1,220 acres), Tin Can (3,905 acres), and Walker Mountain (6,377 acres). The 13 recommended wilderness areas would total 91,757[3] acres (table 48). Acres of designated wilderness, recommended wilderness, and areas classified as Primitive ROS would total 248,131 acres.

Four of the sites currently occupied by Chiricahua leopard frog are within or straddle the boundary of the Cimarron-Boulder recommended wilderness area. The remaining sites are not within any recommended wilderness area. Only three historic locations for the Chiricahua leopard frog are within recommended wilderness areas: one in the Black Mountain recommended wilderness area and two within East Clear Creek recommended wilderness area. No additional plan language would be included in alternative C; the plan components in alternative B (modified) for recommended wilderness areas would apply, so the effects would be similar.

Table 48. Recommended wilderness

Recommended Wilderness	Acres
Alternatives B (modified) and C	
Abineau	415
Davey's	1,739
Strawberry Crater	6,579
Alternative C	
Barbershop	1,305
Black Mountain	9,715
Cedar Bench	5,782
Cimarron Boulder	15,124
Deadwood Draw	11,775
East Clear Creek	1,986
Hackberry	25,836
Railroad Draw	1,220
Tin Can	3,905
Walker Mountain	6,377

Wilderness recommendation could affect Chiricahua leopard frog in both positive and negative ways. Limitation on roads and access could reduce the potential for disturbance, habitat impacts, and spread of disease among sites. However, where riparian habitats and occupied or potential sites exist, there is often a need to conduct restoration activities such as thinning to improve

[3] The 91,757 acres includes 905 acres of Hackberry Wilderness, which extends onto the Prescott NF.

adjacent watershed condition and waterflow, removing non-native species, or fencing to exclude ungulate grazing. Guidelines for recommended wilderness could make it more difficult to implement some of these activities because of limitations on use of motor vehicles and direction to avoid construction of new facilities that cannot be made consistent with the area's wilderness character. For fencing and other facilities supporting reintroduction at new sites, the cost could be increased by the need to mitigate visual impacts and projects may be harder to implement because of the potential difficulty of maintaining these structures if the area is designated by Congress.

Alternative D

Alternative D will have similar effects to alternative B (modified), with a few notable exceptions. Alternative D recommends no new wilderness areas. The effects associated with managing the recommended areas under alternatives B (modified) and C as recommended wilderness would not occur. These areas would still be managed by the other forestwide, management area, and special area direction in alternative B (modified) with the corresponding effects discussed above in the alternative B (modified) section. Not adding any new wilderness areas would avoid both the positive (reducing the likelihood of disturbance, habitat destruction, and spread of disease) and negative (reduced ability to actively restore habitat) that proposing new wildernesses would result in. However, because the Strawberry, Davey's, and Abineau proposed wilderness areas would have no effect on occupied Chiricahua leopard frog habitat and its critical habitat, and a negligible effect on other riparian habitat, the effects from this alternative would be similar to alternative B (modified). See Wilderness and Wild and Scenic Rivers section, volume I for additional detail.

Alternative D adjusts scenic resources direction to allow for expansion along two powerline corridors. One corridor is approximately 21 miles between Sycamore and Red Rock-Secret Mountain wildernesses, and the other is approximately 11 miles along State Highway 87. Neither occur within Chiricahua leopard frog management areas, so there will be no effect to the species or its critical habitat from this adjustment.

Findings

Considering all environmental and cumulative consequences for wildlife, fish, and plants, all alternatives may affect, and are likely to adversely affect the Chiricahua leopard frog and its critical habitat. The reasons for the findings are described above. Implementation of plan components related to vegetation treatments, recreation management, watershed management, wildlife, fish or rare plants management, or land acquisition in any of the alternatives may have short-term negative effects on aquatic and riparian habitat or species populations, but would produce long-term benefits to the maintenance and improvement of habitats and species populations on the Coconino NF.

For landscape-level habitat threats, the coarse filter section of this document summarizes how landscape threats to the primary habitats, including uncharacteristic fire and overall water quality, are addressed in the alternatives. Additional details are in the Vegetation, Soil, and Riparian Resources, and Watersheds and Water sections of this document.

Although all alternatives contribute to the viability and persistence of this species, alternatives B (modified), C, and D share the following characteristics that better maintain the viability and persistence of the Chiricahua leopard frog and contribute to their recovery:

- desired conditions are more clearly articulated for all habitats including Wetlands and Springs, so that the composition, structure, and processes of these habitats better provide for the needs of this species;
- guidelines specifically address disease and invasive animals more comprehensively, resulting in reductions of these threats within the authority of the Forest Service;
- threats to habitats are better defined and plan components would improve habitat conditions as projects are implemented; and
- language regarding movement corridors and connectivity between habitats is updated so that links between breeding and upland habitats, and between suitable habitats would be maintained.

The amount of riparian or wetland habitat and waters could have a slight increase from the current amount of habitat due to restoration work that includes precise and measurable objectives. Alternative C is slightly better than alternatives B (modified) and D for Chiricahua leopard frog recovery because there are additional guidelines that reduce disturbance from motorized dispersed camping and vehicle use. This additional emphasis on ecological integrity in the East Clear Creek recommended wilderness, could benefit Chiricahua leopard frog recovery potential.

The amount of riparian or wetland habitat and waters could have a slight increase from the current amount of habitat due to restoration work that includes precise and measurable objectives. Guidance for water quality among all is similar.

California Condor

Affected Environment

No specific conservation actions have been taken for the condor on the forest. The species does not breed or overwinter on the forest, and there have only been a couple of detections of wandering condors since they were reintroduced.

Distribution

Reintroduction of captive-bred condors in Arizona began in 1996, at the Vermilion Cliffs National Monument. They were introduced under Section 10(j) of the Endangered Species Act as an experimental nonessential population (USDI Fish and Wildlife Service 1996). This means that this population is not essential to the continued existence of the species. There were 74 condors in Arizona as of 2011. Condors generally travel between two main areas: the Grand Canyon in Arizona, and Zion National Park in Utah (USDI Fish and Wildlife Service 2012a). As of the end of 2015, the Arizona/Utah population was 80 condors in the wild (USDI Fish and Wildlife Service 2015b).

There have been two sightings of condors on the forest since the introduction. Coconino NF north of I-40 is within the experimental population area, which was designated to accommodate future movements and expansions of reintroduced condors (USDI Fish and Wildlife Service 1996). The nonessential experimental population status applies to condors in the Southwest only when they are within the geographic bounds of the designated 10(j) area, which is defined by: Interstate Highway 40 on the south, U.S. Highway 191 on the east (parallel to the New Mexico and Colorado state borders), Interstate Highway 70 on the north, and Interstate Highway 15 to U.S.

Highway 93 near Las Vegas, Nevada on the west. Condors outside of this are fully protected as endangered.

Habitat

Condors nest and roost on cliffs, caves, or tall conifers, forage in open terrain for carrion, and can travel 100 miles or more in a day. Condors can occur where there are suitable nest and roost sites and abundant source of large dead mammals. While not tied to any particular ERUs, they favor open habitats and grasslands when searching for food.

Risk Factors

The main threat to the Arizona population of California condors is ingestion of lead shot, which is regulated by the Arizona Game and Fish Department. From 1996 to 2006, the mortality of 14 condors was linked to lead poisoning or suspected lead poisoning (Austin et al. 2007). The Arizona Game and Fish Department has a voluntary lead shot program, along with its partners the Arizona Deer Association, Arizona Elk Society, Arizona Antelope Foundation, Arizona Desert Bighorn Sheep Society, and the Arizona Chapter of the National Wild Turkey Federation. Their message to hunters is to “be part of the solution by using nonlead ammunition when hunting in condor country” which they identify as Game Management Units 9, 10, 12A/B, and 13A/B (none of these are on the forest).

Table 49. Mortality within the Southwest condor population from 1996 to 2011

Cause of Mortality	Number	Percent
Lead Poisoning	21	48
Predation	12	27
Shooting	3	7
Starvation	3	7
Collision	2	5
Impaction	2	5
Infection	1	2

Environmental Consequences

The scope of the analysis for the condor is the entire Forest, with a focus on its designated experimental population area, which includes all Coconino NF lands north of I-40. The forest has very little influence on the factors that are affecting and limiting the condor population in the Southwest. The following analysis focuses on management actions and plan components that could have effects on cliff nesting habitat or could influence the potential for collisions with powerlines or vehicles.

Table 50 summarizes the viability analysis for California condor. This table was developed using the analysis process described under the Species Viability section above. It includes information on the status, F Rank, habitat, habitat condition and trend, likelihood that this species is limited by its habitat, and the projected management effect, by alternative. Management effect categorizes the relative expected outcome of plan language in each alternative in terms of minimizing species viability risk and are the result of plan decisions, including plan objectives. Management effect category values are 1, 2, 3, and 4. The lower the management effects rating for a species' associated habitat, the more effective the alternative is for that species viability. These topics and

the effects of the alternatives are explained in greater detail in the discussions on the alternatives that follow.

Table 50. Analysis summary for the California condor

Species and status	Habitat	Alternative A: Habitat condition and trend relative to desired conditions	Alternative A: Likelihood species is limited	Alternatives B (modified), C, D: Habitat condition and trend relative to desired conditions	Alternatives B (modified), C, D: Likelihood species is limited
California condor (Experimental nonessential, Endangered)	Cliffs	Good, static	L	Good, static	L
F Rank = FN*	Caves	Good, static	L	Good, static	L
Management effect		Cliffs = 4: There is a decline in habitat quality as a result of management or lack of management that result from plan components. Plan components may not exist or may be few. Caves = 3: Plan components maintain or improve protection and management for some habitat occurrences in the plan area. Quality of habitat or habitat elements is maintained or improved by providing protection, maintenance, and restoration to some occurrences.		Cliffs and caves = 2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.	

*FN = Occurs on the forest, but no breeding population is documented on the forest.

Common to All Alternatives

Plan components in all alternatives contribute to species viability by managing for sustainable populations of native species and improving and protecting habitat for threatened, endangered, and sensitive species (1987 Plan, pages 22-1, 23, 64, 64-1, 66, 95, 108-2, 180, 187, 206-9, 206-11, 206-12, 206-13, 206-23, 206-30, 206-32, 206-66, 206-67, 206-71, 206-72, 206-79, 206-87, 206-89, 206-98, 206-103, 206-105, 206-108, 206-109, 206-114; FW-WFP-DC-1, 2, 3, 4, 5, 6, 8, and FW-Eco-DC-1). See At-risk Species in the Wildlife and Plant Issues and Topics section above for more information.

The reintroduced Arizona population of the California condor has been designated as a non-essential, experimental population. By definition, a non-essential experimental population is not essential to the continued existence of the species. Therefore, no proposed action impacting an experimental, non-essential population so designated under Endangered Species Act §10(j) could lead to a jeopardy determination for the entire species.

For the fully listed entity (endangered outside of 10(j) area) implementation of the alternatives would not cause a loss of viability for the endangered California condor. Because condors do not currently occur on the forest, effects are unlikely to occur. If condors do become established during the life of this plan, effects from Forest activities are expected to be minimal because of the plan guidance that would apply as analyzed below. Encouraging maximum use of existing utility corridors and communication sites to minimize new developments across the landscape is common direction to all alternatives. Procedures for the review and response times for special use applications and requests are set by policy and regulations outside the forest plan and would apply regardless of the plan alternative selected.

Motor vehicle use beyond the designated system of roads, trails, and areas is prohibited except where expressly allowed (1987 Plan, page 58, FW-RdsFac-S-1). This could help reduce disturbance to nesting or roosting condors.

Alternative A

<u>Prior consultations under the Endangered Species Act</u>

A BA for the continued implementation of forest LRMPs across the region was prepared in 2004 (USDA Forest Service 2004d). The BA found that LRMPs were “not likely to jeopardize the continued existence” of the California condor, but only the Kaibab NF was analyzed; the Coconino NF LRMP was not. The 2005 BO concurred with the finding (USDI Fish and Wildlife Service 2005a).

Another BA for the continued implementation of forest LRMPs across the region was prepared in 2011, due to new information on species and/or critical habitat (USDA Forest Service 2011f). For the Coconino LRMP, the finding was “not likely to jeopardize” the continued existence of the non-essential experimental California condor population, and “may affect, not likely to adversely affect” the fully listed population. The 2012 BO concurred with these findings (USDI Fish and Wildlife Service 2012d).

The analyses for the TMR project determined that the decision would have no effect on the condor, and therefore, would not jeopardize the continued existence of the species (USDA Forest Service 2010d, 2011m, USDI Fish and Wildlife Service 2011e, 2011f).

In summary, taking into account the “no effect” finding for the TMR project, the findings from the 2011 BA of “not likely to jeopardize” for the non-essential experimental population, and “may affect, not likely to adversely affect” the California condor would remain appropriate for this current analysis.

<u>Viability</u>

While the 1987 plan contains standards and guidelines supporting recovery of listed species and other supportive guidance, (1987 Plan, pages 22-1 to 22-3) the forest has little control over the primary threat to condors (ingestion of lead shot), should they occur on the Coconino NF. Harvest of game animals is regulated by the Arizona Game and Fish Department.

Table 50 summarizes and compares the analysis for the California condor. This table shows that under alternative A, cliffs and caves would remain in good condition and have a static trend with regard to desired conditions. The assumption was that any cave used by California condors for

nesting would be mainly inaccessible and therefore in good condition and likely to remain in that condition.

The likelihood that habitat on the forest would be a limiting factor for California condor is low as shown in table 50. This likelihood was derived by combining the California condor's F Rank of FN with the likelihood of habitat limitation variable for cliffs and caves (low) (table 9). Low to moderate ratings are considered to be within the natural range of fluctuations for the habitat.

The management effect row shows the relative expected outcome of plan language in terms of minimizing species viability risk. The management effect is classified as a 3 for caves, which means that plan components in alternative A maintain or improve protection and management for some habitat occurrences in the plan area, and thus, contribute less to the viability of this species than the other alternatives. The management effect is classified as a 4 for cliffs, which means there is a decline in habitat quality as a result of management or lack of management that result from plan components. Plan components may not exist or may be few.

While alternative A does not have plan components specific to cliffs, it does contain plan language beneficial for peregrine falcons, another cliff-dwelling species. These components could be beneficial for the other cliff-dwelling species in locations where they share habitat with peregrine falcons. Alternative A also includes a goal in the Sedona/Oak Creek Ecosystem Area to work with air tour companies and rock climbers to eliminate disturbing activities near occupied eyries during the peregrine falcon breeding season (March 1 to August 31); and guidelines for specific buffers depending on the disturbance (including smoke from fires) (1987 Plan, page 206-11 through 13). There is similar guidance in the Flagstaff-Lake Mary Ecosystem Area (1987 Plan, pages 206-67, 116). There is also forestwide direction to reduce disturbance to nesting peregrines (1987 Plan, page 64-1). See the discussion on Disturbance in the Wildlife and Plant Issues and Topics section in this volume for additional information.

Plan components in alternative A would conserve wildlife habitat provided by caves and would keep cave locations confidential when needed to protect wildlife habitat and cave biota (1987 Plan, pages 22 and 51-1). Standards and guidelines that minimize impacts to caves would be beneficial to wildlife species including the condor. Management activities planned near or within a known cave area are evaluated for their potential impacts, cave microclimate, hydrology, and entrance vegetation is maintained to preserve cave ecology, and during project planning, at least a 300-foot radius around cave entrances, infeeder drainages, and surface areas immediately over cave passages is maintained to minimize any negative effects on cave resources (1987 Plan, pages 51-1 through 51-2). In addition, caves of high resource values, and a suitable buffer area of approximately one-quarter mile from known cave passages, may be recommended for withdrawal from mineral entry (1987 Plan page 51-2). Alternative A provides the greatest number of miles of NFS roads open to motorized travel, but it does not consider any new wilderness or management areas. Roads would be decommissioned or closed in compliance with the 1987 plan and the 2011 Travel Management Decision, but there are no specific objectives for road decommissioning. The 1987 plan provides direction to provide and manage a transportation system that fulfills the needs of the public (1987 Plan, page 24). This direction could increase opportunities for vehicle collisions by the condor and or large ungulates it preys upon. There is no decision or plan direction to close or decommission roads or camping corridors. Likewise, there are no express suitability determinations included in this alternative. The road system and camping corridors would continue to be managed and adjusted through the TMR process.

Specific special use direction on processing has been changed in policy and regulation since the 1987 plan was implemented and some direction and terminology is outdated. Conflicting direction could affect the special use permitting process and require plan amendments to implement current projects. Utility corridor direction encourages maximizing the use of existing corridors before looking at new ones and new corridors on the forest would be limited (1987 Plan, pages 24, 206-21). This would benefit condors by minimizing collisions with powerlines, should they become established on the forest. Overall, the 1987 plan provides encourages special uses that meet the needs of expanding communities, while minimizing impacts to other resource values, but direction is broad and somewhat outdated. Alternative A has the least restrictions on where transmission lines could be located.

Alternative A, also has some general language that would minimize human interactions with condors by limiting opportunities for commercial recreation and considering natural resources in that process (1987 Plan, page 115-4). Guidelines for ROS aid in determining appropriate types and numbers of individual, groups, outfitter/guides, and special uses (1987 Plan, page 206-62).

Alternative B (modified)

Table 50 shows that under alternative B (modified) cliffs, and caves used by condors, would remain in good condition and have a static trend related to desired conditions, like alternative A.

As shown in table 50, the likelihood that habitat on the forest would be a limiting factor for California condor is low. This likelihood was derived by combining the California condor’s F Rank of FN with the likelihood of habitat limitation variables for cliffs and caves (low) (table 9). Low to moderate ratings are considered to be within the natural range of fluctuations for the habitat.

The management effect row shows the relative expected outcome of plan language in terms of minimizing species viability risk. The management effect is classified as a 2, which means that plan components in alternative B (modified) maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area. Desired conditions for Biophysical Features seek to maintain cliffs in generally undisturbed conditions from human activities, maintaining the cultural, archaeological, geological, hydrological, paleontological, biological, and aesthetic resources of these features (FW-BioPhy-Geo-DC-1) and acknowledge the importance of the specialized habitats for plants and animals that depend on them (FW-BioPhy-Geo-DC-6). Projects should be designed and uses should be managed to maintain the integrity and function of cliffs. A desired condition provides direction for preserving the composition, structure and function of the ERUs and the physical features including cliffs and rock piles that provide habitat and refugia for the plants and animals that depend on them (FW-WFP–DC-5).

Condors in Arizona nest and roost in steep terrain with cliffs, ledges, and caves. Plan components for geological features include desired conditions that biophysical features are generally undisturbed by human activities and (FW-BioPhys-Geo-DC-1) and that they provide habitat for species that require specialized niches for nesting, roosting, and overwintering (FW-BioPhys-Geo-DC-3 and 6). These goals would be positive for condors, by limiting disturbance (e.g., rock climbing) nears cliffs and caves used by condors for nesting or roosting. Guidelines to protect geological features call for designing projects and uses to maintain their integrity and function (FW-BioPhys-Geo-G-1).

Alternative B (modified) provides a mix of road closures, new recommended wilderness areas, more areas managed for SPNM ROS settings, and areas determined to be not suitable for temporary and permanent road construction, which would decrease the motorized travel on the forest compared to alternative A. Existing roads can influence the condor directly through mortality from collision. Collisions that kill ungulates can provide carrion for feeding condors. If condors were present, construction, maintenance and modifications could disturb condors, and construction could provide access to areas occupied by condors. Until condors occupy the forest, these would not affect the population. An objective to decommission 200 to 800 miles of roads during the 10 years following plan approval (FW-RdsFac-O-1) could prove beneficial if roads were decommissioned adjacent to or near condor nest or roost sites, by reducing the unauthorized motorized use of these roads. Finally, 10 guidelines that provide sideboards to future projects and activities are provided in the proposed plan. Most guidelines relate to protecting habitat in a variety of ways, such as ensuring best management practices are applied and to naturalize temporary roads soon after use (FW-RdsFac-G-5 and 8). Relative to the condor, FW-RdsFac-G-6 calls for decommissioning unneeded roads, and FW-RdsFac-G-7 recommends that existing roads be used or realigned before constructing new roads to avoid areas where disturbance-sensitive threatened and endangered species are present. These guidelines would be positive for the condor if applied in the vicinity of nesting or roosting areas.

Lands special use authorizations include utility lines, communication sites, research permits, and others. Recreation special uses include things such as outfitter-guide services, skiing, and special events. Collisions, particularly with powerlines, are a threat to condors and are addressed though two desired conditions:

- FW-Spec-Use-DC-2 states that infrastructure related to utility and energy transmission corridors meets legal mandates while maintaining or moving toward other desired conditions.
- FW-Spec-Use-DC-3 expresses the goal that utility lines be buried when possible, which would avoid any potential for collisions.

Several guidelines would relate to condor management. A guideline recommends that lands special uses should be designed to maintain or move toward desired conditions for other resources (FW-SpecUse-G-1), which would include desired conditions for condors. Several other guidelines call for locating and designing new and reconstructed utility infrastructure to minimize impacts to wildlife (FW-SpecUse-G-5), and for using or expanding existing sites or corridors for communication towers and utilities instead of creating new sites (FW-SpecUse-G-4, 8). Another guideline calls for burying utility lines when possible (FW-Spec-Use-G-9). Collectively, these guidelines would help lessen potential collision impacts to condors, should they occupy the forest in the future.

Communication is a useful tool to make visitors aware of the hazard of using lead shot for carrion-feeding wildlife like condors. A desired condition in the section on Interpretation and Education promotes a land ethic that would reduce visitor impact on ecosystems and supports protection of natural resources. This desired condition could promote lead reduction and other wildlife awareness principles by the visiting public (FW-InterpEd-DC-1).

Within the experimental population area, there are all or portions of three existing wildernesses: Kachina Peaks, Kendrick Mountain, and Strawberry Crater. Kendrick Mountain Wilderness is managed by the Kaibab NF. Alternative B (modified) would recommend adding 415 acres to the

Kachina Peaks Wilderness through the addition of the Abineau recommended wilderness and 6,579 acres to the Strawberry Crater Wilderness. These additions could have a minor beneficial effect to condors by prohibiting motorized use and powerline construction that can result in condor collisions.

Alternative C

Alternative C will have similar effects to alternative B (modified). Alternative C plan components differ very little from alternative B (modified). The environmental effects from adopting the different plan components for old growth, management areas, and special areas are minor. Applying the plan guidance for the 10 additional proposed wilderness areas is expected to result in a minor additional beneficial effect to the species through prohibition of motorized use and powerline construction in these areas. Like alternative B (modified), guidance in alternative C supports re-introduction and management of listed species. Plan guidance would not have a direct influence on the potential for condors to ingest lead shot. Unlike alternative B (modified), mechanized travel in botanical and geological areas is not suitable. This would have some slight benefits for the condor should it become established on the forest, by reducing the possibility of related disturbance in those areas.

Alternative D

Alternative D will have similar effects to alternative B (modified), with a few notable exceptions. Alternative D responds to public suggestions for no additional wilderness areas and to allow mechanized recreation in botanical and geological areas. Alternative D also responds to issues regarding future energy corridor expansion needs. One corridor is approximately 21 miles between Sycamore and Red Rock-Secret Mountain wildernesses, and the other is approximately 11 miles along State Highway 87. Both of these corridors are outside of the experimental population area for condors. However, powerline collisions are a threat to condors, and this alternative increases the risk of collisions along 32 miles of powerline, if and when expansion occurs. Plan guidance for roads, facilities, and special uses as noted in B (modified) above would still apply, however, and mitigate those threats.

No new wilderness areas are being proposed in alternative D. The effects associated with managing those areas as recommended wilderness would not occur. These areas would still be managed by the other forestwide, management area, and special area direction in alternative B (modified) with the corresponding effects discussed above in the alternative B (modified) section. This difference between the alternatives would not result in a change in the condition or trend of the riparian habitats from those provided by alternative B (modified) for this species.

Findings

In the 20 years since reintroduction, wandering condors have only been detected on the forest twice. Their breeding range is focused from the Grand Canyon/Colorado River area north into Utah. The basic elements condors need are cliffs and caves for nesting and roosting, and abundant carrion. The key threat to condors is ingestion of lead shot, and while the forest does not have control over that factor, it would cooperate with Arizona Game and Fish Department should they expand their voluntary lead shot program to the Coconino NF and would promote lead reduction in wildlife awareness communication with the public. Guidance in the plan is generally supportive of re-introduction and management of listed species, which would apply to the condor if it establishes in the future within the experimental population area or outside of it. Of the

primary threats to the condor, the only one affected by Forest management activities is the threat of collisions and the alternatives have plan components to address that threat.

Should the condor become established on the forest in the future, all alternatives would contribute to the viability of the species because all alternatives include plan components that would protect suitable nesting habitat (e.g., caves and cliffs) and balance special use permits with other resource values. Alternative C may be slightly more beneficial than alternatives A, B (modified), and D, because of the additional wilderness area designations and limitations on recreation and mechanized travel that may reduce human-wildlife interactions. Alternative D is least protective because of its provisions for future energy corridor expansion which could increase the risk for collision.

Mexican Spotted Owl

Affected Environment

Since the Mexican spotted owl was listed in 1993, the forest has taken a number of actions to contribute toward recovery of the species. For any project within the range of the owl, the forest considers needs for the species in project design, analyzes effects of the project, and consults with the Fish and Wildlife Service as needed. In addition, surveys are conducted to protocol prior to project implementation; the Regional Office has funded implementation of population occupancy design on NFS lands in the southwestern region; monitoring of known protected activity centers (PACs) is done as needed and as required through biological opinions from the Fish and Wildlife Service, and people conducting surveys and monitoring receive Fish and Wildlife Service - approved training and applicable permits.

Distribution

It ranges from Utah, Colorado, Arizona, New Mexico, and the western portions of Texas south into several states of Mexico (USDI Fish and Wildlife Service 2012b). As of January 2016, there are 192 Mexican spotted owl PACs that are completely or partially on the Coconino NF. Several overlap with Walnut Canyon National Monument, Apache-Sitgreaves National Forests, and Kaibab National Forest.

Habitat

ERUs that support Mexican spotted owl habitat are Ponderosa Pine, Mixed Conifer with Frequent Fire, and Mixed Conifer with Infrequent Fire. Forested riparian types that also provide dispersal or wintering habitat includes Cottonwood Willow, Mixed Broadleaf and Montane Willow Riparian Forests. Mixed conifer systems are moderately departed and Ponderosa Pine is highly departed from reference conditions. Both systems are trending away from reference conditions. Riparian systems are in fair to good condition and are trending toward reference conditions or are static. See the Coarse Filter: Habitat section in this volume and Riparian Resources and Vegetation and Fire in volume 1 for additional details on departures from reference conditions.

On the Coconino NF, ponderosa pine and mixed conifer habitats are the dominant vegetation types within Mexican spotted owl PACs (table 51). Mexican spotted owls use cliffs and canyons within these habitat types, particularly on the Mogollon Rim Ranger District. Habitat is characterized by high canopy closure, high stem density, multi-layered canopies within the stand, numerous snags, and downed woody material. PACs are established at all Mexican spotted owl known and historical sites and are at least 600 acres in size, encompassing known nests, roosts,

and the best available habitat in the area. Current total acreage in PACs on lands managed by the forest is approximately 117,080 acres (table 51). PAC acreage is a relatively small portion of overall ERU acreages (table 51). The first row shows that there are 797,171 acres of ponderosa pine on the forest and there are 85,975 PAC acres in ponderosa pine. This row also shows that 73 percent of the total PAC acreage is ponderosa pine and that 11 percent of ponderosa pine is in PACs. The forest does not have the Ponderosa Pine ERU broken out by pure pine and pine/oak, but it is estimated to be approximately 40 percent (USDA Forest Service 2009a), or 318,868 acres (table 51). Since the Mexican spotted owl does not typically nest or roost in pure ponderosa pine, the 85,975 acres in PACs is assumed to be pine-oak.

Table 52 shows the estimated amount of recovery habitat on the forest. Recovery habitat is primarily ponderosa pine-Gambel oak, mixed conifer, and riparian forest that currently is, or has the potential for becoming nest/roost habitat, or does or could provide foraging, dispersal, or wintering habitats (USDI Fish and Wildlife Service 2012b). The amount was determined by subtracting PAC acres from total ERU acres. Pine-oak recovery habitat is refined at the project level. All vegetation types are typically refined at the project level, based on field observations and available data. Numbers used in this analysis are necessarily at a coarser level than will be available site-specifically as projects are implemented under the forest plan.

Table 51. Mexican spotted owl PAC acreage, percent by ERU, and percent of total ERU acreage within PACs

ERU	ERU Acres	PAC Acres	ERU Percent of Total PAC Acres	Percentage of Total ERU Acreage in PACs
Ponderosa Pine	797,171	85,975	73	11
Pine-oak estimated	*318,868*	*85,975*	*73*	*27*
Mixed Conifer with Infrequent Fire	37,143	13,104	11	35
Mixed Conifer with Frequent Fire	49,595	7,621	7	15
Interior Chaparral	50,471	3,738	3	7
Montane Willow Riparian Forest	3,568	1,615	1	45
Pinyon Juniper Woodland (Persistent)	75,439	1,668	1	2
Gallery Coniferous Riparian Forest*	200	138	<1	69
Spruce Fir	13,946	734	<1	5
Montane/Subalpine Grassland	23,656	645	<1	3
Water	2,932	81	<1	3
Wetland/Cienega/Lakes	10,121	157	<1	2
Cottonwood Willow Riparian Forest	1,324	17	<1	1
Mixed Broadleaf Deciduous Riparian Forest	5,926	183	<1	3
Great Basin Grassland	92,842	119	<1	<1
Pinyon Juniper with Grass	261,454	558	<1	<1
Pinyon Juniper Evergreen Shrub	263,554	827	<1	<1
Totals:		**117,080**	**100**	

*Updated riparian mapping indicates that Gallery Coniferous Riparian Forest does not occur on the forest. The areas formerly classified as Gallery Coniferous (upper end of West Fork and Jack's Canyon for example) more likely fall under the Mixed Broadleaf Deciduous or Montane Willow Riparian Forest types, but this would be decided at the project level.

Table 52. Estimated PAC and recovery habitat on the Coconino NF

ERU	ERU Acres	PAC Acres	Estimated Recovery Habitat (acres)
Pine-oak estimated	*318,868*	85,975	*232,893*
Mixed Conifer with Infrequent Fire	37,143	13,104	24,039
Mixed Conifer with Frequent Fire	49,595	7,621	41,974
Montane Willow Riparian Forest	3,568	1,615	1,953
Gallery Coniferous Riparian Forest*	200	138	62
Cottonwood Willow Riparian Forest	1,324	17	1,307
Mixed Broadleaf Deciduous Riparian Forest	5,926	83	5,843

*Updated riparian mapping indicates that Gallery Coniferous Riparian Forest does not occur on the forest. The areas formerly classified as Gallery Coniferous (upper end of West Fork and Jack's Canyon for example) more likely fall under the Mixed Broadleaf Deciduous or Montane Willow Riparian Forest types but this would be decided at the project level.

Critical Habitat: On August 31, 2004, the Fish and Wildlife Service designated approximately 8.6 million acres of critical habitat for the Mexican spotted owl on Federal lands in Arizona, Colorado, New Mexico, and Utah and described the primary constituent elements (PCE) in detail (USDI Fish and Wildlife Service 2004). Within the critical habitat boundaries, critical habitat included only protected and restricted habitats as defined in the original Recovery Plan (USDI Fish and Wildlife Service 1995b). It also excluded 157 wildland-urban interface project areas on NFS lands. In summary, the primary constituent elements of critical habitat are forest structure (PCE 1a: range of trees species, 1b: canopy, 1c: snags), maintenance of adequate prey base (PCE 2a: high volume of woody debris, 2b: high plant and tree diversity, 2c: adequate plant cover), and canyon habitat (3a: water, 3b: clumps or stringers of riparian vegetation and/or forest and woodland tree species; 3c: canyon walls with crevices, ledges, or caves; 3d: high percentage of litter and woody debris).

On the forest, there are approximately 550,500 acres within critical habitat boundaries. This acreage is within all or a portion of six critical habitat units within the Upper Gila Mountains Recovery Unit. As defined in the 1995 recovery plan (USDI Fish and Wildlife Service 1995), protected and restricted habitat was used as the basis for critical habitat definition. Protected areas included PACs, areas in mixed conifer and pine-oak with greater than 40 percent slopes where timber harvest hasn't occurred in the past 20 years, and administratively reserved lands such as Wilderness Areas or Research Natural Areas. Restricted habitat included mixed conifer, pine-oak, and riparian forests outside of PACs. While a variety of ERUs are within the boundaries of the critical habitat designation, mixed conifer, pine-oak, and riparian forest provide the PCEs necessary for owl habitat. Critical habitat comprises between 2 to 81 percent of total ERU acreage.

Risk Factors

Since the Mexican spotted owl was listed in 1993, the key threat has shifted from even-aged timber management to stand-replacing fire (USDI Fish and Wildlife Service 2012b). Some additional threats and factors influencing the Mexican spotted owl include fuels reduction activities, fuelwood collection, recreation, ungulate grazing, roads and trails, and land development. See the recovery plan for detailed information on current threats.

Environmental Consequences

The scope of the analysis for the Mexican spotted owl includes all habitat on the forest, including designated critical habitat, and PAC and recovery habitat as defined by the recovery plan. The analysis below focuses on those risk factors and program areas that would be most consequential in terms of maintaining viability for Mexican spotted owl.

Table 53 summarizes the viability analysis for Mexican spotted owl. This table was developed using the analysis process described under the Species Viability section above. It includes information on the status, F Rank, habitat, habitat condition and trend, likelihood that this species is limited by its habitat, and the projected management effect, by alternative. Management effect categorizes the relative expected outcome of plan language in each alternative in terms of minimizing species viability risk and are the result of plan decisions, including plan objectives. Management effect category values are 1, 2, 3, and 4. The lower the management effects rating for a species' associated habitat, the more effective the alternative is for that species viability. These topics and the effects of the alternatives are explained in greater detail in the discussions on the alternatives that follow.

Table 53. Analysis summary for the Mexican spotted owl

Species and status	Habitat	Alternative A		Alternatives B (modified), C, D	
		Habitat condition and trend relative to desired conditions	Likelihood species is limited	Habitat condition and trend relative to desired conditions	Likelihood species is limited
Mexican spotted owl (Threatened, endemic) F Rank = F2*	PP	Low objective: Poor at short term then Fair at long term, trending toward High objective: Fair, trending toward	Low objective short term: M-H Low objective long term: M-H High objective: M-H	Low objective: Poor at short term then Fair at long term, trending toward High objective: Fair, trending toward	Low objective short term: M-H Low objective long term: M-H High objective: M-H
	MCFF	Fair, trending toward at short term then static trend at long term	M-H	Low objective: Fair, toward at short term then Fair, static at long term High objective: Good, toward at short term then Good, static at long term	Low objective: M-H High objective: M
	MCIF	Fair, trending away at short term then Poor, trending away at long term	Short term: M-H Long term: H	Fair, static	M-H

Species and status	Habitat	Alternative A		Alternatives B (modified), C, D	
		Habitat condition and trend relative to desired conditions	Likelihood species is limited	Habitat condition and trend relative to desired conditions	Likelihood species is limited
	Cliffs	Good, static	M	Good, static	M

Management effect	PP, MCFF, MCIF = 3: Plan components maintain or improve protection and management for some habitat occurrences in the plan area. Quality of habitat or habitat elements is maintained or improved by providing protection, maintenance, and restoration to some occurrences. Cliffs = 4: There is a decline in habitat quality as a result of management or lack of management that result from plan components. Plan components may not exist or may be few.	All habitats = 2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.

*F2: Rare on the forest within its habitat - occupies a small portion of its habitat

Common to All Alternatives

Plan components in all alternatives contribute to species viability by managing for sustainable populations of native species and improving and protecting habitat for threatened, endangered, and sensitive species (1987 Plan, pages 22-1, 23, 64, 64-1, 66, 95, 108-2, 180, 187, 206-9, 206-11, 206-12, 206-13, 206-23, 206-30, 206-32, 206-66, 206-67, 206-71, 206-72, 206-79, 206-87, 206-89, 206-98, 206-103, 206-105, 206-108, 206-109, 206-114; FW-WFP-DC-1, 2, 3, 4, 5, 6, 8, and FW-Eco-DC-1). See At-risk Species in the Wildlife and Plant Issues and Topics section above for more information.

All alternatives would continue to follow guidance in the most current Mexican spotted owl recovery plan and consult with the Fish and Wildlife Service on project design and implementation. The forest would continue to implement conservation actions as mentioned above. All alternatives would follow management and direction provided in FSM 2356 with regard to cave resource management during project planning and general intent of the Federal Cave Resource Protection Act of 1988 (P.L. 100-691). The Coarse Filter: Habitat sections on the Ponderosa Pine, Mixed Conifer Frequent Fire, and Mixed Conifer Infrequent Fire ERUs provide additional information regarding how the alternatives address habitat threats to Mexican spotted owl habitat.

Alternative A

Prior consultations under the Endangered Species Act

A BA for the continued implementation of forest LRMPs across the region was prepared in 2004 (USDA Forest Service 2004d). The BA found that the continued implementation of the Coconino Land Management Plan was "likely to adversely affect" the Mexican spotted owl and its critical

habitat. Some of the reasons for the adverse effect findings were related to issuance of special use permits, fuels reduction and watershed management projects, and livestock grazing.

The 2005 BO determined that the majority of the applicable standards and guidelines in the Coconino's LRMP would maintain habitat and provide at least minimal recovery for the owl, but that some of the guidance would cause negative effects (USDI Fish and Wildlife Service 2005a). Overall, the BO determined that the effects of the proposed action "is not likely to jeopardize the continued existence" of the Mexican spotted owl, and "is not likely to destroy or adversely modify" designated critical habitat. The BO found that incidental take would be reasonably certain to occur as a result of continued implementation of the LRMPs, and assigned take by recovery unit instead of individual forests.

Another BA for the continued implementation of forest LRMPs across the region was prepared in 2011, due to new information on species and/or critical habitat (USDA Forest Service 2011f). The finding for the Mexican spotted owl for the Coconino LRMP was "may affect, likely to adversely affect" for the species and designated critical habitat. These findings were based on the determination that there was no new significant scientific information or data that would change the effects analysis for the Mexican spotted owl and its designated critical habitat.

The 2012 BO concluded that the continued implementation of the LRMP for the Coconino NF would not be likely to jeopardize the continued existence of the Mexican spotted owl, and would not be likely to destroy or adversely modify designated critical habitat (USDI Fish and Wildlife Service 2012d). The BO found that incidental take would be reasonably certain to occur as a result of continued implementation of the Coconino LRMP, and assigned incidental take specific to the forest.

The BAs for the TMR project determined that the decision would largely benefit the Mexican spotted owl by reducing disturbance of owls and reducing impacts to habitat through a reduction of roads and motorized trails within PACs, but that designation of camping corridors in PACs would continue to concentrate use and could affect the quality of habitat (USDA Forest Service 2010d). The finding was "may affect, not likely to adversely affect" for the Mexican spotted owl and its habitat. The finding for critical habitat was also "may affect, not likely to adversely affect" based on an insignificant and discountable loss of critical habitat through designation of a small amount of user-created road as an NFS road, and designation of some motorized dispersed camping corridors.

The amended BA for motorized big game retrieval (MBGR) found that there would be an increase in MBGR within PACs, other owl habitat, and critical habitat, but that adverse effects would not be expected (USDA Forest Service 2011m). This was based on the timing of MBGR and provisions that minimize potential impacts. Therefore, the finding of "may affect, not likely to adversely affect" for the species and its critical habitat did not change from the 2010 TMR BA. The Fish and Wildlife Service concurred with those findings (USDI Fish and Wildlife Service 2011e, 2011f).

In summary, taking into account the TMR project and its resulting LRMP amendment, the findings from the 2011 BA of "may affect, not likely to adversely affect" the Mexican spotted owl, its habitat, and its designated critical habitat would remain appropriate for this current analysis.

Viability

Table 53 summarizes and compares the analyses for the Mexican spotted owl. This table shows that under alternative A, Ponderosa Pine ERU would remain in poor condition and trend toward desired conditions in the short term under the low Mexican spotted owl treatment objectives (50,000 acres mechanical, 120,000 acres prescribed burn). However, in the short term under the high vegetation treatment objectives (260,050 acres mechanical, 200,000 acres prescribed fire) and in the long term under both the low and high vegetation treatment objectives, the condition would improve to fair and trend toward desired conditions. The improved vegetation structure and composition would reduce the risk of uncharacteristic fire. Mixed Conifer with Frequent Fire would remain in fair condition and initially trend toward desired conditions, but then become static relative to desired conditions in the long term. Mixed conifer with Infrequent Fire would remain in fair condition and trend away from desired conditions in the short term. In the long term, Mixed conifer with Infrequent Fire would be in poor condition with a trend away from desired conditions. Cliffs would remain in good condition with a static trend.

The likelihood that that habitat on the forest would be a limiting factor for Mexican spotted owl is moderate to high and varies by habitat as shown in table 53. These likelihoods were derived by combining the Mexican spotted owl’s F Rank of F2 with the likelihood of habitat limitation variables for each ERU: Ponderosa Pine (moderate in short term and low-moderate in long term for low treatment objective; low-moderate for high treatment objective), Mixed Conifer with Frequent Fire (moderate), Mixed Conifer with Infrequent Fire (moderate in short term and high in the long term), and cliffs (low) (table 9). Low to moderate ratings are considered to be within the natural range of fluctuations for the habitat.

The management effect row shows the relative expected outcome of plan language in terms of minimizing species viability risk. The management effect is classified as a 3 for all the coarse filter habitats associated with Mexican spotted owl. This means that plan components in alternative A maintain or improve protection and management for some habitat occurrences in the plan area, and thus, contribute less to the viability of this species than the other alternatives.

For the Ponderosa Pine and Mixed Conifer ERUs, this management effect rating is because plan language does not move these ERUs toward desired conditions. Alternative A contains outdated language for Mexican spotted owls, Gambel oak, and old growth and does not incorporate best available science. This rating is also because current guidelines create a window of opportunity that is so narrow as to essentially prevent the use of wildfires with resource objectives in wilderness (1987 Plan, pages 93 to 95, 111, 112). As a result, fire has not been allowed to play its natural role in wilderness, and departure from desired conditions has increased along with the risk of uncharacteristic fire under alternative A. Alternative A does not have forestwide desired conditions or objectives that specify restoration of natural fire regimes to address the threat of uncharacteristic fire, except in certain management areas. In addition, alternative A does not distinguish between the two mixed conifer types based on composition, structure, and function but rather plan language separates ponderosa and mixed conifer based on slope.

Cliff habitat also has a management effect rating of 4, because plan components for cliffs are generally lacking and where there is guidance, it focuses on peregrine falcons.

While alternative A does not have plan components specific to cliffs, but it does contain plan language beneficial for peregrine falcons. These could be beneficial for the other cliff-dwelling species in locations where they share habitat with peregrine falcons. Alternative A also includes a

goal in the Sedona/Oak Creek Ecosystem Area to work with air tour companies and rock climbers to eliminate disturbing activities near occupied eyries during the peregrine falcon breeding season (March 1 to August 31); and guidelines for specific buffers depending on the disturbance (including smoke from fires) and direction to apply the Peregrine Falcon Recovery Plan (1987 Plan, page 206-11 through 13). The reference to the recovery plan is outdated because this species is no longer federally listed. There is similar guidance in the Flagstaff-Lake Mary Ecosystem Area (1987 Plan, pages 206-67, 116). There is also forestwide direction to reduce disturbance to nesting peregrines (1987 Plan, page 64-1).

Standards and guidelines that minimize impacts to caves would be beneficial to wildlife species including Mexican spotted owl. Management activities planned near or within known cave areas are evaluated for their potential impacts, cave microclimate, hydrology, and entrance vegetation is maintained to preserve cave ecology, and during project planning, at least a 300-foot radius around cave entrances, infeeder drainages, and surface areas immediately over cave passages is maintained to minimize any negative effects on cave resources (1987 Plan, pages 51-1 to 51-2). In addition, caves of high resource values, and a suitable buffer area of approximately one-quarter mile from known cave passages, may be recommended for withdrawal from mineral entry (1987 Plan, page 51-2). This alternative includes some modest direction that could benefit the owl and its dispersal and overwintering habitat. There are goals that emphasize restoration of riparian communities and the species that depend on them and a broadly defined objective for 80 percent riparian recovery by 2030 (1987 Plan, page 28), likely unachievable given the current rate of implementation on the forest. Without specific measures and completion dates, it is unclear how such projects would get prioritized in the future. Beneficial guidelines emphasize restoration of high-elevation riparian communities particularly in the Lake Mary and Oak Creek watersheds, but are otherwise vague (1987 Plan, page 206-78). One guideline emphasizes the development of trails while protecting riparian communities and wildlife habitat (1987 Plan, page 206-79). There are also standards and guidelines specific to the owl for restricted habitat that emphasize maintenance and restoration of healthy riparian ecosystems (1987 Plan, page 65-5), that management strategies should move degraded riparian vegetation toward good condition as soon as possible and damage to riparian vegetation, streambanks, and channels should be prevented (1987 Plan, page 65-5). Alternative A also includes several standards and guidelines related to protecting water resources and stream riparian areas that would support Mexican spotted owl habitat. These include: procurement of instream flow water rights; protection of riparian areas though filter strips; and maintaining 80 percent crown cover, 80 percent emergent vegetation cover, and three age classes of woody riparian species (1987 Plan, page 174). There are also objectives to construct 10 miles of fences per decade for the first two decades where necessary to protect key wet meadows, wetlands, and riparian regeneration from grazing (1987 Plan, page 175) and prioritize road closures where poorly designed or maintained roads are adjacent to or connected to stream courses where potential for increased runoff or sedimentation is high and where roads within stream courses or wetlands (permanently or intermittently wet) are reducing hydrologic function (1987 Plan, page 206-71). For the riparian forest types, continued implementation of alternative A would slowly move the Cottonwood Willow riparian areas toward the desired condition of properly functioning condition, while the trend for Mixed Broadleaf Forest and Montane Willow Riparian forest type would remain static or slowly toward desired condition, depending on the watershed (see Riparian Areas, volume I). Overall guidance is positive and should provide foraging and dispersal habitat for the owl, as well as for its prey.

Alterative A provides direction with an emphasis on timber production, other forest products, livestock grazing, recreation, and wildlife habitat (1987 Plan, pages 117, 118). Uneven-aged management is emphasized and standard prescription guidelines are provided for ponderosa pine under various scenarios (1987 Plan, pages 130 to 135). Under this alternative, all pine-oak forests are considered to be Mexican spotted owl restricted habitat; in addition, pine-oak areas that are on slopes greater than 40 percent where timber harvest has not occurred in the last 20 years are also considered protected habitat (1987 Plan, page 65). Emphasis is placed on retaining relatively high densities and retaining and promoting large oaks (1987 Plan, pages 65 to 65-4). Alternative A provides direction that allows for a variety of stand conditions across the landscape (1987 Plan, page 65-3) while mimicking natural disturbance patterns that result in irregular tree groups and canopy gaps (1987 Plan, page 65-4), harvest activities, however, even for the purpose of restoration, are limited. Prescribed fire is permitted through much of the protected and restricted areas except for select areas around nests designated for “no treatment” (1987 Plan, pages 65-2 to 65-4). Mechanical treatment in PACs is largely limited to fuelwood harvest and fire risk abatement. In addition, thinning is primarily limited to conifers less than 9 inches d.b.h. (1987 Plan, page 65-2). In 10 percent of the restricted habitat, that would be managed for replacement nesting and roosting habitat, the basal area thresholds are higher than those identified under the current recovery plan for the owl (USDI Fish and Wildlife Service 2012b). As a consequence of these standards and guidelines (1987 Plan, pages 65, 65-2 to 65-4), past treatments prescribed under the existing Forest Plan have left some areas with high tree densities that do not promote resilience and increase the forest’s susceptibility to insect and disease outbreaks and uncharacteristic wildfires. In these areas, high tree densities limit Gambel oak and early seral species like aspen from establishing; however, guidance does favor the retention of large oaks in pine-oak forest/restricted habitat (1987 Plan, pages 65-4, 131).

Direction for old growth under alternative A emphasizes standards and guidelines to maintain and promote development of owl habitat (1987 Plan, page 65-5). However, the minimum criteria used to determine structural attributes for old growth is very prescriptive; determined at the stand level (1987 Plan, page 70-2) and does not necessarily account for natural disturbance processes that frequently occur across multiple scales. Rather than having old-growth components present throughout the landscape, this approach tends to promote more even-aged conditions that could put old growth at risk from active crown fires that can lead to stand replacement. This even-aged stand structure would also limit recruitment of trees into the medium and larger size classes over time, reducing the structural complexity necessary for maintaining adequate roosting/ nesting habitat, and prey availability. In the short term, this prescriptive guidance may be beneficial to MSO; however, in the long term, owl habitat could be more subject to risk from stand-replacing fire, less well distributed and of a lesser quality than it could be.

There are no specific treatment objectives for pine under this alternative; however, based on previous rate of treatment and the expected rate throughout implementation of the Four-Forest Restoration Initiative, the VDDT model for ponderosa pine predicts that over the life of the plan, alternative A (as well as the other alternatives) would improve the vegetative structure and composition of the Ponderosa Pine ERU (see the discussion on Ponderosa Pine ERU in the Vegetation and Fire section in volume 1) and in so doing, would also reduce the risk of uncharacteristic fire. Nesting/roosting habitat (represented by model states K, L, and M; Table C-7, Volume 3) would also move toward desired conditions. Rate of treatment for this alternative would be from 150,000 (low) to 200,000 (high) acres for prescribed burns, and 50,000 (low) to 260,500 (high) for mechanical treatment (Table C-1, Volume 3). At this rate of treatment,

roosting/nesting habitat would move toward desired conditions, but would not be optimized. Snags of various sizes would be scattered across the landscape and are expected to remain static or increase. Overall, the ERU is expected to remain highly departed in the short term and become moderately departed after 15 years using the high treatment objective (see Ponderosa Pine, volume 1).

Alternative A does not distinguish between Mixed Conifer with Frequent Fire and Mixed Conifer with Infrequent Fire, but rather has one management area that is ponderosa pine and mixed conifer less than 40 percent slope, and another management area that is greater than 40 percent slope. Specific direction for mixed conifer in alternative A is vague particularly on how to maintain mixed conifer across multiple spatial scales, and lacks specific objectives (1987 Plan, pages 117,125,133,138). Direction on Mexican spotted owl habitat, however, is more specific but points to an outdated recovery plan that limits mechanical treatment of most trees over 9 inches d.b.h. This could limit the forest's ability to significantly reduce tree densities to the level that risk from stand-replacing fire will be appreciably reduced. This direction is in conflict with the current recovery plan for the owl, which notes stand-replacing wildfires as the most significant threat to owl habitat and does not recommend diameter caps (USDI Fish and Wildlife Service 2012b). Alternative A also has standards and guidelines for Mexican spotted owl restricted habitat that ensure nest/roost habitat is well distributed across the landscape, and that stand conditions are diverse and promote prey habitat, and that the old growth component is maintained. There is an emphasis on uneven-aged management (1987 Plan, pages 65-3 to 65-5). Direction for MSO allows for prescribed fires to meet resource objectives (1987 Plan, pages 65-2 to 65-4; 65-9), but given current densities, it will be difficult to achieve desired conditions through the use of fire without mechanical entry. Within mixed conifer, areas where higher tree density is maintained, such as within protected Mexican spotted owl habitat, the risk of uncharacteristic fire is still higher than elsewhere. Early seral species, such as aspen, may continue to decline where late seral species or closed canopy conditions are emphasized. Outside of protected habitat, mixed conifer would generally be managed as Mexican spotted owl restricted habitat with an emphasis on large trees, large hardwoods, large snags, and large downed woody debris (1987 Plan, pages 65 to 65-6; 65-9 to 65-11).

Like the Ponderosa Pine ERU, there are no specific, measurable objectives to treat mixed conifer under alternative A. The VDDT model for mixed conifer with frequent fire predicts that under the current rate of treatment, vegetation is expected to trend toward desired conditions during the life of the plan, but then become static (in 50 years). This includes states K, L, and M, which represent nesting/roosting habitat for the owl (see Vegetation and Fire, volume I pages 233-234, and Table C-1, volume 3). In the short term, owl habitat would slowly be improved, but in the longer term, progress would be more limited. This assumes rate of treatment would be similar to what has occurred over the past decade.

While prescribed fire and wildfires may be managed to meet resource objectives, under this alternative, wildfires within the wildland-urban interface must be suppressed rather than managed for resource objectives (1987 Plan, page 137). Where wildfires are permitted to function in their natural roles, appropriate open conditions would be maintained, essential nutrient cycling would occur, and age class diversity would be promoted. In the short term, maintenance of open conditions would slow encroachment of trees. In the long term, fire intervals that are closer to desired conditions would also encourage subdominant species such as aspen and Gambel oak. Any restriction on the natural role of fire would slow the pace at which desired conditions can be achieved and would increase the risk of uncharacteristic wildfires near communities and

infrastructure. This alternative also places restrictions on the use of fire management in wilderness areas, the wildland-urban interface, and Oak Creek Canyon (1987 Plan, pages 93 to 94), which would limit the forest's overall ability to improve habitat conditions for the owl.

There are no objectives for wildlife, fish, or rare plants under alternative A, but one standard (1987 Plan, page 64) directs habitat management for federally listed species to take precedence over management for non-listed species, that habitat management for endangered species will take precedence over threatened species, and to follow approved recovery plans. Additional guidelines under Wildlife Operations reiterate existing Forest Service Manual direction on consultation, emphasize inventory and monitoring, and minimize disturbance through seasonal timing restrictions (1987 Plan, pages 64 to 65). There are a number of standards specific to the owl; however, these are largely redundant with an outdated version of the Mexican Spotted Owl Recovery Plan (USDI Fish and Wildlife Service 1995b) and some language is inconsistent with current thinking on restoration (e.g., mechanical treatments in PACS is limited) and desired conditions (1987 Plan, pages 65 to 65-5).

Alternative A presents the least opportunity for implementing treatments, because it has constraints on using wildfires to meet resource objectives and a general lack of emphasis on the ecological need of frequent fire. Alternative A explicitly prohibits the use of wildfires with resource objectives in the wildland-urban interface and Oak Creek Canyon and limits its use in wilderness (1987 Plan, pages 92 to 94). This could hinder restoration efforts in owl habitat. Alterative A does, however, include guidelines for fire abatement and fuel treatment (1987 Plan, pages 65-2 to 65-3) that provide protection for owl PACS during fires, but also limits the types of treatments that can be done (e.g., no mechanical treatment of trees greater than 9 inches in diameter). This largely follows direction from the 1995 Recovery Plan, which is outdated.

Grazing is identified as a potential threat to the Mexican spotted owl if managed insufficiently to protect prey species habitat, nest/roost habitat, and the capacity for the land to support natural fire regimes (USDI Fish and Wildlife Service 2012b). There are standards and guidelines specific to the owl for restricted habitat that emphasize maintenance and restoration of healthy riparian ecosystems for domestic livestock, which include: Implement forest plan forage utilization standards and guidelines to maintain owl prey availability, maintain potential for beneficial fire while inhibiting potential destructive fire, maintain and restore riparian ecosystems, and promote development of owl habitat, and strive to attain good to excellent range conditions that should provide good habitat for owl prey; however, this direction is rather vague in terms of intensity and use (1987 Plan, page 65-5). A standard prohibits grazing in the Sedona/Oak Creek Planning Area-MA 17 (1987 Plan, page 196-1). However, for the most part, plan direction for livestock grazing under alternative A is outdated and lacks clear direction including desired conditions or plan objectives to maintain or restore rangelands toward properly functioning or desired conditions. Alternative A describes a level of grazing management intensity (1987 Plan, page 254), but this system does not tie to desired conditions in the management of range resources, including vegetative desired conditions. Guidelines in the amendment to incorporate the Mexican spotted owl recovery plan use a range condition classification system that is no longer used by the Forest Service and is outdated.

Forest products are provided for personal and commercial uses at levels that are consistent with desired conditions, sustainable, and with consideration of other uses on the forest. There is language to integrate considerations of other resource areas, including wildlife habitat during timber management activities (1987 Forest Plan, page 23), that would be beneficial to the owl.

There is management area guidance for the Sedona/Oak Creek area that removal such as firewood gathering, Christmas tree cutting, and livestock grazing should be designed to maintain or restore ecosystem health (1987 Plan, page 206-11) and that harvesting fuelwood when it can be done in such a way that effects on the owl are minimized. There are specific guidelines for fuel wood harvest in PACs that direct the retention of key habitat components such as snags and large downed logs and harvesting of conifers less than 9 inches in diameter only within PACs to abate fire risk as described below, except for the Clark PAC where trees less than 16 inches diameter will be harvested (1987 Plan, page 65-2). Additional direction for Forest Products under alternative A can be found under the different resources areas including the analyses for Soil, Vegetation and Fire (volume I).

There are goals and objectives to provide trail experiences that are consistent with protection of sensitive resources, meet the needs of a diverse public, emphasize the natural environment, and meet ROS objectives (1987 Plan, page 206-67). There is a very specific guideline that states that trails overlapping with Mexican spotted owl PACS occur should be designated in such a way as to minimize impacts to the owl, and to close and re-vegetate non-system trails in PACs not used for the designated trail (1987 Plan, page 206-68). This guidance would all help to minimize disturbance and human interaction with the owl. Additionally, under alternative A, new motorized and non-motorized trails would not be included in the schedule of activities. Evaluations could be made to determine the need for new trails; see section on Trails (volume I).

There are 38 management areas under this alternative. Plan direction as mentioned under the different program areas above would apply, as well as Forestwide standards and guidelines for Mexican spotted owl (1987 Plan, pages 65 through 65-11). Specific guidelines for MA-1 (West Fork of Oak Creek Canyon in wilderness) place limitations on recreation and camping, and specifically notes that camp areas should be located outside of PACs (1987 Plan, page 108-3). For the entire Sedona/Oak Creek planning area, there is a specific guideline to minimize any adverse recreational impacts to Mexican spotted owl and southwestern willow flycatcher habitat, including closure and limitations on group size (1987 Plan, page 206-13). Similarly, guidelines in the FLEA (MA-35) also place restrictions on human activity within areas of nesting raptors including Mexican spotted owl (1987 Plan, page 206-67), lessen impacts from trails on PACs (1987 Plan, page 206-68), and habitat that potentially could be used for nesting, roosting, or breeding, and is within one-half mile of a proposed site-specific project boundary should be surveyed (1987 Plan, page 206-73).

Of the 10 existing wilderness areas, Mexican spotted owl PAC and/or critical habitat occurs within 6 wilderness areas that the forest manages: Fossil Springs, Kachina Peaks, Munds Mountain, Red Rock-Secret Mountain, Sycamore Canyon, and West Clear Creek. The general management approach for these areas emphasizes solitude and allows natural ecosystem processes such as fire to play a role, an objective supports that vision (1987 Plan, page 108-1). This direction would minimize disturbance for the owl and allow for some habitat improvement.

Table 54. Mexican spotted owl PAC and critical habitat within designated wilderness areas managed by the Coconino NF

Designated Wilderness Area	Wilderness Acres Within Forest Boundary	Wilderness Acres Managed Under Plan	PAC Acres (%)	Estimated Recovery Habitat[1]	Critical Habitat Acres (%)
Fossil Springs Wilderness	**10,431**	**10,431**	**1,597 (15)**	**735 (7)**	**5,693 (55)**
Kachina Peaks Wilderness	**18,705**	**18,705**	**1,328 (7)**	**4,769 (25)**	**18,705 (100)**
Kendrick Mountain Wilderness	2,449	0[1]	n/a	n/a	n/a
Mazatzal Wilderness	2,591	0[2]	n/a	n/a	n/a
Munds Mountain Wilderness	**18,093**	**18,093**	**550 (3)**	**6 (0)**	**0**
Red Rock-Secret Mountain Wilderness	**48,097**	**48,097**	**9,607 (20)**	**0**	**29,377 (61)**
Strawberry Crater Wilderness	10,404	10,404	0	1,006 (10)	0
Sycamore Canyon Wilderness	**23,971**	**23,971**	**1,891 (8)**	**890 (4)**	**12,922 (54)**
West Clear Creek Wilderness	**15,459**	**15,459**	**4,356**	**0**	**6,806 (44)**
Wet Beaver Wilderness	6,173	6,173	0	289 (5)	0

[1]Estimated by calculating 40 percent of the ponderosa pine acreage in the MA to estimate the amount of ponderosa pine-Gambel oak habitat, then adding the acreage outside of PACs for each of the other recovery habitat types (all mixed conifer and riparian forest types), then subtracting PAC acreage from that amount.

[2]Managed by the Kaibab National Forest

[3]Managed by the Tonto National Forest

Alternative B (modified)

A BA for the revision of Coconino NF Land Management Plan was prepared in 2017 (USDA Forest Service 2017c). The determination of effect for the Mexican spotted owl was “may affect, likely to adversely affect” for both the species and its critical habitat, due to the potential for effects from some programs and activities. In its draft Biological and Conference Opinion received on August 8, 2017 (USDI Fish and Wildlife Service 2017b), the Fish and Wildlife Service determined that implementation of the Coconino NF’s revised LRMP would not jeopardize the continued existence of the Mexican spotted owl, and would not be likely to destroy or adversely modify designated critical habitat. No incidental take was assigned. The Fish and Wildlife Service provided three discretionary conservation recommendations intended to minimize or avoid adverse effects, help implement recovery plans, or develop information.

Table 51 shows that under alternative B (modified) the Ponderosa Pine ERU would be similar to alternative A, remaining in poor condition with a trend toward desired conditions in the short term under low treatment objectives (50,000 acres mechanical, 150,000 acres prescribed fire). However, in the short term under the high vegetation treatment objectives (260,050 acres mechanical, 200,000 acres prescribed fire) and in the long term under both the low and high vegetation treatment objectives, the condition would improve to fair and trend toward desired conditions.

Like alternative A, under the low treatment objectives (2,900 acres mechanical, 8,000 acres prescribed fire) Mixed Conifer with Frequent Fire ERU would remain in fair condition with a trend toward desired conditions in the short term. In the long term, Mixed Conifer with Frequent Fire would be in fair condition with a static trend. Under the high treatment objectives

(15,000 acres mechanical, 8,000 acres prescribed fire), Mixed Conifer with Frequent Fire ERU would improve to good condition with a trend toward desired conditions in the short term, then a static trend relative to desired conditions in the long term. There would also be at least 7,500 acres of Mixed Conifer with Frequent Fire burned using wildfire managed for resource objectives. See FW-TerrERU-MC-All-O-1, 2, 3. The Mixed Conifer with Infrequent Fire ERU would remain in fair condition, but the trend would improve to static relative to desired conditions. Cliffs would remain in good condition and have a static trend relative to desired conditions.

As shown in table 53, the likelihood that habitat on the forest would be a limiting factor for Mexican spotted owl is moderate to moderate-high, depending on the habitat. These likelihoods were derived by combining the Mexican spotted owl's F Rank of F2 with the likelihood of habitat limitation variables for each ERU: Ponderosa Pine (moderate in short term and low-moderate in long term for low treatment objective; low-moderate for high treatment objective), Mixed Conifer with Frequent Fire (moderate under the low treatment objective, low under the high treatment objective), Mixed Conifer with Infrequent Fire (moderate), and cliffs (low) (table 9). Low to moderate ratings are considered to be within the natural range of fluctuations for the habitat.

The management effect row shows the relative expected outcome of plan language in terms of minimizing species viability risk. The management effect is classified as a 2 for all the habitats associated with Mexican spotted owl. This means that plan components in alternative B (modified) maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area. For Ponderosa Pine, Mixed Conifer with Frequent Fire, Mixed Conifer with Infrequent Fire, this rating is due to this alternative containing explicit and updated direction on the composition, structure, and processes of these ERUs based on current science. For cliffs, this rating is based on desired conditions to maintain cliffs in generally undisturbed conditions from human activities, maintaining the geological, hydrological, and biological resources of these features (FW-BioPhy-Geo-DC-1) and acknowledge the importance of the specialized habitats for plants and animals that depend on them (FW-BioPhy-Geo-DC-6). Projects would be designed and uses would be managed to maintain the integrity and function of cliffs. Another desired condition provides direction for preserving the composition, structure and function of the ERUs and the physical features including cliffs and rock piles that provide habitat and refugia for the plants and animals that depend on them (FW-WFP–DC-5).

Mexican spotted owls use crevices, ledges, and caves in canyon walls, and they are a PCE for critical habitat. Several of the desired conditions in the Geological Features section include goals that relate to the Mexican spotted owl and its habitat. One desired condition envisions cave and cliff habitat that is undisturbed by human activities so that associated resource values are maintained (FW-BioPhys-Geo-DC-1). Several other desired conditions acknowledge that caves and cliffs provide habitat for species, including federally listed species (FW-BioPhys-Geo-DC-3, 5). A guideline calls for designing projects and managing uses to maintain the integrity and function of caves and cliffs (FW-Bio-Phys-Geo-G-1). Canyon walls used by the Mexican spotted owl for nesting and roosting are usually fairly inaccessible to humans. The primary activity that could have impacts is rock climbing, but hiking, skiing or other recreational uses that go near nesting or roosting owls could cause disturbance as well. The goals and guidelines for Geological Features are expected to minimize or avoid any potential impacts, so effects are not likely to be adverse. Guidance related to geological features relates only to PCE 3c—canyon walls containing crevices, ledges, or caves. As described above, recreational activities can occur within or near this

PCE. Activities that could occur within canyon habitat would strive to keep habitat undisturbed (FW-BioPhys-Geo-DC-1), and would be required to maintain the integrity and function of caves and cliffs (FW-Bio-Phys-Geo-G-1). Therefore, effects on PCE 3c would be minimized, so that adverse effects are not expected.

While riparian forests were used historically as nesting and roosting habitat, owls are not known to currently nest in predominately riparian habitat. On the forest, some riparian forest habitat occurs within PACs, but represents 1 percent or less of total PAC acreage (table 51). Riparian forest habitat outside of PACs (recovery habitat) could be used for dispersal, foraging, or wintering. Riparian forests are a component of the PCE related to forest structure. Riparian habitat is component of all three categories of critical habitat: forest structure (PCE 1a), adequate prey species (PCE 2b), and canyon habitat (PCE 3b). Recovery plan guidance would be applied to all projects associated with riparian forests (FW-WFP-G-1), lessening the potential for adverse effects.

Although the Ponderosa Pine, Mixed Conifer with Infrequent Fire, and Mixed Conifer with Frequent Fire ERUs are the predominant habitats within PACs (table 51), seven other terrestrial ERU types occur as a small proportion of PAC habitat. This analysis will focus on the most dominant ERUs—Ponderosa Pine and the two Mixed Conifer subtypes—because they are the ERUs most likely to be affected by management, and also constitute critical habitat for the owl. In general, desired conditions for Terrestrial ERUs emphasize properly functioning and resilient ecosystems with a mosaic and variety of vegetation, connectivity, and ecologically sustainable amounts of products, including wood and forage which are all consistent with maintenance and improvement of Mexican spotted owl populations and habitat. Harvest to create openings and even-aged stands could negatively impact the Mexican spotted owl if these actions occur within PAC or recovery habitat, but several standards would moderate impacts by minimizing clear cut methods and limiting maximum open sizes to 40 acres (FW-TerrERU-All-S-1 to 4). Guidance in the Wildlife, Fish, and Plants section also includes a standard on timing restrictions to minimize disturbance from activities (FW-WFP-S-2), and a guideline to follow species protection measures from recovery plans (FW-WFP-G-1). These plan components would also aid in lessening potential impacts from cutting and harvest activities within Mexican spotted owl habitat and critical habitat. There are two guidelines to apply to projects and activities in all terrestrial ERUs that would minimize disturbance to the owl. One of the guidelines calls for minimizing impacts to other uses and resources when implementing vegetation treatments and other restoration activities (FW-TerrERU-All-G-1). The other guideline calls for use of native species, when possible, for seeding after restoration activities, which would provide food and cover for Mexican spotted owl prey species (FW-TerrERU-All-G-3).

The scope and magnitude of impacts to Mexican spotted owl PAC and recovery habitat are dependent on additional guidance specific to the ERU in which they occur. These are addressed in the following sections. Vegetation treatments and other restoration activities can affect Mexican spotted owl critical habitat components for forest structure and prey species habitat. As noted above, standards constrain the use of clearcutting and methods designed to establish even-aged stands and opening sizes. And guidelines provide sideboards so that restoration activities will maintain or move toward desired conditions. Even so, restoration activities such as cutting and prescribed burning can affect forest structure, including canopy cover (PCE 1b) and large snags (PCE 1c), as well as downed logs and woody debris (PCE 2a), and tree and plant species (PCEs 2b and 2c) that are components of critical habitat. The scope and magnitude of these impacts are

dependent on additional guidance specific to the ERU in which they occur. These are addressed in the following sections.

The greatest proportion of PAC acreage (73 percent) (table 51) and the largest amount of critical habitat (409,091 acres) occur within the Ponderosa Pine ERU. Much of the fuels reduction and restoration activities using cutting and burning will occur in this ERU over the life of the plan. Desired conditions acknowledge goals for providing habitat for the MSO (FW-TerrERU-PP-DC-1). Detailed desired conditions describe vegetative structure, composition, and function at several scales for the ERU, including the pine-oak subtype. In general, the goals are to have a diverse, functioning ecosystem that supports frequent, low-severity fire (e.g., FW-TerrERU-PP-DC-2, 4, 8, 9, 11, 13). Old growth is to occur throughout the landscape within uneven-aged forests (FW-TerrERU-PP-DC-6, 9). The desired conditions also have goals to provide large snags and downed logs (FW-TerrERU-PP-DC-5, 7), a diversity of understory species (FW-TerrERU-PP-DC-10), an element of dwarf mistletoe (FW-TerrERU-PP-DC-14), and large oak trees and pine-oak groups that provide cooler moister microsites (FW-TerrERU-PP-DC-15). These provide important components for nesting and foraging owls.

In general, designing projects and activities to meet or move toward these desired conditions is expected to be favorable to managing for the Mexican spotted owl and its habitat. The most influential management activities on Mexican spotted owl habitat include tree cutting and prescribed fire. While managing for openness (defined as the inverse of canopy cover) of 10 to 70 percent at the landscape scale (FW-TerrERU-PP-DC-4) would be counter to management for the denser and more closed canopy conditions owl favor for nest and roost habitat, the desired conditions allow for denser conditions in some areas at the mid-scale (FW-TerrERU-PP-DC-8). Combined with the guideline to apply recovery plan guidance to projects (FW-WFP-G-1), moving toward these desired conditions protections and appropriate management for the owl will be achievable at the project level.

The three objectives for the Ponderosa Pine ERU reflect the goal to treat and restore much of this ERU over the life of the plan:

- FW-TerrERU-PP-O-1 calls for prescribed cutting of 50,000 to 260,500 acres each 10-year period over the life of the plan, which equates to 6 to 33 percent of the ERU
- Prescribed fire is planned on 150,000 to 200,000 acres (FW-TerrERU-PP-O-2), representing 19 to 25 percent of the ERU
- Naturally ignited wildfires on at least 135,000 acres, or 17 percent of the ERU (FW-TerrERU-PP-O-3)

Breeding season restrictions are required in a standard (FW-WFP-S-2), which should avoid the potential for adverse effects from noise. While striving toward the desired conditions would be positive for the owl, it is unlikely that avoidance of adverse effects would occur on every project, but standards and guidelines would help to minimize these effects. Guidelines address protecting and perpetuating old-growth conditions and components, which would be beneficial when applied to PAC and pine-oak recovery habitat (FW-TerrERU-PP-G-1 to 4).

Overall, direction for the Ponderosa Pine ERU is expected to provide the goals, objectives, and guidelines that allow for appropriate management of the Mexican spotted owl PAC and pine-oak recovery habitat at the project level. They partly address the key threat to the owl of stand-

replacing fire through thinning and prescribed burning. But some adverse effects could occur from site-specific activities.

There are 409,091 acres of critical habitat within the Ponderosa Pine ERU. Designing projects and activities to meet or move toward the desired conditions would be largely favorable for critical habitat components. A desired condition describes goals to have a mosaic of trees with varying age classes and understory vegetation, providing habitat for the Mexican spotted owl and other species (FW-TerrERU-PP-DC-1). Moving toward this desired condition when implementing thinning, prescribed burning, and other projects within the Ponderosa Pine ERU would provide for forest structure PCEs including a range of tree species (PCE 1a) and a range of tree and plant species that provides prey habitat (PCE 2b). Goals for large snags, downed logs, coarse woody debris (FW-TerrERU-PP-DC-5) support maintenance of PCEs 1c for large snags, and 2a for high volumes of fallen trees. Goals for the Ponderosa Pine-Gambel Oak subtype support PCEs for a range of tree species (PCEs 1a and 2b). Another desired condition envisions all sizes and ages of oaks at the landscape scale. Large oak trees and snags are present, support PCE 1c for large snags (FW-TerrERU-PP-DC-7).

Several guidelines address protecting and perpetuating old-growth conditions and components, which would be beneficial when applied to owl critical habitat components related to forest structure, particularly for large trees (PCE 1a), large snags (PCE 1c) and high volumes of downed logs and woody debris (PCE 2b) (FW-TerrERU-PP-G-1 to 4). Guidelines for specific habitat components emphasize large snags, downed logs, and slash to provide habitat for wildlife, which would help manage for MSO prey as described for PCE 2a (in FW-TerrERU-PP-G-5, 7). Overall for critical habitat, direction for the Ponderosa Pine ERU is expected to provide the goals, objectives, and guidelines that allow for appropriate management of the MSO critical habitat at the project level. However, some adverse effects could occur to PCEs for forest structure (PCEs 1a-c) and maintenance of prey species (PCEs 2a-c) from site-specific activities.

Mixed conifer is the other major habitat type important to the Mexican spotted owl on the forest. There is a total of 20,725 acres of Mixed Conifer with Infrequent Fire and Mixed Conifer with Infrequent Fire ERUs within PACs, representing approximately 18 percent of total PAC acreage (table 51). PAC acreage represents approximately 24 percent of total mixed conifer ERU acres (86,738 acres) (table 51). There is a total of 66,557 acres of mixed conifer habitat designated as critical habitat. Mixed conifer outside of PACs is considered recovery habitat. Alternative B (modified) includes desired conditions that are broken out into three categories: All Mixed Conifer ERUs, Mixed Conifer with Frequent Fire, and Mixed Conifer with Infrequent Fire.

The desired conditions for All Mixed Conifer ERUs are fairly general, describing goals to have a mosaic of trees with varying age classes and understory vegetation, including Gambel oak trees (FW-TerrERU-MC-All-DC-1 to 4). These goals are to provide habitat for the Mexican spotted owl and other wildlife species.

The desired conditions for Mixed Conifer with Frequent Fire describe goals for landscape, mid-scale, and fine scale levels. Similar to ponderosa pine desired conditions, they describe general goals to have a resilient, diverse, and functioning ecosystem that supports frequent, low-severity fires (FW-TerrERU-MC-MCFF-DC-1, 4, 5, 6, 7, 8, 10, and 11). Openness (defined as the inverse of canopy cover) ranges from 10 percent in more productive areas to 50 percent in less productive sites (FW-TerrERU-MC-MCFF-DC-1). The desired condition for basal areas is for a range of 30 to 100 at the mid-scale (FW-TerrERU-MC-MCFF-DC-6). While managing at the higher end of

openness at the landscape scale and for basal areas that range from 30 to 100 would be counter to Mexican Spotted Owl Recovery Plan recommendations for management of owl nesting and roosting habitat, the desired conditions allow for denser conditions where needed to manage for the Mexican spotted owl (FW-TerrERU-MCFF-DC-6). Combined with the guideline to apply recovery plan guidance to projects (FW-WFP-G-1), protections and appropriate management for the owl will be achievable at the project level, but may not avoid adverse effects in all situations. Desired conditions for Mixed Conifer with Frequent Fire envision old growth that occurs over large areas as stands or patches that contain old trees, snags, and downed wood (FW-TerrERU-MC-MCFF-DC-2). Throughout Mixed Conifer with Frequent Fire, snags greater than or equal to 18 inches in diameter, downed logs greater than 12 inches in diameter, and coarse woody debris occurs (FW-TerrERU-MC-MCFF-DC-3).

Some of the desired conditions for Mixed Conifer with Infrequent Fire are fairly similar to Mixed Conifer with Frequent Fire, e.g., to have forest composition, structure, and function that are resilient to disturbances (FW-TerrERU-MC-MCIF-DC-1) and to have large snags 18 inches or greater (FW-TerrERU-MC-MCIF-DC-6). Most MCIF desired conditions, though, paint a picture of a forest with a more closed canopy (FW-TerrERU-MC-MCIF-DC-1) and higher basal with a greater number of large snags and more coarse woody debris (FW-TerrERU-MC-MCIF-DC-6). Fire is less frequent than in Mixed Conifer with Frequent Fire, but fire severity is higher (FW-TerrERU-MC-MCIF-DC-7), so the desired conditions envision the possibility for openings of 10 to 100 percent at the mid-scale (10 to 999 acres) as a result of disturbances. Management-created openings of these sizes (for example, aspen treatments) are not consistent with Mexican Spotted Owl Recovery Plan recommendations for opening size and canopy cover in PAC and recovery nest/roost habitat. If openings are created greater than 2.5 acres within PAC or recovery nest/roost habitat, there could be adverse effects to the Mexican spotted owl. Placement and size of openings would be coordinated and determined at the project level, and recovery plan guidance would be considered (FW-WFP-G-1) in addition to desired conditions for MCIF, lessening the potential for adverse effects.

At the mid-scale level within Mixed Conifer with Infrequent Fire, goals are for tree densities of 20 to 180 square feet basal area per acre (FW-TerrERU-MC-MCIF-DC-6), which encompasses the minimum basal area of 120 specified in the recovery plan for nest/roost recovery habitat.

There are three objectives for Mixed Conifer ERUs, and all three apply to Mixed Conifer with Frequent Fire. This indicates that projects and activities are more likely to occur in Mixed Conifer with Frequent Fire than Mixed Conifer with Infrequent Fire, although they could still occur in Mixed Conifer with Infrequent Fire F. Treatment of a proportionally large amount of the Mixed Conifer with Frequent Fire ERU is expected to be treated during each 10-year period over the life of the plan. These objectives are:

- prescribed cutting of 2,900 to 15,000 acres (6 to 30 percent) (FW-TerrERU-MC-MCFF-O-1),
- prescribed fire on at least 8,000 acres (16 percent or more) (FW-TerrERU-MC-MCFF-O-2),
- naturally ignited wildfires on at least 7,500 acres (15 percent or more) (FW-TerrERU-MC-MCFF-O-3).

Because all mixed conifer habitat outside of PACs is recovery habitat, all of these treatments will be occurring in PAC and/or recovery habitat. Effects of these thinning and prescribed burning

activities on the Mexican spotted owl are addressed in the relevant sections of this analysis. As projects and activities are implemented to meet objectives, and meet or move toward desired conditions, there are three guidelines that apply to both mixed conifer types that would benefit the owl. Retaining slash after treatments in areas where coarse woody debris is deficient (FW-TerrERU-MC-All-G-1) would be beneficial in providing cover for Mexican spotted owl prey (PCE 2). A guideline calls for protecting existing and developing old growth from uncharacteristic disturbances using thinning and fire (FW-TerrERU-MC-All-G-2). Overall, most activities would be designed to meet or move toward desired conditions. While there may be some negative short-term effects on the MSO and its habitat during management treatments, these would be outweighed by the longer-term effects of having improved nesting, roosting, and foraging habitat. There is potential for some effects to have longer-term adverse effects, for example, if large openings are created within Mixed Conifer with Infrequent Fire recovery habitat. The guidance to follow approved recovery plans (FW-WFP-G-1) would lessen the likelihood of these adverse effects occurring. A large portion of mixed conifer ERUs is designated critical habitat for the Mexican spotted owl. There are 31,096 acres of Mixed Conifer with Infrequent Fire (84 percent of the ERU) and 35,461 acres of Mixed Conifer with Frequent Fire (72 percent of the ERU). Desired conditions for mixed conifer encompass PCEs for critical habitat. Desired conditions are described for maintenance of a range of tree species (including hardwoods) and sizes (PCE 1a and 2b) in FW-TerrERU-MC-All-DC-1 and 3; FW-TerrERU-MC-MCFF-DC-1, 7, 10, 11; and FW-TerrERU-MC-MCIF-DC-1, 5. Desired conditions relating to canopy cover for Mixed Conifer with Frequent Fire describe goals for openness of 10 to 50 percent (FW-TerrERU-MC-MCFF-DC-1, 6), equating to canopy closures of 50 to 90 percent. This is consistent with maintenance of PCE 1b, which describes having 40 percent or greater canopy cover. Desired conditions for Mixed Conifer with Infrequent Fire envision the possibility of natural or management-created openings 10 to 999 acres in size (FW-TerrERU-MC-MCIF-DC-5), which would not be consistent with PCE 1b, unless implemented outside of critical habitat at the project level.

Snags 12 inches d.b.h. or greater are a PCE (1c) for critical habitat. Mixed conifer desired conditions describe maintenance of large oak snags (FW-TerrERU-MC-All-DC-3), and specify managing for an average of three snags per acre 18 inches d.b.h. or greater across the landscape in Mixed Conifer with Frequent Fire (FW-TerrERU-MC-MCFF-DC-3). An average of 1 to 5 snags per acre is the goal for the mid-scale in Mixed Conifer with Infrequent Fire (FW-TerrERU-MC-MCIF-DC-6). Since future projects and activities within mixed conifer ERUs will be developed and designed to meet or move toward desired conditions, snags 12 inches or greater (PCE 1c) are expected to be maintained within the mixed conifer ERUs.

Downed logs and woody debris, litter, and residual plant cover are PCEs for maintaining adequate prey (PCE 2a) and are important in canyon habitat (PCE 3d). Desired conditions are to manage for large downed logs and coarse woody debris across the landscape (FW-TerrERU-MC-MCFF-DC-3; FW-TerrERU-MC-MCIF-DC-6). Therefore, projects within mixed conifer types would be expected to maintain PCEs 2a and 3d in owl critical habitat.

Within the mixed conifer types, goals that support maintenance of plant cover and litter are described in several desired conditions (FW-TerrERU-MC-All-DC-2; FW-TerrERU-MC-MCFF-DC-1, 4; FW-TerrERU-MC-MCIF-DC-1, 4). While some activities in mixed conifer such as thinning and prescribed fire could impact PCEs for plant cover (PCE 2c) and ground litter (PCE 3d) in the short term, managing to meet these desired conditions is expected to maintain or enhance these components in the long term.

Due to the complexity in defining the wildland-urban interface, the forest does not have the wildland-urban interface identified spatially. For this analysis, it is assumed that there are portions of PACs and critical habitat within the wildland-urban interface. Goals for the wildland-urban interface include the ability to safely and efficiently suppress wildfires and to protect human life and property (FW-WUI-DC-1, 2). Collectively, the remainder of the desired conditions provide a vision for vegetative conditions, that is, forests are more open with fuel loading, snags, downed logs and coarse woody debris on the low end of the range for the specific ERU, and forests are dominated by early seral, fire-adapted species. Similarly, the one guideline calls for managing tree density, snags, logs, and coarse woody debris at the lower range of desired conditions for the ERU. Aiming for these conditions within the wildland-urban interface could adversely affect Mexican spotted owl PAC, recovery, and/or critical habitat, particularly PCE 1b, 1c, and 2a, but application of guidance in the recovery plan (per FW-WFP-G-1) would help moderate impacts. Suppression activities on naturally ignited wildfires are addressed through emergency consultation procedures. Alternative B (modified) would result in more acreage treated by wildfires managed for resource objectives and higher fire intensities in the wildland-urban interface compared to alternative A. Given that frequent fire decreases fire behavior (and resultant severity), this alternative would provide for more opportunities for fire treatments which would lead to less uncharacteristic fire behavior in the long term.

Two objectives specifically reference listed species and could be implemented within Mexican spotted owl habitat or critical habitat:

- FW-WFP-O-1: Implement at least 20 activities that contribute to the recovery for federally listed species during each 10-year period over the life of the plan. An example of an activity could be thinning a Mexican spotted owl protected activity center to reduce the risk of uncharacteristic fire and to improve habitat conditions for prey species.
- FW-WFP-O-3: Restore or enhance at least 60,000 acres of terrestrial wildlife habitat during each 10-year period over the life of the plan.

A variety of activities and projects could occur to implement these objectives. For the MSO, the most likely activities will be related to fuels reduction projects to reduce the key threat of stand-replacing wildfires within PACs. Additionally, cutting or burning is expected to occur in a portion of recovery habitat to develop additional nesting/roosting habitat. These activities could have some short-term negative impacts, such as a reduction in the amount large woody debris or snags, or short term impacts of ground cover and litter. But since projects in this program would be planned and implemented to benefit the MSO and meet recovery plan guidance (FW-WFP-G-1), any adverse effects would be expected to be minor. These activities would have similar effects in designated critical habitat, with some adverse impacts to PCEs expected in the short-term, including PCE 1b for canopy closure, 1c for snags, 2a for downed logs and woody debris, and 2c for plant cover in order to reach longer-term goals.

Because stand-replacing wildfire is the key threat to the Mexican spotted owl (USDI Fish and Wildlife Service 2012b), fire management is a very important program for protection and recovery of the owl, particularly in Ponderosa Pine and Mixed Conifer ERUs. The desired conditions for fire management are generally consistent with maintenance and improvement of Mexican spotted owl populations and habitat (particularly FW-Fire-DC-2, 3). The goals of these two guidelines are that wildland fires burn within the historic fire regimes and that ecosystem

function is not lost. Two guidelines provide sideboards for fire management. One prioritizes the wildland-urban interface for fuels reduction activities (FW-Fire-G-1). The Mexican spotted owl and/or its critical habitat could occur within wildland-urban interface areas, and goals for wildland-urban interface could be inconsistent with management for the MSO (see wildland-urban interface section above). The other guideline calls for designing fire management activities to be consistent with moving toward desired conditions for other resources (FW-Fire-G-2), which supports goals in the Wildlife, Fish, and Plants section for recovery (see FW-WFP-DC-2). Fuels reduction and fire management activities include thinning, burning, piling, building line by hand or dozer, and other activities. Fire management activities can impact both overstory and understory components important to owls (PCEs 1a-c, 2a-c, and 3d), and can result in disturbance to owls if they occur near occupied habitat. Given limited guidance or sideboards on fire management activities in this section, these activities could result in disturbance or impacts to the Mexican spotted owl or its habitat, so impacts to owls and habitat could occur even while moving toward desired conditions for other resources (FW-Fire-G-2). Goals and other guidance in other sections of the plan would apply (particularly Ponderosa Pine; Mixed Conifer; Wildlife, Fish and Plants), with the expectation that most negative impacts would be short term, while improving conditions for the owl in the long term.

Livestock grazing has the potential to impact prey habitat, which would impact the PCE relating to maintenance of adequate prey species. A grazing desired condition envisions that livestock grazing is consistent with desired conditions for other resources (which would include listed species) (DC-FW-Graz-DC-2); however, the levels and intensity of grazing is determined through allotment-specific analysis and should be at levels that move toward desired conditions for resources. Improvements are considered through allotment-specific analysis or separate analyses for new or individual improvements. A grazing guideline calls for managing livestock grazing to meet or move toward desired conditions for other resources, including species (FW-Graz-G-2), so this would be positive for the Mexican spotted owl and its critical habitat. The other guidelines are generally consistent with habitat for prey populations, focusing on resting treated areas to ensure plant recovery (FW-Graz-G-3), and protection of riparian habitats (FW-Graz-G-4, 5, 7). These guidelines are positive for protecting PCEs for riparian forests (PCE 1a) and residual cover for prey species (PCE 2c), and any effects to PCEs are expected to be insignificant or discountable.

There are three categories of forest products: (1) timber, (2) special forest products, and (3) forest botanical products. Harvesting activities for timber products is likely to be most influential on the Mexican spotted owl and its habitat within the Ponderosa Pine and Mixed Conifer ERUs. These activities can include firewood collection, harvest for sawtimber and pulpwood, and other products. Harvesting can directly impact Mexican spotted owl habitat structure (e.g., PCEs 1a-b), along with associated activities such as piling, creating temporary haul roads, etc. While short-term negative effects can be expected from implementation of the forest Products program, these should usually result in improvement in conditions in the long term. One exception is firewood cutting. Because no sideboards or guidance are provided for woodcutting in habitat, including critical habitat, there could be adverse effects to the standing snags and downed logs. Desired conditions describe goals for providing a sustainable supply of forest products (FW-FProd-DC-1) using silivicultural treatments that reflect natural disturbance patterns and consider other values and resources (FW-FProd-DC-2). Timber harvest activities and systems should be designed and used to meet ecological and social desired conditions (FW-FProd-G1, 2), which would include the Mexican spotted owl. While this section does not specify objectives, explicit objectives for

cutting to produce forest products and meet a variety of desired conditions are found in other sections. The majority of cutting activities are anticipated to occur within Pinyon Juniper with Grass, Ponderosa Pine, and Mixed Conifer with Frequent Fire ERUs:

- FW-TerrERU-PJ-O-1: Mechanically treat between 1,000 and 10,000 acres of Pinyon Juniper with Grass during each 10-year period over the life of the plan.
- FW-TerrERU-PP-O-1: Use prescribed cutting to treat 50,000 to 260,500 acres of Ponderosa Pine during each 10-year period over the life of the plan.
- FW-TerrERU-MC-MCFF-O-1: Use prescribed cutting to treat 2,900 to 15,000 acres of Mixed Conifer with Frequent Fire during each 10-year period over the life of the plan.

Other less explicit objectives designed to restore or enhance habitat, could result in forest products. Examples include:

- FW-TerrERU-AspMpl-O-1: Restore at least 1,000 acres of aspen and maple during each 10-year period over the life of the plan. Restoration could include, but is not limited to, activities that promote regeneration, remove competing vegetation, or remove disturbances that could negatively impact aspen or maple.
- FW-WFP-O-3: Restore or enhance at least 60,000 acres of terrestrial wildlife habitat during each 10-year period over the life of the plan.

While overall guidance is scant for Forest Products, direction from all other relevant sections on the plan would be applied to the Mexican spotted owl, its habitat, and critical habitat when implementing projects. While there could be some site-specific adverse effects, usually short-term, the collective guidance is expected to maintain or improve conditions for the Mexican spotted owl in most cases. The lack of sideboards on firewood cutting could impact critical habitat PCEs for snags and downed wood (PCEs 1c and 2a).

There are currently two trailheads and approximately 55 miles of developed trails within PACs. There are 27 trailheads and 327 miles of trails within critical habitat. Desired conditions for Trails and Trailheads express goals to have a system of trails and trailheads that provide a variety of experiences, including motorized and non-motorized opportunities. One of the desired conditions expresses the goal that damage to resources from the use of trails and trailheads is minimal, and it can be mitigated or restored (FW-Rec-Trails-DC-4). There is an objective to develop or modify 2 to 8 systems of trails to provide for user groups and reduce conflicts between these groups (FW-Rec-Trails-O-1). This would not impact the MSO unless new trails would be placed in its habitat. If that were being proposed, a guideline should help ensure that the design would address impacts to other resources, including the Mexican spotted owl (FW-Rec-Trails-G-1), and other relevant plan guidance would apply as well. Another guideline calls for management of unplanned, user-created trails so that resources damaged by these trails can be rehabilitated (FW-Rec-Trails-G-3). If this guideline is applied to unplanned, user-created trails within Mexican spotted owl habitat, this would help restore habitat. Collectively, activities related to developed and dispersed recreation, and recreational use of trails and trailheads could have impacts to Mexican spotted owl and/or its habitat; however, guidance primarily contained within desired conditions and guidelines does include consideration of other resources in the design and management of recreation activities and trails, which would help minimize potential impacts.

Of the 18 management areas in alternative B (modified), 15 overlap with the Mexican spotted owl PACs and/or critical habitat (table 55). Relatively high acreage of PAC habitat occurs in the C.C.

Cragin, East Clear Creek, Lake Mary, Long Valley, Pine Belt, and Red Rock MAs (table 55). The same is true for critical habitat, with the addition of the San Francisco Peaks MA, which contains over 41,000 acres of critical habitat (table 55).

Table 55. Mexican spotted owl PAC and critical habitat within proposed plan management areas

Proposed Plan Management Area	Proposed Plan Management Area Acres	PAC Acres (% of MA)	Estimated Recovery Habitat*	Critical Habitat Acres (% of MA)
Anderson Mesa	272,731	2,012 (<1)	20,289 (7)	13,443 (5)
C.C. Cragin Watersheds	**45,711**	**11,732 (26)**	**18,272 (40)**	**43,933 (96)**
East Clear Creek	**53,124**	**8,612 (16)**	**24,693 (46)**	**42,834 (81)**
Flagstaff Neighborwoods	53,105	171 (<1)	14,713 (28)	3,655 (7)
Inner Basin Watershed	1,057	0	82 (8)	1,057 (100)
Lake Mary	**51,260**	**8,574 (17)**	**11,108 (22)**	**19,563 (38)**
Long Valley	**164,055**	**24,476 (15)**	**42,024 (26)**	**123,396 (75)**
Mount Elden	17,774	2,552 (14)	8,002 (45)	11,121 (63)
Oak Creek Canyon	6,054	47 (<1)	840 (14)	3,158 (52)
Pine Belt	**426,832**	**40,492 (9)**	**109,661 (26)**	**192,485 (45)**
Red Rock	**105,599**	**10,730 (10)**	**0**	**33,376 (32)**
San Francisco Peaks	57,861	4,494 (8)	24,615 (43)	41,217 (71)
Verde Valley	323,457	1,354 (<1)	4,947 (2)	8,072 (2)
Volcanic Woodlands	157,781	0	16,583 (11)	413 (<1)
Walnut Canyon	21,723	1,830 (8)	5,249 (24)	12,758 (59)

*Estimated by calculating 40% of the ponderosa pine acreage in the MA to estimate the amount of ponderosa pine-Gambel oak habitat, then adding the acreage outside of PACs for each of the other recovery habitat types (all mixed conifer and riparian forest types), then subtracting PAC acreage from that amount.

Overall, direction for the Mexican spotted owl within designated wilderness areas is sparsely and indirectly described. However, other guidance in the plan would apply, such as to apply habitat management objectives and species protection measures from recovery plans when activities are being planned (FW-WFP-G-1). Activities that are anticipated in wilderness areas include managed fire, trail building and maintenance, and dispersed recreation. Some could have negative impacts on owls and their habitat at least in the short term. Management direction and potential impacts from those activities are addressed in the relevant section of this analysis. Goals that support management of federally listed species are reflected in desired conditions that call for retaining the full range of ecological values (SA-Wild-DC-1), having properly functioning ecosystems and ecological resources (SA-Wild-DC-2), and having properly functioning habitat that supports natural assemblages of native species (SA-Wild-DC-3). One objective calls for developing and implementing management plans for any newly designated wilderness areas within 5 years of designation (SA-Wild-O-2). None of the three recommended wilderness areas contain PACs and only Abineau contains a small amount of critical habitat (table 56) (see next section). If Abineau is designated, a management plan that incorporates Mexican spotted owl habitat needs could be beneficial. Two standards indirectly support the Mexican spotted owl by limiting group size (SA-Wild-S-1), which could reduce disturbance to habitat and populations,

and by only permitting group activities that promote wilderness values (SA-Wild-S-2), which includes native species.

Recommended Wilderness

Three areas are being recommended for wilderness designation—Abineau, Davey's, and Strawberry Crater. None of the three contain PAC habitat; Davey's and Strawberry Crater contain small acreages of estimated recovery habitat that would need to be ground verified at the project level. Almost all of Abineau is Mixed Conifer with Infrequent Fire MCIF ERU, plus a small amount of Ponderosa Pine, so that is reflected in the estimated amount of recovery habitat. Only Abineau contains critical habitat. See table 56 for all designated and estimated acreages.

Table 56. Mexican spotted owl PAC and critical habitat within recommended wilderness areas managed by Coconino NF

Wilderness Area	Wilderness Acres Within Forest Boundary	Wilderness Acres Managed Under Plan	PAC Acres (%)	Estimated Recovery Habitat*(%)	Critical Habitat Acres
Abineau	415	415	0	374 (90)	415
Davey's	1,739	1,739	0	8 (0)	0
Strawberry Crater	6,579	6,579	0	12 (0)	0

* Estimated by calculating 40% of the ponderosa pine acreage in the MA to estimate the amount of ponderosa pine-Gambel oak habitat, then adding the acreage outside of PACs for each of the other recovery habitat types (all mixed conifer and riparian forest types), then subtracting PAC acreage from that amount.

Overall, guidance for these special areas emphasizes maintaining and enhancing ecological conditions, limiting human use, with the expected result of minimal habitat and disturbance impacts to the Mexican spotted owl.

Mechanized use in botanical and geological areas is not suitable except on designated trails. This would affect 322 acres of the Immigrant PAC and 340 acres of critical habitat in the Mogollon Rim botanical area. There are no other PACs or critical habitat in botanical or geological areas. Allowing bicycles on designated trails in botanical and geological areas would slightly increase disturbance to the Immigrant PAC owls.

Alternative C

Alternative C is the same as alternative B (modified), except it retains old growth guidance from the 1987 plan (see alternative A, above) and adds more wilderness areas and limitations on disturbance (motorized use and shooting).

With respect to old growth, alternative C differs from alternative B (modified) in that it also incorporates all of the direction (with some minor adjustments) associated with old growth from the 1987 Plan (alternative A). In effect, there is guidance to retain, protect, and promote old growth and desired conditions that emphasize providing for as much old growth as can be sustained on the landscape, but there is also guidance to maintain old-growth stands of 100 to 300 acres and to allocate at least 20 percent of each forest or woodland ERU within any 6th code watershed to old growth, based on minimum structural attributes. Retaining these 1987 Plan standards and guidelines for old growth would have positive impacts on the Mexican spotted owl.

Direction for old growth under alternative A emphasizes standards and guidelines to maintain and promote development of owl habitat (1987 Plan, page 65-5). However, the minimum criteria used to determine structural attributes for old growth is very prescriptive (100- to 300-acre stands over no less than 20 percent of each forested ecosystem management area in a 10,000-acre block); determined at the stand level (1987 Plan, page 70-2). Alternative A distributes old growth and does not necessarily reflect natural disturbance processes. Rather than having old-growth components present throughout the landscape, this approach tends to promote more even-aged conditions which could put old growth at risk from active crown fires that can lead to stand replacement. This even-aged stand structure would also limit recruitment of trees into the medium and larger size classes over time, reducing the structural complexity necessary for maintaining adequate roosting/ nesting habitat, and prey availability. In the short term, this prescriptive guidance may be beneficial to Mexican spotted owl; however, in the long term, owl habitat could be more subject to risk from stand-replacing fire, less well distributed and of a lesser quality than it could be.

In addition to the recommended wilderness areas in alternative B (modified) (Abineau, Strawberry Crater Addition, and Davey's), alternative C includes 10 additional recommended wilderness areas (Barbershop, Black Mountain, Cedar Bench, Cimarron-Boulder, Deadwood Draw, East Clear Creek, Hackberry, Railroad Draw, Tin Can, and Walker Mountain). Of the 13 proposed wildernesses, there are portions of 13 PACs totaling 2,702 acres within 4 of the proposed wilderness areas (Barbershop, East Clear Creek, Railroad Draw, and Tin Can). This represents 2.3 percent of the 118,314 acres within PACs. The portion of PACs within the Barbershop and East Clear Creek Recommended Wilderness Areas are already within the Barbershop and East Clear Creek Inventoried Roadless Areas (IRAs), so there would be little additional benefit to designation as wilderness. Designation of the other recommended wilderness areas would reduce disturbance to Mexican spotted owl from fewer management activities, and recreation use that is managed to preserve wilderness character. Although mechanical thinning treatments would not be allowed, the application of fire could still be used to improve habitat conditions. Overall, designation of wilderness would have a small positive impact on the Mexican spotted owl compared to alternatives A and B (modified). Alternative A recommends no new wildernesses, and the recommended wilderness areas in alternative B (modified) contain no Mexican spotted owl PACs.

Alternative C is the only alternative that has areas designated as not suitable for recreational shooting (Appendix F, table 2). The designation of management areas as not suitable for recreational shooting would result in reduced disturbance within 38,917 acres of PACs within the Flagstaff Neighborwoods, Long Valley, Sedona Oak Creek, and Walnut Canyon MAs (table 57). Designating these areas as not suitable for recreational shooting will benefit the Mexican spotted owl by reducing disturbance to daytime nesting and roosting owls. These acres do not include areas that might already be excluded from recreational shooting by law. Areas designated as not suitable do not automatically become no recreational shooting areas. Subsequent environmental analysis (including public review and comment) and decisions need to be done to make this official.

Table 57. Number and acreage of protected activity centers (PAC) within management areas

Management Area	Number of PACs	PAC Acres
Flagstaff Neighborwoods	1	171
Long Valley	54	26,187
Sedona/Oak Creek	22	10,678
Walnut Canyon	5	1,881
Totals:	**82**	**38,917**

Note: The number of PACs reflects those with all or a portion of their boundaries within management areas.

Alternative C is also the only alternative that has a suitability determination on snowmobile use (Appendix F, table 2). Designating the Walnut Canyon Management Area and areas with a recreation opportunity spectrum objective of “semi-primitive non-motorized” as not suitable for snowmobile use, except to provide ingress/egress for private inholdings would have a positive impact on the five PACs within the boundary by reducing disturbance to roosting owls.

Alternative C includes a guideline that states that livestock grazing should be excluded from research natural areas unless the grazing supports or would not affect the area’s research purpose (Appendix F, SA-RNABotGeo-G-4). There are portions of 5 PACs totaling 1,245 acres within the Oak Creek Research Natural Area and portions of 2 PACs totaling 175 acres in the Rocky Gulch Research Natural Area. Compared to alternative B (modified), restricting grazing would have only a small positive impact on the Mexican spotted owl by improving cover and food production and availability for prey species because little to no grazing occurs in these areas.

Mechanized use in botanical and geological areas is not suitable, even on designated trails. This would affect 322 acres of the Immigrant PAC and 340 acres of critical habitat in the Mogollon Rim botanical area. There are no other PACs or critical habitat in botanical or geological areas. Not allowing bicycles on designated trails in botanical and geological areas would slightly decrease disturbance to the Immigrant PAC owls compared to the other alternatives.

A total of nine management areas are proposed to emphasize reduced human-related disturbance. They are: Anderson Mesa, Pine Grove, Jack’s Canyon, East Clear Creek, Second Chance, Blue Ridge, Limestone Pasture, Hospital Ridge, and Knoll Lake. All of these management areas contain critical habitat and all contain or are adjacent to PACs. Desired conditions for these management areas promote ecological integrity of watersheds and native vegetation, protection of springs, streams, old growth in ponderosa pine and mixed conifer ERUs, corridors, properly functioning wildlife habitat, understory that provides sufficient habitat and cover for wildlife, natural fire regimes, low disturbance in canyons and steep slopes, and emphasis on Mexican spotted owls (MA-AMesa-DC-1, 3, 4, 5, 6, 11, 13, MA-PGrove-DC- 1, 3, 4, 5, 6, 10, MA-Jack-DC-1, 3, 4, 5, 6, 9, MA-EastClr-DC-1,3, 4, 5, 6, 9, MA-ScndChnc-DC-1, 3, 4, 5, 6, 10, MA-1, 3, 4, 5, 6, 9, 11, MA- 1, 3, 4, 5, 6, 10, 12, MA-HospRdg-DC-1, 3, 4, 5, 6, 10, 11, 12, MA-KnollLake-DC-1, 3, 4, 5, 6, 10, 11, 12).

Guidelines for these management areas would limit public access to reduce disturbance from motorized vehicle traffic; would not allow an increase in the area of motorized dispersed camping corridors designated in the MA; and would not allow large group recreation events or large commercial tours except in developed sites (MA-AMesa-G-1, 2, 4, MA- PGrove-G-1, 2, 3, MA-Jack-G-1, 2, 3, MA-EastClr-G-1, 2, 3, MA-ScndChnc-G-1, 2, 3, MA-BlueRidge-G-1, 2, 3, MA-Limestone-G- 1, 2, 3, MA-HospRdg-G-1, 2, 3, MA-KnollLake-G-1, 2, 3). In addition, there

would be a limit on public road density (not to exceed an average of 1 mile of road per square mile) in the Anderson Mesa MA (MA-AMesa-G-3).These desired conditions and guidelines could positively affect Mexican spotted owls because of the emphasis on this species and their habitats and reduced disturbance from recreational and motorized uses of the area.

Alternative D

The consequences of alternative D are very similar to alternative B (modified). The forest proposes alternative D to be responsive to public recommendations for no additional wilderness areas and to allow biking in botanical and geological areas on designated trails (like alternative B (modified). Alternative D differs from the proposed action in the following ways:

- Recommends no new wilderness area;
- Allows mechanized recreation (e.g., bikes) on designated trails in botanical and geological areas;
- Allows for expansion and/or increased access for future energy corridors needs, and modifies scenic integrity objectives along existing energy corridors.

Not adding any new wilderness areas would mean that the effects associated with managing those areas as recommended wilderness would not occur. These areas would still be managed by the other forestwide, management area, and special area direction in alternative B (modified) with the corresponding effects discussed above in the alternative B (modified) section. Therefore, impacts would not be as positive for Mexican spotted owl as alternatives C and B (modified).

Alternative D reduces the scenic integrity object from moderate or high, to low, for approximately 32 miles along two utility corridors to accommodate future energy corridor expansion. Since the corridors already exist and disturbance to habitat has already occurred, it is unlikely that there would be additional impacts on the Mexican spotted owl.

Findings

The finding for all alternatives is May Affect, Likely to Adversely Affect for the species and critical habitat. All alternatives would contribute to species viability by providing the compositional and structural habitat elements needed by the owl and its prey and reducing the risk of uncharacteristic stand-replacing fire, which is the primary threat to the owl. Nesting and roosting habitat is expected to move toward desired conditions under all alternatives. All alternatives would follow guidance in the approved Mexican Spotted Owl Recovery Plan and integrate direction that would benefit the owl and its habitat, including conservation actions under 7(a)(1).

Language in alternative A contributes less to viability than the other alternatives. Plan language is based on an outdated recovery plan (USDI Fish and Wildlife Service 1995b) that does not incorporate the latest science on Mexican spotted owl needs, or recognize current thinking on forest restoration practices and natural disturbance processes. The forest would still follow direction in the revised recovery plan (USDI Fish and Wildlife Service 2012b); however, plan amendments could be required where plan direction conflicts with current Fish and Wildlife Service recommendations. As described above, there is also outdated language regarding old growth, Gambel oak, livestock grazing, and there are restrictions on the ability to use wildfire for resource objectives in wilderness, wildland-urban interface, and Oak Creek Canyon. Forestwide plan language for cliffs is lacking. Alternative A would reduce fire risk, promote the growth of

Gambel oak, maintain and protect larger trees, reduce noise disturbance during the breeding season, protect and maintain dispersal and wintering habitat; however, outdated language on current restoration practices would likely limit the overall amount of habitat the forest would move toward desired conditions during the life of the plan. In addition, activities may be permitted that may have adverse effects to individual owls or critical habitat. These could include communication sites, powerline corridor maintenance, fuels reduction, watershed management projects, and livestock grazing. These types of activities have occurred in the past and are likely to occur into the foreseeable future. See sections on Vegetation and Fire, Fire Management and Wildland-urban Interface in Volume I for additional detail on those program areas.

Alternative B (modified) contributes more to the viability of Mexican spotted owls than alternative A because it emphasizes uneven-aged management and the restoration and maintenance of ecosystem health, has specific, measurable objectives, and incorporates current scientific thinking on the owl, climate change, and ecosystem restoration. While the plan generally strives to move degraded ERUs toward historical reference conditions, some programs and activities could have adverse effects to the Mexican spotted owl and its habitat as projects are implemented to reach those goals. Additionally, some plan components (i.e., desired conditions) may place emphasis on particular activities that could have negative impacts to the owl and its habitat. Overall coordination and implementation of all of the guidance in the plan is expected to minimize potential impacts, but not to the point where they will be insignificant or discountable over the life of the plan. While it is difficult to predict the scope and intensity of effects of future projects, future projects under several program areas could result in adverse effects, at least in the short term, including the Wildland-urban Interface, Fire, Forest Products (for firewood gathering), Scenic Resources (as relates to implementing fire and forestry projects), and Special Areas (primarily the Red Rock MA guidance). The types of impacts and effects for critical habitat are similar to the effects to the Mexican spotted owl with most negative impacts being short term.

Forest plan desired conditions include cliffs, generally describe improved conditions for resources over the life of the plan, and standards and guidelines provide sideboards to project implementation. Alternative B (modified) is based on current scientific thinking with regard to Mexican spotted owl and forest restoration practices, and includes guidance to incorporate the most current recovery plan for the owl. Alternative B (modified) also includes management objectives that are specific and measurable for the primary ERUs used by the owl. This will better allow the forest to assess its progress over time and to revise the plan when and if necessary so it can continue to move toward desired conditions. Although there may be some short-term negative impacts under implementation of alternative B (modified), the overall approach should be positive for the owl, maintaining viability through quality, well-distributed habitat.

In general, under alternative B (modified), forest conditions would be better able to withstand climate change-related disturbances over time. Habitat for the owl, including old growth, would be provided for as a shifting mosaic across the landscape reflecting natural disturbance regimes.

Alternative C is similar to alternative B (modified) except it could make slightly more improvements in critical habitat than the other three alternatives through the addition of more wilderness acres and minimized disturbance. However, restoration activities in wilderness areas would also be more limited under this alternative, and as result, those areas could be more susceptible to uncharacteristic high-intensity fire, making the net positive gain for the owl small.

Alternatives C and A have more prescriptive language for providing important structural components for old growth at the stand level, e.g., 100- to 300-acre stands; however, some guidance is not in line with current restoration practices and could limit optimal distribution of owl habitat across the landscape over time. These stands may be more vulnerable to uncharacteristic fire or uncharacteristic outbreaks of insects or disease.

Alternative D is similar to alternative B (modified) except there is no recommended wilderness.

Southwestern willow flycatcher (SWFL)

Affected Environment

The forest has been taking actions to improve the status of the southwestern willow flycatcher, which was listed as endangered in 1995. These actions would continue under all alternatives. For example, the forest considers needs for the species in project design, analyzes effects of the project within the NEPA process, and consults with the Fish and Wildlife Service as needed. Trained personnel survey for flycatchers and monitor potential habitat most years. In 1997, two Coconino biologists participated on a Regional team (one as team leader) to visit southwestern willow flycatcher sites and habitat throughout the Southwestern Region. The team identified critical short-term management actions, and long-term management direction, which was subsequently issued to all forests in the Region by the Regional Forester.

Distribution

These endangered neotropical migrants nest in the southwestern United States and winter in Mexico and central and South America. There are known populations of nesting willow flycatchers at various sites on private land along the Verde River. Migrating individuals and floater males (single singing males during the breeding season) have been detected on Forest Service land in four areas: Dry Beaver Creek at Stagestop, Sheepshead Spring, Wet Beaver Creek, and West Clear Creek Campground). Breeding flycatchers have been monitored at Tuzigoot bridge and Tavasci Marsh (both extirpated sites), and Superior (also known as the Camp Verde site). Other sites on private land where flycatchers have been detected but not monitored include private land downstream of the Hwy 260/West Clear Creek bridge (single flycatcher detected in 1997) and three other sites along the Verde on private land between White bridge and the West Clear Creek confluence (of these, only the site within Section 7 has documented breeding flycatchers).

Habitat

Suitable and potential habitat for southwestern willow flycatchers mainly occurs below the Mogollon Rim along various perennial streams in the Verde Valley. Much of their habitat is located in the Verde Wild and Scenic River corridor. Some potentially suitable habitat occurs above the Mogollon Rim. They generally nest in areas where quiet water is present from April through September in riparian thickets with dense understory and midstory vegetation. In the Verde Valley, nesting willow flycatchers occur in tamarisk and mixed riparian habitats in patches varying from 460 feet to 1,640 feet in width (Sferra et al. 1995) and 5 to 121 acres in size (Spencer et al. 1996). They are associated with Cottonwood Willow, Mixed Broadleaf Deciduous, and Montane Willow riparian forest types and springs. These habitats are more fully evaluated in the Coarse Filter: Habitat section.

Critical Habitat: The final rule to designate critical habitat for the southwestern willow flycatcher was published on October 19, 2005 (USDI Fish and Wildlife Service 2011c). The Fish and Wildlife Service designated stream segments in 24 Management Units found in six Recovery Units as critical habitat for the southwestern willow flycatcher (USDI Fish and Wildlife Service 2013a). Critical habitat on the forest occurs along portions of three of the five stream segments that make up the Verde Management Unit within the Gila Recovery Unit. The three segments are:

- Segment 1 is 26.1 miles long and begins above Tuzigoot National Monument downstream to the north end of Yavapai Apache Tribal land.
- Segment 2 is 9.5 miles long and begins at the south end of Yavapai Apache Tribal land downstream to the north end of a different parcel of Yavapai Apache Tribal land.
- Segment 3 is 8.7 miles long and begins at the south end of Yavapai Apache Tribal land downstream to Beasley Flat.

Land ownership along these segments of the Verde River is mixed, with the majority being non-Coconino National Forest land. The Verde forms the forest's southwestern boundary with the Prescott National Forest. Additionally, there is private land, other Federal land, and other land ownership designations throughout this critical habitat. There is approximately 474 acres of designated critical habitat on the forest, which represents only 0.6 percent of the 79,856 acres of critical habitat in Arizona (USDI Fish and Wildlife Service 2013a).

A proposed rule to revise critical habitat was published on August 15, 2011 (USDI Fish and Wildlife Service 2011c). There are about 549 acres of proposed critical habitat on the forest. The current designation remains in effect throughout the rulemaking process for revised designation.

Critical habitat on the forest occurs in the Fish and Wildlife Service's Verde Management Unit under both rules. Within the upper Verde segment, the proposed rule designates 4.2 miles more than the existing rule. Much of the Verde River within proposed and designated critical habitat flows through lands of other ownership, and only 358 acres (29 percent) of 1,238 acres are on the Coconino NF.

Primary constituent elements for existing critical habitat and proposed critical habitat are listed below. Both rules list riparian vegetation and insect prey as the two primary constituent elements. The main difference is that riparian habitat in the proposed rule is expanded from riverine systems to include lakeside, natural or manmade habitat.

Primary constituent elements are riparian vegetation and insect prey populations. Riparian habitat occurs along a river, lake, or a natural or human-made environment that supports trees and shrubs suitable for nesting, foraging, migration, dispersal, and shelter. Insect prey populations include a variety of species found within or adjacent to moist or floodplain environments.

The riparian forest types that contain critical habitat on the Coconino are Cottonwood Willow (approximately 376 acres) and Mixed Broadleaf Deciduous Riparian Forest (approximately 35 acres). Other habitats that could potentially support southwestern willow flycatcher include Montane Willow, Wetlands, and Springs.

Overall, the riparian forest types are low to moderately departed from reference conditions with approximately 62 percent in proper functioning condition (PFC), 28 percent functional-at-risk, 4 percent non-functional, and 1 percent are of unknown condition (USDA Forest Service 2016b).

Risk Factors

Habitat loss and modification is the primary cause of the species' decline. This is mainly due to dams and reservoirs, diversions and groundwater pumping, channelization and bank stabilization, phreatophyte control, livestock grazing, recreation, fire, agricultural development, and urbanization. Another threat is changes in the abundance of other species such as exotic plant species and brood parasitism. The small populations of southwestern willow flycatcher are vulnerable because there are a small number of territories in very small breeding groups and these isolated groups are vulnerable to local extirpation from many factors. The small populations of southwestern willow flycatcher create concerns about low genetic variation, inbreeding, and low effective population size. Finally, stopover and overwintering habitats are subject to the same risks noted above for breeding habitat. These habitats are important so flycatchers can replenish their energy reserves and migration is a period of high energy demands.

Environmental Consequences

The scope of the analysis includes critical habitat, and Cottonwood Willow and Mixed Broadleaf Deciduous Riparian Forest habitat that supports potential habitat. The transient and floater flycatchers detected on the forest occurred in these ERU types. The analysis below focuses on those risk factors and program areas that would be most consequential in terms of maintaining viability for southwestern willow flycatcher. No southwestern willow flycatcher breeding is known to occur on the Coconino NF; however, there have been migrants and floaters observed. Therefore, any potential effects associated with implementation of the LRMP are expected to be to these migrants/floaters and not to breeding birds.

Table 58 summarizes the viability analysis for the southwestern willow flycatcher. This table was developed using the analysis process described under the Species Viability section above. It includes information on the status, F Rank, habitat, habitat condition and trend, likelihood that this species is limited by its habitat, and the projected management effect, by alternative. Management effect categorizes the relative expected outcome of plan language in each alternative in terms of minimizing species viability risk and are the result of plan decisions, including plan objectives. Management effect category values are 1, 2, 3, and 4. The lower the management effects rating for a species' associated habitat, the more effective the alternative is for that species viability. These topics and the effects of the alternatives are explained in greater detail in the discussions on the alternatives that follow.

Table 58. Analysis summary for the southwestern willow flycatcher

Species and status	Habitat	Alternative A		Alternatives B (modified), C, D	
		Habitat Trend relative to desired conditions	Likelihood species is limited	Habitat Trend relative to desired conditions	Likelihood species is limited
Southwestern willow flycatcher (Endangered) F Rank = F1*	CWRF	Fair, slowly toward	VH	Good, slowly toward	H
	MBDRF	Good, static to slowly toward	H	Good, slowly toward	H
	MWRF	Good, static to slowly toward	H	Good, slowly toward	H

Species and status	Habitat	Alternative A		Alternatives B (modified), C, D	
		Habitat Trend relative to desired conditions	Likelihood species is limited	Habitat Trend relative to desired conditions	Likelihood species is limited
	Springs	Fair**, slowly toward	VH	Fair**, slowly toward	VH
Management effect		CWRF, MBDRF, and MWRF = 3: Plan components maintain or improve protection and management for some habitat occurrences in the plan area. Quality of habitat or habitat elements is maintained or improved by providing protection, maintenance, and restoration to some occurrences. Management effect for Springs = 4: Decline in habitat quality as a result of management or lack of management that result from plan components. Plan components may not exist or may be few.		All habitats = 2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.	

*F1 = Very rare on the forest within its habitat – occupies a very small portion of its habitat.

** For analysis, springs were considered in fair condition. However, some springs could be in poor or good condition depending on accessibility, protection, or degree of development.

Common to All Alternatives

Plan components in all alternatives contribute to species viability by managing for sustainable populations of native species and improving and protecting habitat for threatened, endangered, and sensitive species (1987 Plan, pages 22-1, 23, 64, 64-1, 66, 95, 108-2, 180, 187, 206-9, 206-11, 206-12, 206-13, 206-23, 206-30, 206-32, 206-66, 206-67, 206-71, 206-72, 206-79, 206-87, 206-89, 206-98, 206-103, 206-105, 206-108, 206-109, 206-114; FW-WFP-DC-1, 2, 3, 4, 5, 6, 8, and FW-Eco-DC-1). See At-risk Species in the Wildlife and Plant Issues and Topics section above for more information.

All alternatives incorporate the standards and guidelines in the Verde Wild and Scenic River Comprehensive River Management Plan (CRMP) (USDA Forest Service 2004a) (1987 Plan, pages 113, 114, 115-1, SA-WSR-G-1). Each congressionally designated wild and scenic river is required to have a comprehensive river management plan. The comprehensive river management plan establishes the river corridor boundary; includes detailed descriptions of the outstandingly remarkable values; and addresses goals and desired conditions, development of lands and facilities, user capacities, water quality, instream flow, and monitoring strategy. It may also include plan components (desired conditions, objectives, standards, guidelines, and monitoring). These plan components are equivalent to and have the same weight as direction in this plan. Wildlife is an outstandingly remarkable value (ORV), and the southwestern willow flycatcher is listed as an example. Desired conditions call for managing wildlife habitat at optimal levels. Standards require all activities to protect and enhance ORVs, and recovery actions for the southwestern willow flycatcher should be implemented. The original designation for the CRMP allows for some water diversion. Specifically, designation shall not prevent water users receiving Central Arizona Project water allocations from diverting that water through an exchange

agreement with downstream water users in accordance with Arizona water law, thus, streamflows could be reduced in the future; the forest would have limited control of this effect.

Disturbance during the breeding season can reduce or eliminate the reproductive success of any southwestern willow flycatchers that might nest on NFS land. The discussion on Disturbance in the Wildlife and Plant Issues and Topics section above compares the different alternatives as they relate to disturbance. All alternatives have plan components that reduce disturbance to southwestern willow flycatchers and, thus, would promote recruitment and survival should any breeding or nesting occur (1987 Plan, pages 64-1,206-13; FW-WFP-S-2).

Upstream diversions, impoundments, and tamarisk invasion all affect riparian communities; the forest has little control over upstream water management. For this reason, it will be difficult for the forest to fully restore this habitat to reference conditions. Water resource management activities, including maintaining perennial water quality, quantity, and timing of flows contribute a very important role in overall ecological function and sustainability of these watersheds. Many of these activities are regulated outside the boundary of the forest. Although the Coconino NF manages what it can in terms of riparian health, cumulatively when combined with management activities of other jurisdictions, these actions would not likely be sufficient to fully restore this habitat to reference conditions.

Treatments to control tamarisk, a non-native plant species, can impact southwestern willow flycatchers because tamarisk provides dense midstory habitat used by this species. Removal of tamarisk can open up the habitat, which can cause heat stress or increase flycatcher susceptibility to predators or to cowbirds. All alternatives promote a strategy to address establishment, containment, control, and eradication of invasive plants (1987 Plan, page 23, FW-Invas-DC-1, 2) and they have forestwide standards and guidelines to incorporate control measures into projects (1987 Plan, page 69, FW-Invas-G-1-2). All alternatives point to “Design Features, Best Management Practices, Required Protection Measures, and Mitigation Measures” in the “Final Environmental Impact Statement for Integrated Treatment of Noxious or Invasive Weeds on the Coconino, Kaibab, and Prescott National Forests” (USDA Forest Service 2005a) as part of the strategy to prioritize and treat invasive plants while protecting native species (1987 Plan, page 69, FW-Invas-G-2). See discussion on Non-native or Invasive Species in the Wildlife and Plant Issues and Topics for additional information on this threat.

All alternatives incorporate Travel Management Rule direction that prohibits motor vehicle use beyond the designated system of roads, trails, and areas (including areas where motorized big game retrieval is allowed). This should help protect threatened and endangered species habitat, including the southwestern willow flycatcher, by keeping impacts to vegetative cover, soil compaction and other impacts to known and specific areas.

There are three livestock grazing allotments on the forest that contain critical habitat: 13-Mile Rock has 29 acres, Walker Basin has 8 acres, and Windmill has 1 acre. However, there is no authorized access to critical habitat along the Verde River, so there will be no impacts from this program on the southwestern willow flycatcher or its critical habitat.

There are approximately 2,415 acres of Mixed Broadleaf Deciduous and Cottonwood Willow Riparian forest types, which could provide potential habitat for southwestern willow flycatcher in the Fossil Springs, Mazatzal, Sycamore, West Clear Creek, and Wet Beaver Wilderness Areas. Wilderness designation provides extra protections for southwestern willow flycatcher potential

habitat because motorized use (and associated disturbances) is more restricted, and the potential for development of recreation and administrative facilities is reduced. These areas are managed for their wilderness character, which includes native species and maintenance of natural process. Recreation use is managed to protect wilderness character. The restrictive management associated with designated wilderness is beneficial for southwestern willow flycatcher habitat.

Alternative A

Prior consultations under the Endangered Species Act

A BA for the continued implementation of forest LRMPs across the region was prepared in 2004 (USDA Forest Service 2004d). The BA did not include the Coconino NF.

Another BA for the continued implementation of forest LRMPs across the region was prepared in 2011, due to new information on species and/or critical habitat (USDA Forest Service 2011f). The finding for the southwestern willow flycatcher was “may affect, not likely to adversely affect” for the species and designated critical habitat. The BA found that many programs could implement activities that would have negative impacts to southwestern willow flycatcher, but that standards and guidelines in the LRMP would eliminate or mitigate most impacts. In an appendix to the 2012 BO, the Fish and Wildlife Service concurred with the “may affect, not likely to adversely affect” the southwestern willow flycatcher and its habitat, and concluded that the LRMP is not likely to destroy or adversely modify flycatcher critical habitat (USDI Fish and Wildlife Service 2012d).

The 2010 BA for the TMR project determined that the decision would have some beneficial effects to flycatchers and their habitat from road closures near nest sites and within critical habitat, but that there could also be some slight negative effects from designation of motorized camping corridors within habitat (USDA Forest Service 2010d). The determination for both the species and its critical habitat was “may affect, not likely to adversely affect.”

The amended BA for motorized big game retrieval (MBGR) found that there would be an increase in MBGR within southwestern willow flycatcher habitat, but that adverse effects would not be expected (USDA Forest Service 2011m). This was based on the timing of MBGR and provisions that minimize potential impacts. Therefore, the finding of “may affect, not likely to adversely affect” for the species and its critical habitat did not change from the 2010 TMR BA. The Fish and Wildlife Service concurred with those findings (USDI Fish and Wildlife Service 2011e, 2011f).

In summary, taking into account the TMR project and its resulting LRMP amendment, the findings from the 2011 BA of “may affect, not likely to adversely affect” the southwestern willow flycatcher and its designated critical habitat would remain appropriate for this current analysis.

Viability

Table 58 shows that Cottonwood Willow Riparian Forest would remain in fair condition and have a slow trend toward desired conditions. In Cottonwood Willow Riparian Forest, some portions of the Verde River, Dry Beaver Creek, and Spring Creek, would be static due to high recreation or private land, such as the area around Childs, Spring Creek, Dry Beaver Creek, and private lands.

MBDRF would remain in good condition. Static trends would be associated with the Oak Creek and West Clear Creek 5th code HUCs. The trend would be static or moving slowly toward

desired conditions except in the Beaver Creek, West Clear Creek and Oak Creek 5th code HUCs and portions of Fossil Creek where recreation impacts are high. Areas of private land would remain static as well.

MWRF would remain in good condition with a majority of the habitat either static or trending slowly toward desired conditions, except the Upper Clear Creek 5th code HUC is trending toward desired conditions.

Springs would remain in fair condition with a trend slowly toward desired conditions. Accessible, unprotected springs would remain in poor condition, while springs that are inaccessible, protected, or undeveloped would remain in good condition.

The likelihood that SWFL would be limited by the quality of its habitat on the forest is high to very high and varies by habitat as shown in table 58. These likelihoods were derived by combining the southwestern willow flycatcher's F Rank of F1 with the likelihood of habitat limitation variables for each ERU: Cottonwood Willow Riparian Forest (high), Mixed Broadleaf Deciduous Riparian Forest (moderate), Montane Willow Riparian Forest (moderate, except the Fern Mountain Botanical Area and Upper Clear Creek 5th code HUC is high), and springs (high) (table 9). Low to moderate ratings are considered to be within the natural range of fluctuations for the habitat.

The management effect row shows the relative expected outcome of plan language in terms of minimizing species viability risk. The management effect is classified as a 3 for Cottonwood Willow Riparian Forest, Mixed Broadleaf Deciduous Riparian Forest, and Montane Willow Riparian Forest, which means that plan components in alternative A maintain or improve protection and management for some habitat occurrences in the plan area and thus contribute less to the viability of this species than the other alternatives. Alternative A would maintain or improve riparian forests and streamcourses because it has a focus on improving riparian areas in any condition, preventing damage to riparian vegetation, stream banks, and channels, and restoring degraded riparian areas to good condition as soon as possible (1987 Plan, pages 65-2, 65-8, 172, and 206-8). Other protective language includes the following: Only beneficial new special uses are allowed in riparian areas and exceptions such as utility line or roads crossing stream courses are designed to minimize the extent and magnitude of impact to riparian (1987 Plan, page 177). Aggressive fire suppression may be used to prevent resource damage utilizing methods that minimize long-term adverse impacts to riparian habitats (1987 Plan, page 177). In addition, acquisition of riparian areas through land exchange is a high priority (1987 Plan, pages 177 and 185). The plan would manage commercial uses, and recreation in some areas, to protect riparian values (1987 Plan, pages 206-10, 22, 26, and 39). This alternative has less potential for improvement to riparian condition compared to the other alternatives because plan language for specific riparian forest types is lacking and there is not a focus on functioning-at-risk and non-functional riparian areas (USDA Forest Service 2016b).

The management effect is classified as a 4 for springs, which means there is a decline in habitat quality as a result of management or lack of management that result from plan components. Plan components may not exist or may be few. For springs, desired conditions and guidelines are largely lacking, therefore, managers do not have clear direction when restoring or protecting springs or to maintain or restore toward desired condition of properly functioning, resilient springs and spring riparian areas (USDA Forest Service 2016b).

Plan components are discussed further in the Coarse Filter: Habitat section by ERU or riparian forest type. Many of the plan components and program areas that apply to southwestern willow flycatcher also apply to Chiricahua leopard frog, see Watersheds and Water, Stream Ecosystems, Invasive Animals and Disease, Riparian Forest Types, Livestock Grazing, Connectivity, Fire Management, Recreation, and Management Area Direction in that section. Additional guidance and effects for southwestern willow flycatcher are analyzed below.

Outside of the Central Arizona Project water allocations, plan components in this alternative would provide sufficient water for southwestern willow flycatchers. A forestwide goal would maintain high quality sustained water yield for forest users and others as well and protect wetlands and floodplains (1987 Plan, page 24). Guidelines promote adequate instream flows and adequate instream flow water rights to maintain riparian and aquatic communities (1987 Plan, page 206-116); and taking action to legally protect forest use of needed waters (1987 Plan, page 74).

Alternative A addresses cowbird parasitism through plan components that would implement cowbird control programs based on Fish and Wildlife Service consultation requirements and site-specific determination of need (1987 Plan, page 206-14) and adaptively manage southwestern willow flycatchers and their habitat and cowbirds based on new information and work with other agencies (1987 Plan, page 206-10).

Alternative B (modified)

A BA for the revision of Coconino NF Land Management Plan was prepared in 2017 (USDA Forest Service 2017c). The determination of effect for the southwestern willow flycatcher was “may affect, likely to adversely affect” for both the species and its critical habitat, due to the potential for effects from some programs and activities. In its draft Biological and Conference Opinion received on August 8, 2017 (USDI Fish and Wildlife Service 2017b), the Fish and Wildlife Service determined that implementation of the Coconino NF’s revised LRMP would not jeopardize the continued existence of the Southwestern willow flycatcher, and would not be likely to destroy or adversely modify designated critical habitat. No incidental take was assigned. The Fish and Wildlife Service provided two discretionary conservation recommendations intended to minimize or avoid adverse effects, help implement recovery plans, or develop information.

Table 58 shows that under alternative B (modified), Cottonwood Willow Riparian Forest would improve to good condition and trend slowly toward desired conditions except portions of the Verde River, Towel Creek, Spring Creek and Dry Beaver Creek would improve faster (i.e., have a trend toward desired conditions).

Mixed Broadleaf Deciduous Riparian Forest would remain in good condition and slowly move toward desired conditions except portions of Fossil Creek and Wet Beaver Creek would remain static in areas of high recreation use. It would improve faster than alternative A in the Beaver Creek, Oak Creek, West Clear Creek, and Fossil Creek 5th code HUCs.

Montane Willow Riparian Forest would remain in good condition and slowly move toward desired conditions. In the Upper Clear Creek 5th code HUC, MWRF would move toward desired condition at a faster rate than alternative A.

Springs would remain in fair condition with a trend slowly toward desired conditions. Accessible, unprotected springs would remain in poor condition, while springs that are inaccessible, protected, or undeveloped would remain in good condition.

As shown in table 58, the likelihood that habitat on the forest would be a limiting factor for MSO is high to very high depending on the habitat. These likelihoods were derived by combining the southwestern willow flycatcher's F Rank of F1 with the likelihood of habitat limitation variables for each ERU: Cottonwood Willow Riparian Forest (moderate), Mixed Broadleaf Deciduous Riparian Forest (moderate), Montane Willow Riparian Forest (moderate considering wetland functional condition), and springs (high) (table 9). Low to moderate ratings are considered to be within the natural range of fluctuations for the habitat.

The management effect row shows the relative expected outcome of plan language in terms of minimizing species viability risk. The management effect is classified as a 2 for all the coarse filter habitats associated with southwestern willow flycatcher. This means that plan components in alternatives B (modified), C, and D maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area. For Cottonwood Willow Riparian Forest, Mixed Broadleaf Deciduous Riparian Forest and Montane Willow Riparian Forest, this rating is primarily because there are updated desired conditions and guidelines that distinguish between the riparian forest types and that support their respective composition, structure, and function (FW-Rip-RipType-DC-1 to 6; FW-Rip-RipType-G-1 to 4). In addition, riparian functional condition would improve faster than alternative A, especially along the Verde River, Towel Creek, Spring Creek, and Dry Beaver Creek. Desired conditions manage for vegetation diversity and riparian function (FW-Rip-RipType-DC-1 and 2; FW-Water-G-2; FW-Rip-RipType-O-1). More site-specific aquatic management zone guidelines protect riparian function and water quality (FW-Rip-All-G-3; Fw-Rip-Strm-G-2).

For springs, this rating is because alternative B (modified) has desired conditions and guidelines to guide spring management on the forest (FW-Rip-Spr-DC-1 to 4; FW-Rip-Spr-G-1 to 4). For intermittent streamcourses, this rating is based on language regarding mitigating the effects of roads, connectivity of drainages, connectivity between streamcourses and upland habitats, and earthen stock tank locations (to minimize impacts to sensitive resources) (FW-ConstWat-G-1, 2; FW-RdsFac-G-2, 5, 7, 9 and Connectivity under Wildlife and Plants Topics and Issues).

Several forestwide desired conditions for all ecosystems are generally consistent with maintenance and improvement of southwestern willow flycatcher populations and habitat. They envision ecosystems that provide habitat for native species, and are resilient to natural and uncharacteristic disturbances (FW-Eco-DC-1, 2, 3). Desirable non-natives may be present and should be in balance with properly functioning ecosystems (FW-Eco-DC-4). Non-native vegetation is a threat to southwestern willow flycatcher s, and their critical habitat, particularly PCEs for riparian vegetation and dynamic riverine processes. This desired condition is moderated by the vision that any non-natives must be in balance with properly functioning ecosystems, and that the key non-native species that threaten southwestern willow flycatcher habitat (e.g., tamarisk, giant reed) are not considered desirable. Therefore, adverse effects to flycatchers or critical habitat PCEs are unlikely from implementation of this guidance at the project level.

Desired conditions and guidelines in the watersheds and water section would protect southwestern willow flycatcher and their PCEs. Desired conditions for the watersheds and water program are generally consistent with maintenance and improvement of southwestern willow

flycatcher populations and habitat. They generally envision properly functioning conditions. The goal is to have vegetation and soil conditions that support clean water, base flows, riparian communities, and long-term soil productivity, which would have a positive impact on habitat for southwestern willow flycatcher s (FW-Water-DC-3). Best management practices and Total Maximum Daily Load (TMDL) plans should be applied to maintain or improve water quality (FW-Water-G-4 and 5). Watershed restoration and maintenance should focus on priority 6th code watersheds (FW-Water-G-2). Some 6th code watersheds that contain currently occupied and potential habitat are in impaired condition (USDA Forest Service 2016j) and could be prioritized for treatments during the life of the proposed plan. Vegetative ground cover should be maintained so that watersheds can recover quickly from disturbances (FW-Water-G-1). Two other guidelines address acquiring instream flow water rights and ensuring excess water flows back into natural habitats (FW-Water-G-3, 6). Potential future watershed activities and projects are varied, and could include vegetation thinning, prescribed burning, channel stabilization, and other activities that could have impacts on habitats adjacent to or within southwestern willow flycatcher habitat. Although short-term negative impacts that disturb soil or ground vegetation could occur with project implementation, the goal to improve watersheds is likely to result in positive results in the long term, by supporting maintenance and improvement of riparian habitat. If projects occur within or adjacent to critical habitat, short-term adverse effects could occur through removal of vegetation, affecting PCEs for dense riparian vegetation and prey populations it supports, but these effects are expected to be minor in the short term, and should result in long-term net improvement in riparian habitat.

Desired conditions for All Riparian Areas are consistent with maintenance and improvement of southwestern willow flycatcher populations and habitat. They generally describe goals to have naturally functioning ecosystems, instream flows that provide for channel and floodplain maintenance, and habitat connectivity. Projects implemented in the future to be consistent with desired conditions will be guided by several guidelines. Two guidelines would have positive effects, as one calls for maintaining habitat and corridors for species (FW-Rip-All-G-2), and to identify aquatic management zones around all riparian habitats to protect water quality and to avoid adverse effects to connected resources (FW-Rip-All-G-3). An objective would restore the function of 200 to 500 acres of nonfunctioning and functioning-at-risk riparian areas during each 10-year period over the life of the plan, with emphasis on priority 6th code watersheds, so that they are in or moving toward proper functioning condition (FW-Rip-All-O-1). The mixture of adverse and beneficial effects described above applies to critical habitat as well. Impacts to riparian habitat can reduce the density of vegetation and affect insect prey populations that use riparian vegetation.

Altered hydrologic and stream processes (diversions, channelization and bank stabilization) are a key threat to southwestern willow flycatchers and their critical habitat, so guidance in this section is particularly important for protection and enhancement of southwestern willow flycatcher habitat. While there are no major dams on the portion of the Verde River and southwestern willow flycatcher critical habitat on the forest, there are many water diversions and modifications in the Verde Valley. The desired conditions for all Stream Ecosystems are generally consistent with maintenance and improvement of southwestern willow flycatcher populations and habitat. They envision streamcourses with natural sinuosity, where flooding is a natural disturbance where energy is dissipated appropriately. There are two guidelines to apply during project development and implementation. The first (FW-Rip-Strm-G-1) emphasizes streambank stability, native vegetation, and riparian and soil function. This would benefit SWFL habitat and critical habitat

PCEs for dense riparian vegetation (PCE 1a-d) and insect prey (PCE 2). The other guideline (FW-Rip-Strm-G-2) calls for establishment of aquatic management zones adjacent to non-riparian, intermittent streamcourses, which wouldn't have a direct influence on southwestern willow flycatcher habitat.

The desired conditions for riparian forest types generally provide a vision for riparian forests that is consistent with maintenance and improvement of southwestern willow flycatcher populations and habitat. In general, goals are to have proper functioning conditions, with protective litter and plant cover, root masses and herbaceous vegetation to stabilize and protect banks, and snags (FW-Rip-RipType-DC-1 to 5). These goals support suitable forest structure for breeding southwestern willow flycatcher s.

A riparian forest type objective calls for restoring function to 200 to 500 acres of nonfunctioning and functioning-at-risk riparian areas during each 10-year period of the plan with emphasis on priority 6th code watersheds (FW-Rip-RipType-O-1). This objective does not specify which riparian forest types will be treated. And because the plan is not site-specific, it is unknown how many acres of southwestern willow flycatcher habitat may be restored. This could be beneficial if it occurs in southwestern willow flycatcher habitat. Two guidelines address water diversions and groundwater pumping, which have been identified as key threats to the southwestern willow flycatcher and its critical habitat. One guideline states that these activities, if they occur, should not lower the water table (FW-Rip-RipType-G-1). The other guideline calls for recreation activities, permitted uses, and management activities to occur at levels that maintain or allow improvement of soil function, riparian vegetation, and water quality at the stream reach scale (FW-Rip-Rip-Type-G-3). Activities to restore riparian could include weed removal, fencing to exclude ungulate browsing or off-road driving, road improvements or obliterations, and other actions that could have impacts to the southwestern willow flycatcher and its habitat. Impacts from the implementation of these restoration activities may have short-term effects to southwestern willow flycatcher s (such as disturbance during the breeding season or ground and vegetation disturbance). However, in the long term, these activities would achieve the goal of restoring functional condition within riparian forest types. Several wildlife program desired conditions are particularly relevant and describe a positive vision for the southwestern willow flycatcher and its habitat. One desired condition states goals for properly functioning ecosystems that support sustainable populations of native animals (FW-WFP-DC-1). Another desired condition envisions habitat conditions on the forest that contribute to the survival and recovery of listed species (FW-WFP-DC-2). Additional desired conditions call for terrestrial and riparian habitats to provide the necessary physical and biological habitat components to support life cycle needs of native species and stream ecosystem conditions that support habitat for self-sustaining populations of native species.FW-WFP-DC-3, 4). Another desired condition promotes forest attributes of mature forests including large trees, snags, and large logs. These attributes would provide habitat structure and insect prey for southwestern willow flycatcher s within riparian forests (FW-WFP-DC-7), including both PCEs.

Two objectives would maintain or improve southwestern willow flycatcher populations and habitat if they occur within southwestern willow flycatcher habitat:

- FW-WFP-O-1 states that at least 20 activities that contribute to the recovery of federally listed species will be implemented during each 10-year period of the plan.

- FW-WFP-O-4 calls for restoring or enhancing at least 70 miles of stream habitat during each 10-year period of the plan.

A standard in the section on wildlife, fish, and plants is required to be implemented for projects and activities. It prioritizes direction for federally listed and candidate species over other species (FW-WFP-S-1). This standard has limited benefit, as it only prioritizes federally listed species over non-listed species, but does not prioritize threatened and endangered species management over other programs or activities.

Several guidelines incorporate the guidance from recovery plans and other conservation or guidance documents (FW-WFP-G-1, 2). Another guideline calls for designing projects and managing activities to maintain or improve habitat for native species (FW-WFP-G-3). Projects should be designed to minimize any negative impacts from pesticides, herbicides, or chemicals (FW-WFP-G-4), which would apply to removal of vegetation in riparian habitat. Lastly, designing new roads and trails to maintain species' access to adjoining habitat and to allow for dispersal (FW-WFP-G-13) will be positive for the southwestern willow flycatcher.

Overall, guidance is positive for southwestern willow flycatcher s and their critical habitat. Wildlife projects implemented under the plan will apply this guidance, and impacts are expected to be mostly positive for both the southwestern willow flycatcher and its critical habitat. There is some potential for short-term adverse impacts, for example, herbicide application to remove non-native vegetation could temporarily reduce prey abundance, but the overall net effect is positive.

The expansion of non-native vegetation or the conversion of native vegetation to non-native vegetation is a threat to the southwestern willow flycatcher and its critical habitat. While the desired conditions accept the presence of invasive species, the stated goals are that native species' sustainability is not affected (FW-Invas-DC-1) and that infestations are detected early (FW-Invas-DC-2). Presumably, detecting infestations early would allow for more successful control or elimination. Although there are no objectives for invasive species, it is anticipated that activities will continue to occur to work toward desired conditions under the proposed plan. Removal of non-native vegetation will also contribute to improvement of PCEs, so these impacts are similar for critical habitat. The intent of all the guidelines is to prevent, control, contain, or eradicate invasive species to protect native species and to improve watershed condition and ecosystem function (FW-Invas-G-1, 2, 3).

The desired conditions related to fire management are generally consistent with maintenance and improvement of southwestern willow flycatcher populations and habitat (particularly FW-Fire-DC-2, 3). The goals of these two desired conditions are that wildland fires burn within the historic fire regimes and that ecosystem function is not lost. One guideline calls for designing fire management activities to be consistent with moving toward desired conditions for other resources (FW-Fire-G-2). However, fire management activities are unlikely to occur within low-elevation riparian habitats, since they are not fire-adapted systems. Indirect effects such as short-term sedimentation and long-term ground vegetation improvement could occur from prescribed fire in adjacent uplands. This includes designated critical habitat along the Verde River. Since direct effects of prescribed fire are unlikely in southwestern willow flycatcher habitat or critical habitat, and only indirect minor effects would be expected in upland habitat, overall effects are not expected to be adverse.

Recreational use (e.g., hiking, camping) of occupied southwestern willow flycatcher habitat can result in visual and aural disturbance to nesting and foraging southwestern willow flycatcher s.

Frequent disturbance, disturbance of high intensity, or disturbance of long duration can disturb birds resulting in increased predation of young and eggs, abandonment of nesting areas, flushing of adults incubating eggs long enough for the eggs to become unviable, abandonment of eggs or young, decreased success during foraging, and premature fledging of young. Developed and dispersed recreation can trample or remove riparian vegetation (PCE 1a-d). Several guidelines are expected to minimize potential disturbance impacts from recreational use (FW-Rec-All-G-1, 2, 4, 5).

A guideline that states dispersed camping along riparian areas should be managed to maintain or move toward desired conditions for riparian areas and water should help protect riparian habitat that the southwestern willow flycatcher depends on (FW-Rec-Disp-G-5).

Of the 18 management areas (MA) in alternative B (modified), only one contains critical habitat. The 323,457-acre Verde Valley MA contains 474 acres of southwestern willow flycatcher critical habitat. Desired conditions (MA-Verde-DC-1, 3) call for managing watersheds to reduce the risk of uncharacteristic flooding and sedimentation into perennial streams and other areas and retaining the natural character of areas used for dispersed recreation to the extent possible, while maintaining or moving toward other desired conditions. These should benefit southwestern willow flycatcher habitat. A guideline (MA-VerdeV-G-1) is intended to design and implement projects to maintain or improve watershed and riparian function and/or prevent the introduction or spread of disease, invasive, or undesirable species. This would also be beneficial to southwestern willow flycatcher habitat as well.

The only special area that contains southwestern willow flycatcher habitat is the Verde Valley Botanical Area, which contains approximately 16 acres of critical habitat. Goals for Botanical Areas are to protect and maintain their unique characteristics (SA-RNABotGeo-DC-5), and to provide opportunities for study, monitoring, and interpretation (SA-RNABotGeo-DC-6). A guideline limits human use and access to protect characteristics of the area (SA-RNA-BotGeo-G-1). Guidelines for fire and allotment management also protect resources and unique characteristics of the area (SA-RNABotGeo-G-3, 4). Mechanized travel in botanical and geological areas is not suitable except on designated trails. This direction is consistent with protection and maintenance of the southwestern willow flycatcher and its habitat, including critical habitat.

Alternative B (modified) recommends three new wildernesses, but none of these wildernesses include designated or proposed critical habitat, therefore, there is no effect.

Alternative C

Alternative C has the same effects as alternative B (modified) except it recommends a total of 13 wilderness areas, has some management areas would be managed for reduced human disturbance, and has some areas that would not be suitable for recreational shooting. None of these areas include critical habitat, therefore, there is no effect.

In addition, this alternative restricts grazing in research natural areas, which reduces disturbance in 18 acres of Mixed Broadleaf Deciduous Riparian Forest and 117 acres of Montane Willow Riparian Forest.

Alternative D

Alternative D is similar to alternative B (modified) in most aspects. However, alternative D recommends no new wilderness areas. The effects associated with managing those areas as recommended wilderness would not occur. The areas would still be managed by the other forestwide, management area, and special area direction in alternative B (modified) with the corresponding effects discussed above in the alternative B (modified) section. This difference between the alternatives would not result in a change in the condition or trend of the riparian habitats from those provided by alternative B (modified) for this species.

This alternative also changes the scenic integrity objectives along existing energy corridors to allow for expansion and/or increased access. Since the corridors already exist and disturbance to habitat has already occurred, it is unlikely to have impacts to the southwestern willow flycatcher.

Findings

The determination of effect for all alternatives is May Affect, Likely to Adversely Affect for the southwestern willow flycatcher and its critical habitat. While these alternatives generally strive to improve degraded ERUs, some programs and activities could have adverse effects to the southwestern willow flycatcher as projects are implemented to reach those goals. Although there are currently no breeding southwestern willow flycatchers on the forest, a number of individual detections have been made over the years, so it is possible that breeding could occur over the life of the LRMP. The potential exists for some adverse effects to occur to primary constituent elements of critical habitat within the same plan sections as disclosed for the species. Effects are often short-term, and/or minimized through standards and guidelines, but the potential for adverse effects cannot always be ruled out.

Implementation of plan components related to vegetation treatments, recreation management, watershed management, wildlife, fish, or rare plants management, or land acquisition in any of the alternatives may have short-term effects on aquatic and riparian habitat or species populations, but would produce long-term benefits to the maintenance and improvement of southwestern willow flycatcher and its habitat on the Coconino NF.

The action alternatives contribute more to the viability of southwestern willow flycatcher than alternative A because of updated language on riparian forest types, springs, ecosystem restoration and better address movement corridors and connectivity between habitats.

Western Yellow-billed Cuckoo (YBCU)

The yellow-billed cuckoo was proposed for listing as a threatened distinct population segment in 2013 (USDI Fish and Wildlife Service 2013b). The Fish and Wildlife Service published the final rule to list the distinct population segment as threatened in 2014 (USDI Fish and Wildlife Service 2014).

Affected Environment

The forest has undertaken actions to improve the status of the yellow-billed cuckoo and its habitat prior to and since listing. For projects within the range of the cuckoo, the forest considers needs for the species in project design, analyzes effects of the project within the NEPA process, and consults with the Fish and Wildlife Service as needed. For noise-disturbing activities, the Forest Service requires activities occur outside of breeding season (May 15 through September 30) in areas with cuckoos or that are unsurveyed. The forest conducts surveys for various projects that

could impact cuckoos or their habitat and conducts monitoring of some sites. The forest also maintains riparian exclosures that exclude livestock or motorized vehicles in occupied and critical habitat.

Distribution

Historically, the western yellow-billed cuckoo was locally common in a number of western states, but over the last 90 years, its breeding range has contracted significantly. In Arizona, the cuckoo was widespread and locally common. Although numbers have substantially declined, Arizona still contains the largest remaining population in the West (USDI Fish and Wildlife Service 2013b).

On the forest, the Verde River is one of 12 locations in the state that supports populations of greater than 10 pairs (USDI Fish and Wildlife Service 2013b). In 2004 and 2005, surveys were conducted in the Verde watershed. Of the 37 sites surveyed, cuckoos were detected at 22 sites, which included detections at 12 of 16 historic sites, and 10 of 21 random sites (Holmes et al. 2008). In addition to the Verde River mainstem, cuckoos have been detected along Oak Creek, West Clear Creek, and Beaver Creek and tributaries (Dry Beaver Creek, Wet Beaver Creek, Red Tank Draw, and Walker Creek).

Habitat

Nesting habitat for the cuckoo consists of low- to moderate-elevation riparian habitat of 50 acres or more in size (USDI Fish and Wildlife Service 2013b). On the forest, nesting sites are within deciduous riparian habitat at least 325 feet in width (Holmes et al. 2008). Cuckoos nesting in the Verde Watershed appear to favor native cottonwood and willow habitat with adjacent stands of mesquite at least 5 hectares (12 acres) in size (Holmes et al. 2008). ERUs that contain current or potential breeding sites on the Coconino NF include Cottonwood Willow (approximately 1,324 acres) and Mixed Broadleaf Deciduous Riparian Forests (approximately 5,926 acres). These habitats are more fully evaluated in the Coarse Filter: Habitat section.

Proposed Critical Habitat: The Fish and Wildlife Service proposed 80 units, or blocks of riparian habitat, as critical habitat for the western distinct population segment of the yellow-billed cuckoo in August 2014 (USDI Fish and Wildlife Service 2014). Four units are partly or wholly within the forest and contain lands with a variety of ownerships (table 59). Acres of proposed critical habitat by ERU are shown in table 60. There are approximately 2,086 acres of proposed critical habitat on lands managed by the forest.

Table 59. Yellow-billed cuckoo proposed critical habitat units that include lands within the Coconino NF. Federal acres include lands on other forests.

Unit No.	Name of Unit	Size of Unit (Acres)	Federal Acres (Percent)	Coconino NF Acres	State	Tribal[1]	Private
17	AZ-9 Upper Verde River	4,531	2,217 (49)	384	776 (17)	0	1,538 (34)
18	AZ-10 Oak Creek	1,323	433 (33)	433	160 (12)	0	730 (55)
19	AZ-11 Beaver Creek and tributaries	2,082	1,491 (72)	968	0 (0)	3 (0.1)	588 (28)
20	AZ-12 Lower Verde River and West Clear Creek	2,053	447 (22)	301	31 (2)	43 (2)	1,532 (75)
	Totals:	**9,989**	**4,618**	**2,086**	**967**	**46**	**4,388**

[1]According to the proposed rule, these acre are being considered for exclusion from critical habitat.

Table 60. Acres of western yellow-billed cuckoo critical habitat by ERU within lands managed by the Coconino NF

ERU	Critical Habitat (Acres)
Cottonwood Willow Riparian Forest	393
Desert Communities	456
Interior Chaparral	8
Mixed Broadleaf Deciduous Riparian Forest	1,038
Pinyon Juniper Evergreen Shrub	59
Semi-Desert Grassland	134
Total:	**2,088**

Primary constituent elements that are essential to the cuckoo are riparian woodlands, adequate prey base, and dynamic riverine processes. Each element is described in more detail in the final rule (USDI Fish and Wildlife Service 2014 and the Biological Assessment (USDA Forest Service 2017c)

Risk Factors

Threats to the cuckoo were described in the final listing rule (USDI Fish and Wildlife Service 2014). The primary factors threatening the distinct population segment are the loss and degradation of habitat due to altered hydrologic and stream processes, livestock overgrazing, encroachment from agriculture, and conversion of native habitat to predominantly non-native vegetation. The proposed rule identified threats to proposed critical habitat. Threats for all four units include: altered hydrologic processes from dams, diversions, and groundwater withdrawals, floodplain encroachments such as road/bridge construction, development, and bank stabilization, livestock overgrazing, wood cutting, and recreation.

Environmental Consequences

Table 61 summarizes the viability analysis for the western yellow-billed cuckoo. This table was developed using the analysis process described under the Species Viability section above. It includes information on the status, F Rank, habitat, habitat condition and trend, likelihood that this species is limited by its habitat, and the projected management effect, by alternative.

Management effect categorizes the relative expected outcome of plan language in each alternative in terms of minimizing species viability risk and are the result of plan decisions, including plan objectives. Management effect category values are 1, 2, 3, and 4. The lower the management effects rating for a species' associated habitat, the more effective the alternative is for that species viability. These topics and the effects of the alternatives are explained in greater detail in the discussions on the alternatives that follow.

Table 61. Analysis summary for the western yellow-billed cuckoo

Species and status	Habitat	Alternative A		Alternatives B (modified), C, D	
		Habitat Trend relative to desired conditions	Likelihood species is limited	Habitat Trend relative to desired conditions	Likelihood species is limited
Western yellow-billed cuckoo (Threatened)	CWRF	Fair, slowly toward	H	Good, slowly toward	M-H
F Rank = F2*	MBDRF	Good, static to slowly toward	M-H	Good, slowly toward	M-H
Management effect		All habitats = 3: Plan components maintain or improve protection and management for some habitat occurrences in the plan area. Quality of habitat or habitat elements is maintained or improved by providing protection, maintenance, and restoration to some occurrences.		All habitats = 2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.	

*F2 = Rare on the forest within its habitat - occupies a small portion of its habitat.

Common to All Alternatives

Plan components in all alternatives contribute to species viability by managing for sustainable populations of native species and improving and protecting habitat for threatened, endangered, and sensitive species (1987 Plan, pages 22-1, 23, 64, 64-1, 66, 95, 108-2, 180, 187, 206-9, 206-11, 206-12, 206-13, 206-23, 206-30, 206-32, 206-66, 206-67, 206-71, 206-72, 206-79, 206-87, 206-89, 206-98, 206-103, 206-105, 206-108, 206-109, 206-114; FW-WFP-DC-1, 2, 3, 4, 5, 6, 8, and FW-Eco-DC-1). See At-risk Species in the Wildlife and Plant Issues and Topics section above for more information.

All alternatives incorporate the standards and guidelines in the Verde Wild and Scenic River Comprehensive River Management Plan (CRMP) (USDA Forest Service 2004a) (1987 Plan, pages 113, 114, 115-1, SA-WSR-G-1). Each congressionally designated wild and scenic river is required to have a comprehensive river management plan. The comprehensive river management plan establishes the river corridor boundary; includes detailed descriptions of the outstandingly remarkable values; and addresses goals and desired conditions, development of lands and facilities, user capacities, water quality, instream flow, and monitoring strategy. It may also include plan components (desired conditions, objectives, standards, guidelines, and monitoring). These plan components are equivalent to and have the same weight as direction in the forest plan.

Wildlife is an outstandingly remarkable value (ORV). Desired conditions call for managing wildlife habitat at optimal levels. Standards require all activities to protect and enhance ORVs, and recovery actions for listed species should be implemented. The original designation for the CRMP allows for some water diversion. Specifically, designation shall not prevent water users receiving Central Arizona Project water allocations from diverting that water through an exchange agreement with downstream water users in accordance with Arizona water law, thus, streamflows could be reduced in the future; the forest would have limited control of this effect.

Upstream and off-Forest water diversions, impoundments, and tamarisk invasion affect riparian communities on the forest; however, the forest has little control over upstream water or invasive species management. For this reason, it will be difficult for the forest to fully restore cuckoo habitat to reference conditions. Water resource management activities, including maintaining perennial water quality, quantity, and timing of flows contribute a very important role in overall ecological function and sustainability of these watersheds. Many of these activities are regulated outside the boundary of the forest. Although the Coconino NF manages what it can in terms of riparian health, cumulatively when combined with management activities of other jurisdictions, these actions would not likely be sufficient to fully restore this habitat to reference conditions. The forest will continue to provide viability for yellow-billed cuckoo within its management capabilities.

All alternatives promote a strategy to address establishment, containment, control, and eradication of invasive plants (1987 Plan, page 23, FW-Invas-DC-1, 2) and they have forestwide standards and guidelines to incorporate control measures into projects (1987 Plan, page 69, FW-Invas-G-1, 2). All alternatives point to “Design Features, Best Management Practices, Required Protection Measures, and Mitigation Measures” in the “Final Environmental Impact Statement for Integrated Treatment of Noxious or Invasive Weeds on the Coconino, Kaibab, and Prescott National Forests” (USDA Forest Service 2005a) as part of the strategy to prioritize and treat invasive plants while protecting native species (1987 Plan, page 69, FW-Invas-G-2). See discussion on Non-native or Invasive Species in the Wildlife and Plant Issues and Topics section above for additional information on this threat.

Disturbance during the breeding season can reduce or eliminate the reproductive success of any western yellow-billed cuckoo that might nest on NFS land. The discussion on Disturbance in the Wildlife and Plant Issues and Topics section above compares the different alternatives as they relate to disturbance. All alternatives have plan components that would reduce disturbance to western yellow-billed cuckoo and, thus, would promote recruitment and survival should any breeding or nesting occur (1987 Plan, pages 64-1, FW-WFP-S-2).

All alternatives incorporate Travel Management Rule direction that prohibits motor vehicle use beyond the designated system of roads, trails, and areas (including areas where motorized big game retrieval is allowed). This should help protect threatened and endangered species habitat, including the yellow-billed cuckoo, by keeping impacts to vegetative cover, soil compaction and other impacts to known and specific areas.

There are three livestock grazing allotments on the forest that contain critical habitat: 13-Mile Rock has 29 acres, Walker Basin has 8 acres, and Windmill has 1 acre. However, there is no authorized access to critical habitat along the Verde River, so there will be no impacts from this program on the yellow-billed cuckoo or its critical habitat.

There are approximately 2,415 acres of Mixed Broadleaf Deciduous and Cottonwood Willow Riparian forest types, which could provide potential habitat for yellow-billed cuckoo in the Fossil Springs, Mazatzal, Sycamore, West Clear Creek, and Wet Beaver Wilderness Areas. Wilderness designation provides extra protections for yellow-billed cuckoo potential habitat because motorized use (and associated disturbances) is more restricted, and the potential for development of recreation and administrative facilities is reduced. These areas are managed for their wilderness character, which includes native species and maintenance of natural process. Recreation use is managed to protect wilderness character. The restrictive management associated with designated wilderness is beneficial for yellow-billed cuckoo habitat.

Alternative A

Prior consultations under the Endangered Species Act

A BA for the continued implementation of forest LRMPs across the region was prepared in 2004 (USDA Forest Service 2004d). At that time, the yellow-billed cuckoo was a Federal candidate species. The BA determined that the Coconino LRMP was "Not Likely to Jeopardize" the continued existence of the cuckoo. The BA also made a determination of "May Affect, Likely to Adversely Affect" the cuckoo, in the event the species was listed in the future. Adverse effects were expected from diversions and water authorizations, livestock grazing, invasive riparian plants, and recreation. The 2005 BO found that incidental take is reasonably certain to occur from several programs, including engineering, lands and minerals, rangeland, management, recreation, and watershed management. It concluded that the continued implementation of the Coconino LRMP was not likely to jeopardize the continued existence of the yellow-billed cuckoo (USDI Fish and Wildlife Service 2005a).

Another BA for the continued implementation of forest LRMPs across the region was prepared in 2011, due to new information on species and/or critical habitat. The yellow-billed cuckoo was not included in that BA for any of the forests in the region.

The 2010 BA for the TMR project addressed the yellow-billed cuckoo as a Candidate species (USDA Forest Service 2010d). Given a mixture of positive and slight negative effects, the finding was "may affect, not likely to adversely affect" the cuckoo and its habitat. The Fish and Wildlife Service concurred with the finding on December 22, 2010 (USDI Fish and Wildlife Service 2011e).

The amended BA for motorized big game retrieval (MBGR) found that there would be an increase in MBGR within cuckoo habitat, but that adverse effects would not be expected (USDA Forest Service 2011m). This was based on the timing of MBGR and provisions that minimize potential impacts. Therefore, the finding of "may affect, not likely to adversely affect" for the species and its critical habitat did not change from the 2010 TMR BA. The Fish and Wildlife Service concurred with those findings (USDI Fish and Wildlife Service 2011f).

In summary, taking into account the TMR project and its resulting LRMP amendment, the findings from the 2004 BA of "may affect, not likely to adversely affect," the yellow-billed cuckoo and its habitat would remain appropriate for this current analysis.

Viability

Table 61 summarizes the viability analysis for yellow-billed cuckoo. Cottonwood Willow Riparian Forest would remain in fair condition and have a slow trend toward desired conditions.

In Cottonwood Willow Riparian Forest, some portions of the Verde River, Dry Beaver Creek, and Spring Creek, would be static due to high recreation use or private land, such as the area around Childs, Spring Creek, and Dry Beaver Creek.

Mixed Broadleaf Deciduous Riparian Forest would remain in good condition. The trend would be static or moving slowly toward desired conditions except in the Beaver Creek, West Clear Creek, and Oak Creek 5th code HUCs and portions of Fossil Creek where recreation impacts are high. Areas of private land would remain static as well.

The likelihood that habitat on the forest would be a limiting factor for the yellow-billed cuckoo is moderate-high to high depending on the habitat as shown in table 61. These likelihoods were derived by combining the yellow-billed cuckoo’s F Rank of F2 with the likelihood of habitat limitation variables for each ERU: CWRF (high) and MBDRF (moderate) (table 9). Low to moderate ratings are considered to be within the natural range of fluctuations for the habitat.

The management effect row shows the relative expected outcome of plan language in terms of minimizing species viability risk. The management effect is classified as a 3 for Cottonwood Willow Riparian Forest and Mixed Broadleaf Deciduous Riparian Forest, which means that plan components in alternative A maintain or improve protection and management for some habitat occurrences in the plan area and thus contribute less to the viability of this species than the other alternatives. Alternative A would maintain or improve riparian forests because it has a focus on improving riparian areas in any condition, preventing damage to riparian vegetation, stream banks, and channels, and restoring degraded riparian areas to good condition as soon as possible (1987 Plan, pages 65-2, 65-8, 172, and 206-8). Other protective language includes the following: Only beneficial new special uses are allowed in riparian areas and exceptions such as utility line or roads crossing stream courses are designed to minimize the extent and magnitude of impact to riparian areas (1987 Plan, page 177). Aggressive fire suppression may be used to prevent resource damage utilizing methods that minimize long-term adverse impacts to riparian habitats (1987 Plan, page 177). In addition, acquisition of riparian areas through land exchange is a high priority (1987 Plan, pages 177 and 185). The plan would manage commercial uses, and recreation in some areas, to protect riparian values (1987 Plan, pages 206-10, 22, 26, and 39).

This alternative has less potential for improvement to riparian condition compared to the other alternatives because plan language does not distinguish between different types of riparian forest types. Management guidance for riparian habitat is primarily contained with MA 12. Management of wildlife habitat is a key emphasis. The goal in the 1987 Plan is to recover 80 percent of riparian habitats by year 2030, with the remaining 20 percent significantly improved; however, the rate of implementation has proven to not be realistic, and the amount of forest riparian habitat improved is expected to be the same under all alternatives (USDA Forest Service 2011f).

Alternative A lacks desired conditions or guidance for mesquite bosques. The combination of Mixed Broadleaf Deciduous Riparian Forest and Cottonwood Willow Riparian Forest with mesquite bosques create a vegetative community favored by cuckoos and other riparian birds. Management of this unique community type could be inconsistent or unfavorable to cuckoos due to the lack of plan language.

Alternative B (modified)

A BA for the revision of Coconino NF Land Management Plan was prepared in 2017 (USDA Forest Service 2017c). The determination of effect for the western yellow-billed cuckoo was

"may affect, likely to adversely affect" for both the species and its proposed critical habitat, due to the potential for effects from some programs and activities. In its draft Biological and Conference Opinion received on August 8, 2017 (USDI Fish and Wildlife Service 2017b), the Fish and Wildlife Service determined that implementation of the Coconino NF's revised LRMP would not jeopardize the continued existence of the yellow-billed cuckoo. No incidental take was assigned. The Fish and Wildlife Service provided five discretionary conservation recommendations intended to minimize or avoid adverse effects, help implement recovery plans, or develop information.

Viability

Table 61 shows that under alternative B (modified), Cottonwood Willow Riparian Forest would improve to good condition and trend slowly toward desired conditions except portions of the Verde River, Towel Creek, Spring Creek and Dry Beaver Creek would improve faster (i.e., have a trend toward desired conditions).

Mixed Broadleaf Deciduous Riparian Forest would remain in good condition and slowly move toward desired conditions except portions of Fossil Creek and Wet Beaver Creek would remain static in areas of high recreation use. It would improve faster than alternative A in the Beaver Creek, Oak Creek, West Clear Creek, and Fossil Creek 5th code HUCs.

As shown in table 61, the likelihood that habitat on the forest would be a limiting factor for the yellow-billed cuckoo is moderate-high for Cottonwood Willow Riparian Forest and Mixed Broadleaf Deciduous Riparian Forest. These likelihoods were derived by combining the yellow-billed cuckoo's F Rank of F2 with the likelihood of habitat limitation variables for each ERU: Cottonwood Willow Riparian Forest (moderate) and Mixed Broadleaf Deciduous Riparian Forest (moderate) (table 9). Low to moderate ratings are considered to be within the natural range of fluctuations for the habitat.

The management effect row shows the relative expected outcome of plan language in terms of minimizing species viability risk. The management effect is classified as a 2 for Cottonwood Willow Riparian Forest and Mixed Broadleaf Deciduous Riparian Forest. This means that plan components in alternatives B (modified), C, and D maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area. This rating is primarily because there are updated desired conditions and guidelines that distinguish between the riparian forest types and that support their respective composition, structure, and function (FW-Rip-RipType-DC-1 to 6; FW-Rip-RipType-G-1 to 4). In addition, riparian functional condition would improve faster than alternative A, especially along the Verde River, Towel Creek, Spring Creek, and Dry Beaver Creek. The desired conditions manage for vegetation diversity and riparian function including in priority watersheds (FW-Rip-RipType-DC-1 and 2; FW-Water-G-2; FW-Rip-RipType-O-1). More site-specific aquatic management zone guidelines protect riparian function and water quality (FW-Rip-All-G-3; Fw-Rip-Strm-G-2) (USDA Forest Service 2016b). Plan components in the Wildlife, Fish, and Plant section also contribute to the viability of species associated with riparian areas by promoting properly functioning ecosystems that have the necessary physical and biological components to meet the needs of associated native species (FW-WFP-DC-1, 3).

The desired conditions for all ecosystems are generally consistent with maintenance and improvement of cuckoo populations and riparian habitat. They envision ecosystems that provide habitat for native species, and are resilient to natural and uncharacteristic disturbances (FW-Eco-

DC-1, 2, 3). Desirable non-natives may be present and should be in balance with properly functioning ecosystems (FW-Eco-DC-4). Non-native vegetation is a threat to cuckoos, and their critical habitat, particularly PCEs for riparian vegetation and dynamic riverine processes. This potentially contrary desired condition is moderated by the vision that any non-natives must be in balance with properly functioning ecosystems, and that the key non-native species that threaten cuckoo habitat (e.g., tamarisk, giant reed) are not considered desirable.

The desired conditions in the section for watersheds and water are generally consistent with maintenance and improvement of cuckoo populations and habitat. They generally envision properly functioning conditions. In particular for the cuckoo, the goal is to have vegetation and soil conditions such that they support clean water, base flows, riparian communities, and long-term soil productivity (FW-Water-DC-3), which would have a positive impact on habitat for cuckoos, including all three PCEs. Forest management practices and Total Maximum Daily Load (TMDL) plans should be applied to maintain or improve water quality (FW-Water-G-4 and 5). Watershed restoration and maintenance should focus on priority 6th code watersheds (FW-Water-G-2). Some 6th code watersheds that contain currently occupied and potential habitat are in impaired condition (USDA Forest Service 2016j) and could be prioritized for treatments during the life of the proposed plan. Vegetative ground cover should be maintained so that watersheds can recover quickly from disturbances (FW-Water-G-1). Two other guidelines address acquiring instream flow water rights and ensuring excess water flows back into natural habitats (FW-Water-G-3, 6). All of these guidelines will protect cuckoos and all three PCEs. Potential future watershed activities and projects are varied, and could include vegetation thinning, prescribed burning, channel stabilization, and other activities that could have impacts on habitats adjacent to or within cuckoo occupied, potential, or proposed critical habitat. Although short-term negative impacts that disturb soil or ground vegetation could occur with project implementation, the goal to improve watersheds is likely to result in positive results in the long-term, by supporting maintenance and improvement of riparian and mesquite habitat that is important to cuckoos. This applies to proposed critical habitat as well, since PCEs for riparian habitat, prey, and riverine processes could also be impacted in the short-term, but goals and guidance support long-term improvement.

The desired conditions for All Riparian Areas are consistent with maintenance and improvement of cuckoo populations and habitat. They generally describe goals to have naturally functioning ecosystems, instream flows that provide for channel and floodplain maintenance, and habitat connectivity (FW-Rip-All-DC-1 to 5). Two guidelines (FW-Rip-All-G-2 and FW-Rip-All-G-3) would have positive effects as they call for maintaining habitat and corridors for species; and to identify aquatic management zones around all riparian habitats to protect water quality and to avoid adverse effects to connected resources.

Altered hydrologic and stream processes are a key threat to cuckoos and their proposed critical habitat, so guidance in this section is particularly important for protection and enhancement of cuckoo habitat. While there are no major dams on the portion of the Verde River on the forest, there are many water diversions and modifications in the Verde Valley. The desired conditions for all Stream Ecosystems are generally consistent with maintenance and improvement of cuckoo populations and habitat. They envision streamcourses with natural sinuosity, where flooding is a natural disturbance where energy is dissipated appropriately (FW-Rip-Strm-DC-1 to 4). A guideline that emphasizes streambank stability, native vegetation, and riparian and soil function (FW-Rip-Strm-G-1) would further benefit cuckoo habitat during project implementation.

Mixed Broadleaf and Cottonwood Willow are the two riparian forest types that support cuckoos and their proposed critical habitat. There are approximately 393 acres of Cottonwood Willow, and 1,038 acres of Mixed Broadleaf Deciduous Riparian Forest within critical habitat on Coconino NF lands (table 60). The desired conditions generally provide a vision for riparian forests that is consistent with maintenance and improvement of cuckoo populations and habitat. In general, goals are to have proper functioning conditions, with protective litter and plant cover, root masses and herbaceous vegetation to stabilize and protect banks, and snags (FW-Rip-RipType-DC-1 to 5). Of particular importance to cuckoos, a desired condition provides a vision of a combination of lower elevation riparian forest and mesquite bosques that provide a unique vegetation community favored by cuckoos and other bird species (FW-Rip-RipType-DC-6). A variety of age classes would be present in mesquite bosques, and native grasses and forbs would comprise the understory in this community. These goals support suitable forest structure for breeding cuckoos.

A riparian forest type objective calls for restoring function to 200 to 500 acres of riparian habitat during each 10-year period of the plan (FW-Rip-RipType-O-1). This objective does not specify which riparian forest types will be treated. And because the plan is not site-specific, it is unknown how many acres of cuckoo habitat may be restored. This could be beneficial if it occurs in yellow-billed cuckoo habitat. There is a total of 11,018 acres of riparian forest on the Coconino NF, with approximately 3,382 acres (31 percent) not in PFC (USDA Forest Service 2016b). Therefore, implementation of this objective equates to an expected improvement of 6 to 15 percent of riparian acres not currently in PFC, which is a fairly small proportion of what's currently not functioning properly. Activities to restore riparian could include weed removal, fencing to exclude ungulate browsing or off-road driving, road improvements or obliterations, and other actions that could have impacts to the cuckoo and its habitat. Impacts from the implementation of these restoration activities may have short-term effects to cuckoos (such as disturbance during the breeding season or ground and vegetation disturbance). However, in the long term, these activities would achieve the goal of restoring functional condition within riparian forest types.

Water diversions and groundwater pumping have been identified as key threats to the cuckoo and its proposed critical habitat. One guideline states that these activities, if they occur, should not lower the water table (FW-Rip-RipType-G-1). This would lessen the likelihood that riparian forest habitat is adversely affected, but still could occur. Also important to cuckoos, a guideline calls for enhancing the connectivity and maintaining the ecological function of the combination of mesquite bosques with lower elevation riparian forests to provide habitat for cuckoos and other wildlife (FW-Rip-RipType-G-2). Another guideline calls for managing fuelwood cutting or wood removal so that impacts to understory species, tree density, tree growth, and channel function is avoided (FW-RipType-G-4). Woodcutting has been identified as a threat to proposed critical habitat. Since mesquite bosques are an important component of cuckoo habitat, these guidelines support maintenance and improvement of the cuckoo's habitat, including PCEs 1 and 3). Another guideline calls for recreation activities, permitted uses, and management activities to occur at levels that maintain or allow improvement of soil function, riparian vegetation, and water quality at the stream reach scale, but excludes fine-scale activities such as intermittent livestock crossings, water gaps, and facilities and infrastructure (FW-RipType-G-3). Since livestock use of habitat and the construction or use of facilities in riparian could impact habitat, critical habitat components (PCEs 1 through 3), and occupied sites, this caveat is not protective for the cuckoo, and could cause adverse effects at the project scale.

The desired conditions describe goals for wildlife, fish, and plants, none of which are inconsistent with maintenance and improvement of cuckoo populations and habitat. Several are particularly relevant and describe a vision very positive for the cuckoo and its habitat. For example, one desired condition states goals for properly functioning ecosystems that support sustainable populations of native animals (FW-WFP-DC-1). Another desired condition envisions habitat conditions on the forest that contribute to the survival and recovery of listed species (FW-WFP-DC-2). Additional desired conditions call for terrestrial and riparian habitats to provide the necessary physical and biological habitat components to support life cycle needs of native species and stream ecosystem conditions that support habitat for self-sustaining populations of native species (FW-WFP-DC-3, 4). Another desired condition promotes forest attributes of mature forests, including large trees, snags, and large logs. These attributes would provide habitat structure and insect prey for cuckoos within riparian forests (FW-WFP-DC-7), and critical habitat.

Two plan objectives relate to maintaining or improving cuckoo populations and habitat. FW-WFP-O-1 states that at least 20 activities that contribute to the recovery of federally listed species will be implemented during each 10-year period of the plan. Given that there are currently 22 listed or proposed species to work toward recovery for on the forest, there may be some, but not likely to be significant, progress for the cuckoo. This could be beneficial if it occurs in cuckoo habitat. FW-WFP-O-4 calls for restoring or enhancing at least 70 miles of stream habitat during each 10-year period of the plan. If stream restoration activities, such as streambank protection or removal of invasive species occur within cuckoo habitat, this could benefit the species. A standard requires the application of timing restrictions where projects or activities could negatively affect listed species, providing protection from disturbance during implementation (FW-WFP-S-2). This standard could be applied as needed to protect cuckoos from disturbance during the breeding season.

A guideline calls for designing projects and managing activities to maintain or improve habitat for native species (FW-WFP-G-3). Projects should be designed to minimize any negative impacts from pesticides, herbicides, or chemicals (FW-WFP-G-4), which would apply to removal of invasive non-native vegetation in riparian habitat. Another guideline calls for using fire suppression techniques that would minimize habitat and disturbance impacts (FW-WFP-G-9). Chytrid fungus does not impact the cuckoo directly, but can affect tree frogs, an important food item and a PCE. Preventing the introduction and spread of disease (FW-WFP-G-12) will help protect this food source. Lastly, designing new roads and trails to maintain species' access to adjoining habitat and to allow for dispersal (FW-WFP-G-13) would be positive for the cuckoo.

Overall, guidance is positive for cuckoos and their proposed critical habitat. Wildlife projects implemented under the plan will apply this guidance, and impacts are expected to be mostly positive for both the cuckoo and its proposed critical habitat. There is some potential for short-term negative impacts, for example, herbicide application to remove non-native vegetation could temporarily reduce prey abundance (PCE 2).

The expansion of non-native vegetation or the conversion of native vegetation to non-native vegetation is a threat to the cuckoo and its critical habitat. While the desired conditions accept the presence of invasive species, the stated goals are that native species' sustainability is not affected (FW-Invas-DC-1) and that infestations are detected early (FW-Invas-DC-2). Presumably, detecting infestations early would allow for more successful control or elimination. Although there are no objectives for invasive species, it is anticipated that activities would continue to

occur to work toward desired conditions under the proposed plan. Removal of non-native vegetation would also contribute to improvement in all three PCEs, so these impacts are similar for proposed critical habitat. The intent of the guidelines is to prevent, control, contain, or eradicate invasive species to protect native species and to improve watershed condition and ecosystem function (FW-Invas-G-1, 2, 3).

Overgrazing by livestock is identified as one of the primary factors threatening the cuckoo and its proposed critical habitat. On the forest, there are approximately 459 acres of proposed critical habitat within several grazing allotments. Livestock grazing is largely excluded from riparian habitats on the forest. For example, except for two water gaps infrequently used, there is no authorized livestock grazing on the Verde River. The three desired conditions are generally consistent with maintenance and improvement of cuckoo populations and habitats. A desired condition does allows for lower levels of vegetation and higher levels of soil compaction around livestock concentration areas such as earthen stock ponds, springs, and other features (FW-Graz-DC-2). If such concentration areas occur in or near occupied sites, potential habitat, or critical habitat, there could be negative impacts, but livestock grazing as a whole is fairly limited within Cottonwood Willow and Mixed Broadleaf Riparian on the forest. One guideline calls for managing livestock grazing to meet or move toward desired conditions for other resources, including species (FW-Graz-G-2), so this would be positive for the cuckoo and its habitat. The other guidelines are generally consistent with habitat and populations of the cuckoo. However, one guideline is not. It calls for maintaining riparian habitat, banks, and soils where livestock have access, except for situations such as intermittent livestock crossing through riparian and use of water gaps (FW-Graz-G-7). If these crossing or water gap areas overlap with occupied, potential, or critical habitat, there could be negative impacts. However, livestock grazing is largely excluded from riparian areas on the forest, so the extent of impacts from grazing and associated activities is expected to be fairly low.

There are currently four developed recreation sites (Beaver Creek, Chavez Crossing, Crescent Moon Ranch, and V-V Ranch) within proposed critical habitat for the cuckoo. Several of the desired conditions for developed recreation sites include language to protect resources, which would include the cuckoo and its habitat. The vision is that developed sites do not cause ecological damage (FW-Rec-Dev-DC-1), are located strategically to protect resources (FW-Rec-Dev-DC-7), and those adjacent to water protect water quality, and prevent resource damage (FW-Rec-Dev-DC-8). The goals include provisions that recreation demand is in balance with resource protection (FW-Rec-G-3) and that invasive weeds and/or aquatic organisms are not established or transported (FW-Red-Dev-DC-9). One guideline (FW-Rec-Dev-G-2) relates to cuckoo habitat, calling for the use of native plants for sites, and removal or treatment of invasive species before they become widespread. This supports minimizing the threat of non-native vegetation encroaching into cuckoo habitat.

This alternative includes a standard that prohibits motor vehicle use beyond the designated system of roads, trails, and areas (including areas where motorized big game retrieval is allowed) (FW-Rec-Disp-S-1). This should help protect threatened and endangered species habitat, including the cuckoo, by keeping impacts to vegetative cover, soil compaction and other impacts to known and specific areas. A guideline states that dispersed camping along riparian areas should be managed to maintain or move toward desired conditions for riparian areas and water (FW-Rec-Disp-G-5). This will help protect riparian habitat that the cuckoo depends on.

There are approximately 3.2 miles of trails within proposed critical habitat. There are no developed trailheads within proposed critical habitat. A Trails and Trailheads desired condition expresses the goal that damage to resources from the use of trails and trailheads is minimal, and can be mitigated or restored FW-Rec-Trails-DC-4. A guideline FW-Rec-Trails-G-3 calls for management of unplanned, user-created trails, so that resources damaged by these trails can be rehabilitated (FW-Rec-Trails-G-3). If within cuckoo habitat, this would help restore habitat. Collectively, activities related to developed and dispersed recreation, and recreational use of trails and trailheads could have impacts to the cuckoo through disturbance to breeding birds, or loss of habitat due to new construction of trails or trailheads. Guidance primarily contained within desired conditions and guidelines does include consideration of other resources in the design and management of recreation activities and trails, which would help minimize potential impacts.

Of the 18 management areas in the proposed plan, several contain proposed critical habitat. Relative to the total size of the management areas, cuckoo habitat represents a very minor portion (table 62).

Table 62. Yellow-billed cuckoo proposed critical habitat within management areas

Management Area	Management Area Acres	Yellow-billed Cuckoo Proposed Critical Habitat Acres (% MA)
House Mountain Lowlands	40,901	157 (<1)
Red Rock	105,599	55 (<1)
Sedona Neighborwoods	15,125	196 (1)
Verde Valley	323,457	1,680 (1)
Total:		**2,088**

The management direction for these management areas focuses on recreation use, scenery resources, and land exchanges. In general, there is little wildlife direction contained within the plan components. As projects are proposed to meet desired conditions for recreation and scenery in these MAs, the primary guidance for protection and guidance of listed species and their habitat will come from other relevant sections of the plan, particularly from forestwide direction for ERUs, recreation, and Wildlife, Fish, and Plants. Desired conditions in the Verde Valley MA (MA-Verde-DC-1, 3) call for managing watersheds to reduce the risk of uncharacteristic flooding and sedimentation into perennial streams and other areas and retaining the natural character of areas used for dispersed recreation to the extent possible, while maintaining or moving toward other desired conditions. A guideline (MA-VerdeV-G-1) is intended to design and implement projects to maintain or improve watershed and riparian function and/or prevent the introduction or spread of disease, invasive, or undesirable species. These should be beneficial to southwestern willow flycatcher habitat as well.

Recommended wilderness in alternative C would have localized impacts on riparian forest types, but would not affect the sustainability at the forest level. There would be a total of 895 acres of Cottonwood Willow and Mixed Broadleaf Deciduous Riparian forest types in recommended wilderness. This is about 17 percent of the Cottonwood Willow on the forest and 11 percent of the Mixed Broadleaf Deciduous. Some plan components for recommended wilderness would be beneficial for yellow-billed cuckoo because recommended wilderness would be managed to maintain or enhance primitive and undeveloped characteristics; to preserve native species and unique features; to reduce evidence of modern human control and manipulations; and motor

vehicle uses should only occur for limited administrative and permitted activities to be consistent with wilderness character (FW-RWild-DC-1 to 3; FW-RWild-G-1 and 3). Recommended wildernesses would provide additional areas of low disturbance, but the recommended wilderness would also preclude restoration treatments that would require motorized equipment. With this restriction on motorized equipment, the forest would be less likely to conduct restoration treatments, which, over time, could increase the risk of uncharacteristic fire or slow the trend toward desired conditions in these areas.

The only special area that contains cuckoo habitat is the Verde Valley Botanical Area, which contains approximately 18 acres of proposed critical habitat. Goals for Botanical Areas are to protect and maintain their unique characteristics (SA-RNABotGeo-DC-5), and to provide opportunities for study, monitoring, and interpretation (SA-RNABotGeo-DC-6). A guideline limits human use and access to protect characteristics of the area (SA-RNA-BotGeo-G-1). Guidelines for fire and allotment management also protect resources and unique characteristics of the area (SA-RNABotGeo-G-3, 4). These are consistent with protection and maintenance of cuckoos and their habitat, including proposed critical habitat. The remainder of the guidance is specific to areas that do not contain cuckoo habitat. Mechanized travel in botanical and geological areas is not suitable except on designated trails. This direction is consistent with protection and maintenance of the yellow-billed cuckoo and its habitat, including critical habitat.

Alternative C

Plan direction for yellow-billed cuckoo and its habitat is largely the same as alternative B (modified). Alternative C would recommend 13 additional wilderness areas. Recommended wilderness in alternative C would have localized impacts on riparian forest types, but would not affect the sustainability at the forest level. The Cottonwood Willow and Mixed Broadleaf Riparian forest types comprise only a small percentage (874 acres or 1 percent) of the total recommended wilderness. This is about 17 percent of the Cottonwood Willow on the forest and 11 percent of the Mixed Broadleaf Deciduous. Some plan components for recommended wilderness would be beneficial for yellow-billed cuckoo because recommended wilderness would be managed to maintain or enhance primitive and undeveloped characteristics; to preserve native species and unique features; to reduce evidence of modern human control and manipulations; and motor vehicle uses should only occur for limited administrative and permitted activities to be consistent with wilderness character (FW-RWild-DC-1 to 3; FW-RWild-G-1 and 3). Recommended wildernesses would provide additional areas of low disturbance, but the recommended wilderness would also preclude restoration treatments that would require motorized equipment. With this restriction on motorized equipment, the forest would be less likely to conduct restoration treatments, which, over time, could increase the risk of uncharacteristic fire or slow the trend toward desired conditions in these areas.

Alternative C also includes a guideline that would exclude livestock grazing from research natural areas under most circumstances (Appendix F, SA-RNABotGeo-G-4). Compared to alternative B (modified), restricting grazing would have only a small positive impact on the yellow-billed cuckoo by improving riparian habitats because little to no grazing occurs in these areas.

Alternative C would include a determination that mechanized recreation is not suitable in botanical and geological areas, which would also limit disturbance to species like the yellow-billed cuckoo.

Alternative D

The effects to yellow-billed cuckoo from alternative D are largely the same, except, unlike alternative B (modified), alternative D does not propose any new wilderness. The effects associated with managing those areas as recommended wilderness would not occur. These areas would still be managed by the other forestwide, management area, and special area direction in alternative B (modified) with the corresponding effects discussed above in the alternative B (modified) section. This difference between the alternatives would not result in a change in the condition or trend of the riparian habitats from those provided by alternative B (modified) for this species.

Findings

Effects are similar to effects for the southwestern willow flycatcher. The action alternatives include updated language on ecosystem restoration, riparian habitat, mesquite bosques, and better address movement corridors and connectivity between habitats. This would contribute more to the viability of the species compared to alternative A.

Based on threats identified for the species and for proposed critical habitat, the main impacts that could occur from future projects that implement the plan are those that impact Cottonwood Willow and Mixed Broadleaf Deciduous Riparian Forests, their associated streams, and adjacent mesquite bosques. As disclosed in the analysis, most programs and specific management areas have guidance that is expected to be positive for the cuckoo and its proposed critical habitat. But some programs and expected activities (primarily minerals and recreation) could have short-term adverse effects as projects are implemented to reach desired conditions in the LRMP. Overall, coordination and implementation of all of the guidance in the plan is expected to minimize potential impacts, and benefit the cuckoo in the long run. And, despite containing occupied and proposed critical habitat, some management areas emphasize other programs, such as recreation and scenery. Application of other protective guidance in the plan would apply, but the lack of emphasis could impact the cuckoo. Additionally, the cuckoo does not yet have a recovery plan to guide management actions.

Species

While the plan generally strives to move degraded ERUs toward historical reference conditions, management direction for some programs and associated activities could have adverse effects to the cuckoo in achieving those goals. Effects are often short-term, and/or minimized through standards and guidelines, but the potential for adverse effects cannot always be ruled out. Based on the analysis, implementation of the LRMP over the next 10 to 15 years is likely to have a mixture of adverse and beneficial effects on the species, resulting in a finding of “May Affect, Likely to Adversely Affect” the yellow-billed cuckoo and its habitat.

Proposed Critical Habitat

The potential exists for some adverse effects to occur to proposed primary constituent elements of critical habitat within the same program/plan sections as disclosed for the species. Effects are often short-term, and/or minimized through standards and guidelines, but the potential for adverse effects cannot always be ruled out.

The proposed primary constituent elements for riparian woodlands, adequate prey base, and dynamic riverine processes have the potential to be adversely affected through implementation of

future projects using guidance in the plan. Therefore, the finding for the yellow-billed cuckoo's proposed critical habitat is also "May Affect, Likely to Adversely Affect."

Alternative C would provide slightly more potential yellow-billed cuckoo habitat in Cottonwood Willow and Mixed Broadleaf Deciduous than alternatives B (modified) and D through the addition of 13 recommended wilderness areas. Guidelines for suitability would reduce disturbance from motorized dispersed camping and vehicle use in these areas. However, as noted in other sections, forest restoration methods would be more limited in wilderness, and given the potential for habitat loss resulting from fire, particularly in riparian forests that did not co-evolve with fire as natural disturbance, habitat loss could be disproportionately high, given the rarity of the ERUs on the forest. As a result, the overall net gain of alternative C over B (modified) is minimal. Alternative D would be similar in effect as alternative A in this regard.

Yuma Ridgway's Rail (YRR)

The following information for Yuma's Ridgway's rail is from the Biological Assessment (USDA Forest Service 2017c). The name for Yuma clapper rail was recently changed to Yuma Ridgway's rail. These terms are used interchangeably in this section.

There have never been any Yuma Ridgway's rails detected on the forest. The Yuma clapper rail was listed as endangered in 1967 (32 FR 4001, March 11, 1967). The recovery plan was published in 1983 (USDI Fish and Wildlife Service 1983), and a draft revised recovery plan was completed in 2009 (USDI Fish and Wildlife Service 2009). In Arizona, the Yuma clapper rail was historically found only along the lower Colorado River from Yuma north to the Bill Williams River delta (Phillips et al. 1964). Breeding bird atlas and other survey data show that the Yuma clapper rail still occurs throughout most of its previously described range in Arizona along the lower Colorado and Gila Rivers (Corman and Wise-Gervais 2005). Habitat use by the Yuma clapper rail changes seasonally, with birds using densely vegetated marshes with shallow water for nesting, and marsh habitat with low stem densities and moderate water depths for foraging and year-round use (Conway et al. 1993).

The Yuma clapper rail has been on the forest threatened and endangered list primarily due to reported detections at Tavasci Marsh sometime in 1997-1998 (Von Gausig 1998). The rails detected on private land at Tavasci Marsh were reportedly Yuma clapper rails, but additional surveys have not detected any Yuma clapper rails there, or at any other locations on the forest.

Given that the elevational range of the forest is approximately 2,600 to 12,633 feet, and the elevational range of the Yuma clapper rail is 100 to 1,500 feet, it is unlikely that the rail will establish on the forest.

Since Yuma clapper rails are not present on the forest, and are not likely to occur, implementation of the proposed plan (or the other alternatives) would not have any effects. If Yuma clapper rails are detected on the forest sometime in the future, a BA will be completed and consultation with the Fish and Wildlife Service will occur.

Threatened and Endangered: Fish

Colorado Pikeminnow

Affected Environment

Distribution

The pikeminnow was once common throughout the Colorado River system, including the Gila River Basin, but populations are now found only in scattered areas of the upper Colorado River system in Utah, Colorado, and New Mexico (USDI Fish and Wildlife Service 2002c). Colorado pikeminnow are believed to have ranged in the Verde River up to Perkinsville, Arizona (Minckley and Alger 1968). The experimental populations in Arizona represent the only extant populations in the lower Colorado River basin. Colorado pikeminnow potentially occupy the Cherry Creek-Verde River, Fossil Creek-Verde River, Grindstone Wash-Verde River HUCs within Cottonwood Willow and Mixed Broadleaf Deciduous Riparian Forests. This species is considered to occupy the Verde River as it runs along much of the western border of the Coconino NF within Cottonwood Willow and Mixed Broadleaf Deciduous Riparian Forests.

Habitat

Colorado pikeminnow is associated with perennial streamcourses and Cottonwood Willow and Mixed Broadleaf Deciduous Riparian Forests. These habitats are more fully evaluated in the Coarse Filter: Habitat section. The Colorado pikeminnow is characterized as a large-river generalist species, occurring in turbid, deep, and strongly flowing water. The fish has adapted to rivers with high seasonally variable flows, high silt loads, and turbulence (USDI Fish and Wildlife Service 1994a). Young-of-year, juveniles, and sub-adults occupy shallow backwater areas with little or no current and silt/sand substrates where young and juveniles will feed on insect larvae and zooplankton. Adults and sub-adults are primarily piscivorous, including both native and non-native fishes. During flood periods, adults move out of the river channels and occupy flooded bottom-lands where they may feed on terrestrial animals (AZGFD 2002a). Spawning occurs from late June through about mid-August depending on local hydrology and temperature regimes. No critical habitat has been designated on the forest for Colorado pikeminnow.

Risk Factors

Historically, several factors contributed to this species decline and near extinction, most significantly, alterations in the hydrologic regime and water quality due to waterway development (AZGFD 2002a). Dams have blocked migration routes (Tyus 1991). Water temperature changes (e.g., hypolimnetic releases below large dams) can be significant, as cold temperatures can inhibit embryonic development (Marsh 1985) and increase early life mortality (Kaeding and Osmundson 1988). Additionally, interactions with non-native fishes is an important factor in the continued survival or success of reintroduced populations of Colorado pikeminnow, especially to juvenile recruits (AZGFD 2002a, Creef et al. 1992, Hendrickson 1993, Brooks 1986, and AZGFD 1988) all pointed to predatory interactions as an impediment to successful pikeminnow reintroduction. Channel catfish, smallmouth bass, and flathead catfish were identified as major predators in Arizona. Overlap and interactions with non-native fishes such as red shiner, fathead minnow and green sunfish may result in reduced growth and survival of age-0 pikeminnow (Karp and Tyus 1990).

Coconino NF management activities that have contributed to habitat degradation include road construction and maintenance, timber management, fire suppression and subsequent stand-replacing fires, stream diversion, and permitted livestock grazing. Management needs include: re-establishment of large pikeminnow in historical habitats, amelioration of impacts from non-native predatory and competitor fish species, and maintenance and restoration of select habitats within historical range.

Environmental Consequences

Table 63 summarizes the viability analysis for Colorado pikeminnow. This table was developed using the analysis process described under the Species Viability section above. It includes information on the status, F Rank, habitat, habitat condition and trend, likelihood that this species is limited by its habitat, and the projected management effect, by alternative. Management effect categorizes the relative expected outcome of plan language in each alternative in terms of minimizing species viability risk and are the result of plan decisions, including plan objectives. Management effect category values are 1, 2, 3, and 4. The lower the management effects rating for a species' associated habitat, the more effective the alternative is for that species viability. These topics and the effects of the alternatives are explained in greater detail in the discussions on the alternatives that follow.

Table 63. Analysis summary for Colorado pikeminnow

Species and status	Habitat	Alternative A		Alternatives B (modified), C, D	
		Habitat condition and trend relative to desired conditions	Likelihood species is limited	Habitat condition and trend relative to desired conditions	Likelihood species is limited
Colorado pikeminnow (Experimental nonessential, Restricted Distribution) F Rank = F2*	Perennial streams	Poor, static	H	Poor, toward	H
	CWRF	Fair, slowly toward	H	Good, slowly toward	M-H
	MBDRF	Good, static to slowly toward	M-H	Good, slowly toward	M-H
Management effect		Perennial streams = 4: Decline in habitat quality as a result of management or lack of management that result from plan components. Plan components may not exist or may be few. CWRF and MBDRF = 3: Plan components maintain or improve protection and management for some habitat occurrences in the plan area. Quality of habitat or habitat elements is maintained or improved by providing protection, maintenance, and restoration to some occurrences.		All habitats = 2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.	

*F2 = Rare on the forest within its habitat - occupies a small portion of its habitat.

Common to All Alternatives

This species also has a recovery plan in place, and Forest plan language includes guidance for incorporating recovery actions and conservation strategies for federally listed or candidate species (1987 Plan, pages 23 and 64, FW-WFP-G-1 and 2). This guidance would have positive contributions to maintaining Colorado pikeminnow viability on the forest.

Plan components in all alternatives contribute to species viability by managing for sustainable populations of native species and improving and protecting habitat for threatened, endangered, and sensitive species (1987 Plan, pages 22-1, 23, 64, 64-1, 66, 95, 108-2, 180, 187, 206-9, 206-11, 206-12, 206-13, 206-23, 206-30, 206-32, 206-66, 206-67, 206-71, 206-72, 206-79, 206-87, 206-89, 206-98, 206-103, 206-105, 206-108, 206-109, 206-114; FW-WFP-DC-1, 2, 3, 4, 5, 6, 8, and FW-Eco-DC-1). See At-risk Species in the Wildlife and Plant Issues and Topics section above for more information.

Disease, competition, and predation through introductions of non-native species are the greatest fine filter threats to Colorado pikeminnow. There is language under all alternatives that prioritizes habitat improvement and protections for projects for threatened and endangered species (1987 Plan, pages 23, 59, 64-6, and 87; FW-LndAdj-G-1; FW-Minerals-G-3; FW-RdsFac-G-7). Additionally, management applications under alternatives B (modified), C, and D provide recommendations to managers regarding approaches for successful implementation of plan components, such as prioritization of work to benefit threatened and endangered species (Management Approaches for Roads and Facilities, All Riparian Areas, Stream Ecosystems, and Watersheds and Water). Finally, all alternatives contain plan components provide for some guidance to manage introductions of non-native species (see Non-native or Invasive Species in the Wildlife and Plant Issues and Topics section); however, viability of native species is threatened on the forest when the focus is limited solely to introductions because most of the aquatic habitat on the forest already has undesirable non-native species.

Three 5th code watersheds (Cherry Creek-Verde River, Fossil Creek-Verde River, and Grindstone Wash-Verde River) also have portions of three existing or eligible wild and scenic river areas, some with corresponding river management plans that provide for protections of outstandingly remarkable values and limit motorized and recreational access. Managing for these outstandingly remarkable values would have the effect of improving habitat quality for this species.

Alternative A

<u>Prior consultations under the Endangered Species Act</u>

A BA for the continued implementation of forest LRMPs across the region was prepared in 2004 (USDA Forest Service 2004d). The 2004 BA found the continued implementation of the Coconino Land Management Plan would result in effects that are discountable. The Biological Opinion concurred with the finding (USDI Fish and Wildlife Service 2005a).

Since 2011, there have been two amendments to the current plan. One amendment addresses cultural resources and has no significant effect on the management of Colorado pikeminnow. The second incorporates the direction of the Travel Management Rule into the current plan. The decision closed cross-country motorized travel across the forest, limiting vehicles to designated roadways. The Biological Assessments for the Travel Management Rule determined that the project “may affect but is not likely to adversely affect Colorado pikeminnow or its habitat”

(USDA Forest Service 2010d, 2011m). The Fish and Wildlife Service concurred with the finding (USDI Fish and Wildlife Service 2011e, 2011f).

Another BA for the continued implementation of forest LRMPS across the region was prepared in 2011, due to new information on species and/or critical habitat (USDA Forest Service 2011f). The finding for the experimental/nonessential population of Colorado pikeminnow was “not likely to jeopardize” (USDA Forest Service 2011f). The 2011 BA concluded that after reviewing the standards and guidelines in the Coconino NF LRMP, the effects would be insignificant. The Fish and Wildlife Service concurred with the finding (USDI Fish and Wildlife Service 2012d).

Since 2012, there have been no significant changes in LMRP or significant scientific information to warrant a change in the finding.

Viability

Table 63 shows that perennial streams would remain in poor condition with a static trend relative to desired conditions. Cottonwood Willow Riparian Forest would remain in fair condition and have a slow trend toward desired conditions. In Cottonwood Willow Riparian Forest, some portions of the Verde River, Dry Beaver Creek, and Spring Creek, would be static due to high recreation or private land, such as the area around Childs, Spring Creek, Dry Beaver Creek, and private lands.

Mixed Broadleaf Deciduous Riparian Forest would remain in good condition. Static trends would be associated with the Oak Creek 5th code and West Clear Creek 5th code HUCs. The trend would be static or moving slowly toward desired conditions except in the Beaver Creek, West Clear Creek and Oak Creek 5th code HUCs and portions of Fossil Creek where recreation impacts are high. Areas of private land would remain static as well.

The likelihood that habitat on the forest would be a limiting factor for the Colorado pikeminnow is moderate-high to high depending on the habitat as shown in table 63. These likelihoods were derived by combining the Colorado pikeminnow’s F Rank of F2 with the likelihood of habitat limitation variables for each ERU: perennial streams (high), Cottonwood Willow Riparian Forest (high), and Mixed Broadleaf Deciduous Riparian Forest (moderate) (table 9). Low to moderate ratings are considered to be within the natural range of fluctuations for the habitat.

The management effect row shows the relative expected outcome of plan language in terms of minimizing species viability risk. The management effect is classified as a 4 for perennial streams, which means there is a decline in habitat quality as a result of management or lack of management that result from plan components. Plan components may not exist or may be few. As described in the Coarse Filter: Habitat section, the threat of dispersed recreation to riparian resources is not addressed forestwide in alternative A. Special areas such as the Verde Wild and Scenic River and wilderness, and the management areas within Flagstaff/Lake Mary Ecosystem Area and the Sedona-Oak Creek Planning Area most specifically address the conflicts and strategies to resolve resource damage in riparian areas. This direction mainly addresses dispersed recreations impact to specific riparian areas where there have been past conflicts and resource damage, but it provides very limited direction when areas that previously received low use are “discovered” and see unexpected increases in recreation, such as Fossil Creek. As a result, alternative A addresses this threat sporadically compared with alternatives B (modified), C, and D, but it does mitigate some of the areas where the conflict is most pronounced.

The management effect is classified as a 3 for Cottonwood Willow Riparian Forest and Mixed Broadleaf Deciduous Riparian Forest, which means that plan components in alternative A maintain or improve protection and management for some habitat occurrences in the plan area and thus contribute less to the viability of this species than the other alternatives. Alternative A would maintain or improve riparian forests and associated streamcourses because it has a focus on improving riparian areas in any condition, preventing damage to riparian vegetation, stream banks, and channels, and restoring degraded riparian areas to good condition as soon as possible (1987 Plan, pages 65-2, 65-8, 172, and 206-8). Other protective language includes the following: Only beneficial new special uses are allowed in riparian areas and exceptions such as utility line or roads crossing stream courses are designed to minimize the extent and magnitude of impact to riparian (1987 Plan, page 177). Aggressive fire suppression may be used to prevent resource damage utilizing methods that minimize long-term adverse impacts to riparian habitats (1987 Plan, page 177). In addition, acquisition of riparian areas through land exchange is a high priority (1987 Plan, pages 177 and 185). The plan would manage commercial uses, and recreation in some areas, to protect riparian values (1987 Plan, pages 206-10, 22, 26, and 39). This alternative has less potential for improvement to riparian condition compared to the other alternatives because plan language for specific riparian forest types is lacking and there is not a focus on functioning-at-risk and non-functional riparian areas (USDA Forest Service 2016b).

Alternative A provides some guidance to reduce introductions of non-native species (primarily focused on plant species, 1987 Plan, page 206-72), but this language is insufficient in scope to maintain viability of Colorado pikeminnow on the forest. Alternative A also has forestwide language that allows for the construction of barriers to improve fisheries habitat in lakes and streams separating native from non-native species and that promotes improvement of habitat through the installation of 10 stream improvement projects on perennial streams (1987 Plan, page 175). This alternative also allows for the retention of logging and other debris in stream channels if environmental analysis shows it can be used to improve fisheries habitat (1987 Plan, page 72). Other management concerns for Colorado pikeminnow not adequately addressed under alternative A include language to address threatened and endangered species conservation strategies, integration of riparian, water, and aquatic species management strategies, habitat connectivity, and strategies to address climate change. Trends in watershed conditions are likely to remain static, with declining flows in perennial streams due to climate change and continued water development off forest lands that impact groundwater and stream volume on the forest. Colorado pikeminnow populations on the forest are considered experimental, non-essential, and are not currently self-sustaining under existing conditions that may continue to degrade due to climate change, and increasing groundwater withdrawals outside of Forest jurisdictions. A substantial part of these watersheds lie within wilderness areas (32 percent), with protections provided within from pollution, development, and sedimentation; however, invasive species threats exist throughout. Considering these conditions and cumulative effects, the continued implementation of alternative A is not likely to jeopardize the experimental, nonessential population of Colorado pikeminnow in the Verde River.

Alternative B (modified)

Consultation under the Endangered Species Act

A BA for the revision of Coconino NF Land Management Plan was prepared in 2017 (USDA Forest Service 2017c). The determination of effect for Colorado pikeminnow was “not likely to jeopardize” the 10j population of Colorado pikeminnow due to insignificant effects from forest management activities to water quality or stream habitat in the area of the Verde River they

occupy. The Fish and Wildlife Service concurred with this finding in their draft Biological and Conference Opinion received on August 8, 2017 (USDI Fish and Wildlife Service 2017b).

Viability

Table 63 shows that under alternative B (modified) perennial streams would remain in poor condition but the trend would be toward desired conditions because of updated plan components (see management effect discussion below).

Cottonwood Willow Riparian Forest would improve to good condition and trend slowly toward desired conditions except portions of the Verde River, Towel Creek, Spring Creek and Dry Beaver Creek would improve faster (i.e., have a trend toward desired conditions).

Mixed Broadleaf Deciduous Riparian Forest would remain in good condition and slowly move toward desired conditions except portions of Fossil Creek and Wet Beaver Creek would remain static in areas of high recreation use. It would improve faster than alternative A in the Beaver Creek, Oak Creek, West Clear Creek, and Fossil Creek 5th code HUCs.

As shown in table 63, the likelihood that habitat on the forest would be a limiting factor for the Colorado pikeminnow is moderate-high to high depending on the habitat. These likelihoods were derived by combining the Colorado pikeminnow's F Rank of F2 with the likelihood of habitat limitation variables for each ERU: perennial streams (high), CWRF (moderate), and MBDRF (moderate) (table 9). Low to moderate ratings are considered to be within the natural range of fluctuations for the habitat.

The management effect row shows the relative expected outcome of plan language in terms of minimizing species viability risk. The management effect is classified as a 2 for all the coarse filter habitats associated with the Colorado pikeminnow. This means that plan components in alternative B (modified) maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area. For perennial streams, this rating is based on a broad array of plan language.

Desired conditions under alternative B (modified) support and trend to improved stream ecosystem function (FW-Water-DC-2 and 3) and collaborative efforts to maintain stream flow (FW-Water-DC-5 and 6; FW-Rip-Strm-DC-4) and reduce or eliminate the impacts of invasive species (FW-Invas-DC-1). Implementation of plan components under alterative B (modified) will likely move large perennial stream habitats more rapidly toward desired conditions (USDA Forest Service 2016j), possibly making habitat suitable for naturally reproducing populations of Colorado pikeminnow.

Other plan language is designed to mitigate the effects of roads and promote connectivity within drainages and between streamcourses and upland habitats (FW-RdsFac-G-2, 5, 7 and 9 and the Connectivity topic in the Wildlife and Plants Topics and Issues section). Although there are three recommended wildernesses, only the Davey's recommended wilderness area connects to perennial water, Fossil Creek. Guidelines for recommended wilderness would lessen the effects of roads by restricting motorized use except for limited permitted and administrative use and promoting trails for mechanized and non-motorized use (SA-RWild-G-3, 5). This is beneficial for connected waters and habitat for these species because roads can alter natural water flow patterns and natural sediment levels.

More site-specific aquatic management zone guidelines protect riparian function and water quality (FW-Rip-All-G-3; Fw-Rip-Strm-G-2). Also, alternative B (modified) has a guideline that balances recreation activities, permitted uses, and management activities with soil function, riparian vegetation, and water quality at the stream reach scale (FW-Rip-RipType-G-3). This guideline would not apply to fine-scale activities and facilities such as intermittent livestock crossing locations, water gaps, or other infrastructure used to manage impacts to riparian areas at a larger scale. This guideline is intended to protect riparian function, especially in areas of high recreation use such as Oak Creek, Beaver Creek, and Fossil Creek.

Alternative B (modified) has desired conditions that protect riparian resources including soil conditions and water quality while recognizing the demand for and need to properly manage the public's dispersed recreation opportunities. A forestwide desired condition for dispersed recreation supports managing dispersed recreation to avoid resource damage (FW-Rec-Disp-DC-3). Several guidelines about dispersed recreation would manage trails, camping, and recreation types to prevent further resource damage to riparian resources (FW-Rec-Disp-G-1 to 5).

Plan components in alternative B (modified) specify that livestock grazing maintains desired conditions of plant communities (FW-Graz-DC-2; FW-Graz-G-2). They also protect and minimize impacts to riparian areas by recommending that livestock use be restricted to the dormant season, recommending utilization levels on woody vegetation, maintenance of adequate vegetative cover to protect streambanks, and state that riparian areas are rarely negatively impacted by livestock (FW-Graz-G-7). This would maintain riparian structure, composition, and promote proper functioning. Guidelines are in place to reduce cattle concentrations and sedimentation into connected waters by specifying that range improvements should not interfere with riparian function and rare species, and further specifies a minimum distance of salts and supplements from riparian areas (FW-Graz-G-4 and 5).

Alternative B (modified) addresses uncharacteristic flooding by maintaining natural hydrographs through time and by promoting riparian forest composition and structure that would reduce the effects of flooding (FW-Rip-Strm-DC-4, FW-Rip-RipType-DC-2). For stream riparian areas, functional riparian areas and herbaceous vegetation provide protection from uncharacteristic wildfire and flooding disturbance, resiliency, and should filter sediment and protect water quality (FW-Rip-RipType-DC-2, 3, 4). This alternative also contains a guideline protects riparian resources by recommending against issuing a lands and recreation special use permit for activities proposed to occur within 200 feet of perennial streams, springs, or waters that contribute to or support sensitive resources, such as federally listed or Southwestern Region sensitive species (FW-SpecUse-G-3).

For Cottonwood Willow Riparian Forest and Mixed Broadleaf Deciduous Riparian Forest, this management effect rating is primarily because there are updated desired conditions and guidelines that support the composition, structure, and function of riparian forest types (FW-Rip-RipType-DC-1 to 6, FW-Rip-RipType-G-1 to 4). In addition, riparian functional condition would improve faster than alternative A, especially along the Verde River, Towel Creek, Spring Creek, and Dry Beaver Creek. Plan components manage for vegetation diversity and riparian function (FW-Rip-RipType-DC-1 and 2; FW-Water-G-2; FW-Rip-RipType-O-1). Plan components in the Wildlife, Fish and Plants section also contribute to the viability of species associated with riparian areas by promoting properly functioning ecosystems that have the necessary physical and biological components to meet the needs of associated native species (FW-WFP-DC-1 and 3).

Alternative C

Implementation of plan components under alternative C will have similar effects to alternative B (modified) except that alternative C recommends two additional wilderness areas along the Verde River, bordering the existing Hackberry Inventoried Roadless Area. While these areas will add some additional acreage to the already protected wilderness, the acreages represent a small addition of protected riparian habitat along the river from accessibility and road use. These small changes will not change the conditions and trends in aquatic habitats from those provided by alternatives B (modified) and D for this species.

Alternative D

Implementation of alternative D will have similar effects to alternative B (modified) except that alternative D would designate only the Cottonwood Basin Geological Area. This area does not contain springs and has smaller acreage than the Cottonwood Basin Geological and Botanical Area designated for alternatives B (modified) and C.

Alternative D recommends no new wilderness areas. The effects associated with managing the recommended areas under alternatives B (modified) and C as recommended wilderness would not occur. These areas would still be managed by the other forestwide, management area, and special area direction in alternative B (modified) with the corresponding effects discussed above in the alternative B (modified) section. Implementation would be the same as alternative A with regard to maintenance of existing wilderness. These small changes will not change the conditions and trends in aquatic habitats from those provided by alternatives B (modified) and C for this species.

Findings

Implementation of alternative B (modified) would contribute more to the viability of Colorado pikeminnow than alternative A because of updated plan components for management of the different riparian forest types, for invasive animal species and associated disease management, for updated language for water quality, and for language that addresses endemic species. Although alternative C would have the same effects as alternative B (modified), it would contribute slightly more to the viability of these species due to the additional protection provided in recommended wilderness in the watersheds for this species. Continued management under alternative A would contribute to the viability of this species, but less so than the other alternatives. Although it has language to maintain the viability of wildlife species, much of the plan language is outdated. For example, it lacks sufficient guidance for invasive animal species or disease; does not distinguish between the different riparian forest types; and lacks language that would protect endemic species or those with restricted distributions.

Gila Chub

Affected Environment

Existing Conditions

The taxonomic uniqueness of the three chub species currently federally listed in Arizona (Gila, roundtail, and headwater) was reviewed recently. On April 6, 2017, the Fish and Wildlife Service withdrew the proposed listing for headwater chub (*Gila nigra*) and roundtail chub (*Gila robusta*) in the Lower Colorado River Basin due to the findings of the Joint Committee on the Names of Fishes (USDI Fish and Wildlife Service 2017a). These findings concluded that the two formerly proposed species, as well as the currently listed Gila chub (*Gila intermedia*), are no longer valid

species and should be all considered roundtail chub. The Fish and Wildlife Service is still working internally to clarify the process that will be taken for this species complex. It is likely that the Fish and Wildlife Service will do a full species status review either for the roundtail chub complex in the Distinct Population Segment in the Lower Colorado or potentially range-wide. This process is likely to take a few years. In the interim, Gila chub will continue to be considered a listed species. Populations considered to be Gila chub are listed in the draft recovery plan (USDI Fish and Wildlife Service 2015a). Roundtail and headwater chub are no longer proposed for listing as a threatened or endangered species, but continue to be on the Regional Forester's sensitive species list.

Gila chub are found in the Beaver Creek and Oak Creek watersheds within both Mixed Broadleaf Deciduous and Cottonwood Willow Riparian Forests. Both of these riparian forest types in these watersheds are moderately departed from reference, primarily due to dispersed recreation that has degraded stream side vegetation and compacted soils (USDA Forest Service 2016b). However, both are slowly moving toward reference with past damaging practices reduced or eliminated by other forest decisions (USDA Forest Service 2016b), such as the Coconino NF Travel Management Decision (USDA Forest Service 2011g). Additionally, instream flow rights have been sought for Red Tank Draw, and Spring and Walker Creeks have existing rights. Finally, existing Walker Mountain Inventoried Roadless Area and the Wet Beaver Creek, Munds Mountain, and Red Rock-Secret Mountain Wilderness Areas protect parts of critical and potential habitat for this species in the Oak and Beaver Creek watersheds from sedimentation due to roads and accessibility (15 percent).

Distribution

Gila chub were historically found in headwater streams of the Gila River drainage in Arizona and New Mexico and likely in the Santa Cruz River system in Sonora, Mexico. Present distribution on the forest consists of small streams in the Verde River drainage (Red Tank Draw and Walker Creeks in the Beaver Creek 5th HUC watershed, and Spring Creek in the Oak Creek 5th HUC watershed; 11.8 potential perennial stream miles). Not all of these stream miles are occupied at any one time, as population size and distribution is dependent upon habitat conditions, drought, and abundance of non-native fish and invertebrate species.

Habitat

Gila chub occur in perennial streams bordered by Cottonwood Willow Riparian Forest and Mixed Broadleaf Deciduous Riparian Forest. These habitats are more fully evaluated in the Coarse Filter: Habitat section. Gila chub were commonly found in association with Gila topminnow, desert and Sonora sucker, and longfin and speckled dace. It is highly secretive, seeking out deeper waters near cover (AZGFD 2002c). It uses diverse habitat types based on season and age. Habitat use varies from deeper, permanent pools or springs to vegetated margins and undercut banks, based on life-stage. Gila chub probably mature in their second to third year. Reproduction occurs primarily from late spring into summer in streams, but can extend into late winter in constant temperature springs. Spawning occurs over beds of submerged aquatic vegetation. Gila chub are omnivorous, preferring terrestrial and aquatic insects. At larger sizes, the species becomes piscivorous and has been found to consume speckled dace and probably other small cyprinids as available. Juveniles will feed throughout the day on insects and filamentous and diatomaceous algae (USDI Fish and Wildlife Service 2005a).

Critical Habitat

Only small sections of designated critical habitat are present on the Coconino NF. These are found in Red Tank Draw and Walker Creek in the Beaver Creek 5th HUC watershed, and Spring Creek in the Oak Creek 5th HUC watershed (16.4 miles total).

The primary constituent elements of critical habitat for Gila chub are summarized:

- Perennial pools with channel complexity and areas of open waters for passage between streambed vegetation;
- Water temperatures appropriate for all life stages at appropriate timing;
- Water quality criteria including low levels of contaminants, sediments, and meeting physiological requirements;
- Sufficient cover, including streamside vegetation, woody debris, boulders, and stable streambanks;
- Absence on non-native predators or competitors that are detrimental to Gila chub; and
- Natural flow and hydrologic pattern, including periodic flooding.

Risk Factors

Gila chub are highly susceptible to predation by and competition with non-native fish and invertebrate species. Activities that degrade water quality, quantity, or change flow regimes will impact Gila chub as various life stages of this species use a wide variety of aquatic habitats, from deep spring pools, to seeking cover alongside vegetated and undercut banks, and spawning on vegetated stream beds (USDI Fish and Wildlife Service 2005a). Coconino NF management activities that have contributed to habitat degradation include road construction and maintenance, timber management, fire suppression and subsequent stand-replacing fires, stream diversion, and recreation and permitted livestock grazing in riparian areas.

Environmental Consequences

Table 64 summarizes the viability analysis for Gila chub. This table was developed using the analysis process described under the Species Viability section above. It includes information on the status, F Rank, habitat, habitat condition and trend, likelihood that this species is limited by its habitat, and the projected management effect, by alternative. Management effect categorizes the relative expected outcome of plan language in each alternative in terms of minimizing species viability risk and are the result of plan decisions, including plan objectives. Management effect category values are 1, 2, 3, and 4. The lower the management effects rating for a species' associated habitat, the more effective the alternative is for that species viability. These topics and the effects of the alternatives are explained in greater detail in the discussions on the alternatives that follow.

Table 64. Analysis summary for Gila chub

Species and status	Habitat	Alternative A: Habitat condition and trend relative to desired conditions	Alternative A: Likelihood species is limited	Alternatives B (modified), C, D: Habitat condition and trend relative to desired conditions	Alternatives B (modified), C, D: Likelihood species is limited
Gila chub (Endangered, Endemic) F Rank = F1*	Perennial streams	Poor, static	VH	Poor, toward	VH
	CWRF	Fair, slowly toward	VH	Good, slowly toward	H
	MBDRF	Good, static to slowly toward	H	Good, slowly toward	H
Management effect		Perennial streams = 4: Decline in habitat quality as a result of management or lack of management that result from plan components. Plan components may not exist or may be few. CWRF and MBDRF = 3: Plan components maintain or improve protection and management for some habitat occurrences in the plan area. Quality of habitat or habitat elements is maintained or improved by providing protection, maintenance, and restoration to some occurrences.		All habitats = 2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.	

*F1 = Very rare on the forest within its habitat – occupies a very small portion of its habitat.

Common to All Alternatives

Plan components in all alternatives contribute to species viability by managing for sustainable populations of native species and improving and protecting habitat for threatened, endangered, and sensitive species (1987 Plan, pages 22-1, 23, 64, 64-1, 66, 95, 108-2, 180, 187, 206-9, 206-11, 206-12, 206-13, 206-23, 206-30, 206-32, 206-66, 206-67, 206-71, 206-72, 206-79, 206-87, 206-89, 206-98, 206-103, 206-105, 206-108, 206-109, 206-114; FW-WFP-DC-1, 2, 3, 4, 5, 6, 8, and FW-Eco-DC-1). See At-risk Species in the Wildlife and Plant Issues and Topics section above for more information.

This species has a draft recovery plan (USDI Fish and Wildlife Service 2015), in place but does have critical habitat designated on the forest, some of which is accessible to grazing and recreational impacts. Plan language for alternative B (modified) includes guidance for incorporating recovery actions and conservation strategies for federally listed or candidate species including their critical habitats (FW-WFP-G-1 and 2).

Disease, competition, and predation through introductions of non-native species the greatest fine filter threats to Gila chub. There is language under all alternatives that prioritizes habitat improvement and protections for projects for threatened and endangered species (1987 Plan, pages 23, 59, 64-6, and 87; FW-LndAdj-G-1; FW-Minerals-G-3; FW-RdsFac-G-7). Additionally,

management applications under alternatives B (modified), C, and D provide recommendations to managers regarding approaches for successful implementation of plan components, such as prioritization of work to benefit threatened and endangered species (Management Approaches for Roads and Facilities, All Riparian Areas, Stream Ecosystems, and Watersheds and Water). Finally, all alternatives contain plan components provide for some guidance to manage introductions of non-native species (see Non-native or Invasive Species in the Wildlife and Plant Issues and Topics section); however, viability of native species is threatened on the forest when the focus is limited solely to introductions because most of the aquatic habitat on the forest already has undesirable non-native species.

Alternative A

Prior consultations under the Endangered Species Act

A BA for the continued implementation of forest LRMPs across the region was prepared in 2004, prior to the listing of Gila chub (USDA Forest Service 2004d). The 2004 BA found that the Coconino Land Management Plan was "not likely to jeopardize the continued existence of the Gila chub." The BA continues: "If the Gila chub is listed as an endangered species, the continued implementation of the LRMPs 'may affect and is likely to adversely affect' the Gila chub because there exists the potential for multiple activities in several programs to be carried out under the guidance of the S&Gs which may result in take of Gila chub. The effects are minimized greatly particularly by S&Gs in the Watershed and Wildlife, Fish, and Rare Plants Programs to avert jeopardizing individual populations. Generally, the overall guidance of the LRMP S&Gs is to protect resources while maintaining multiple use activities. Most program guidance in the S&Gs does seek to allow multiple uses while still maintaining ecosystem health and function. However, some conflicts will arise with effects to the species occurring due to the general lack of complete filtering necessary to prevent incidental take. The effects will be minimized due to the guidance in the S&Gs; however, incidental take may not be eliminated but should remain very small."

For critical habitat, the 2004 BA found that the LRMP is "not likely to destroy or adversely modify" "proposed critical habitat for the Gila Chub. If critical habitat is designated officially through the rule-making process, continued implementation 'may affect and is likely to adversely affect' the Gila chub critical habitat" for the same reasons as stated for the species above. There is a "lack of complete filtering necessary to prevent adverse influence on the primary constituent elements."

The 2005 Biological Opinion concurred with these findings (USDI Fish and Wildlife Service 2005a). The BO concluded that continued implementation of forest land management plans would not be likely to jeopardize the continued existence of Gila chub and would not be likely to destroy or adversely modify proposed critical habitat for the Gila chub.

Another BA for the continued implementation of forest LRMPs across the region was prepared in 2011 due to new information on species and/or critical habitat (USDA Forest Service 2011f). The findings in the 2011 BA for the continued implementation of the Coconino LRMP were "may affect, likely to adversely affect" for the species and designated critical habitat. These findings were for similar reasons as stated in the 2004 BA. The 2012 Biological Opinion concluded that continued implementation of the Coconino LRMP is not likely to jeopardize the continued existence of Gila chub and is not likely to destroy or adversely modify Gila chub designated critical habitat (USDI Fish and Wildlife Service 2012d).

Since 2011, there have been two amendments to the current plan. One amendment addressed cultural resources by removing plan language that required management to achieve a ‘no effect’ determination for significant or potentially significant inventoried sites in consultation with the SHPO (State Historic Preservation Office) and ACHP (Advisory Council on Historic Preservation) (36 CFR 800). The amendment also removed language stating that management would strive to achieve a ‘no effect’ determination. This amendment was needed because this plan language conflicted with standard practices used to meet the requirements of the National Historic Preservation Act. This amendment had no changes in effects on the management of Gila chub. The second amendment incorporates the direction from the Travel Management Rule decision in 2011 and prohibits motor vehicle use off designated roads and trails and outside of designated areas, except where exempted. A biological assessment for the Travel Management Rule was prepared in 2010, and was amended in 2011, and both assessments concluded that the preferred alternative “may affect but is not likely to adversely affect Gila chub or its critical habitat” (USDA Forest Service 2010d, 2011m). The Fish and Wildlife Service concurred with these findings (USDI Fish and Wildlife Service 2011e, 2011f). Since 2011, there have been no significant changes to the LMRP or significant scientific information to warrant a change in the 2011 finding for continued implementation of the Coconino LRMP.

Table 64 shows that under alternative A, perennial streams would remain in poor condition with a static trend in relation to desired conditions. This condition is generally due to most streams having invasive and non-native animal species that are outside of their historic variability.

Cottonwood Willow Riparian Forest would remain in fair condition and have a slow trend toward desired conditions. In Cottonwood Willow, some portions of the Verde River, Dry Beaver Creek, and Spring Creek, would be static due to high recreation or private land, such as the area around Childs, Spring Creek, Dry Beaver Creek, and private lands.

Mixed Broadleaf Deciduous Riparian Forest would remain in good condition. Static trends would be associated with the Oak Creek 5th code and West Clear Creek 5th code HUCs. The trend would be static or moving slowly toward desired conditions except in the Beaver Creek, West Clear Creek and Oak Creek 5th code HUCs and portions of Fossil Creek where recreation impacts are high. Areas of private land would remain static as well.

The likelihood that habitat on the forest would be a limiting factor for the Gila chub is high to very high depending on the habitat as shown in table 64. These likelihoods were derived by combining the Gila chub’s F Rank of F1 with the likelihood of habitat limitation variables for each ERU: perennial streams (high), CWRF (high), and MBDRF (moderate) (table 9). Low to moderate ratings are considered to be within the natural range of fluctuations for the habitat.

The management effect row shows the relative expected outcome of plan language in terms of minimizing species viability risk. The management effect is classified as a 4 for perennial streams, which means there is a decline in habitat quality as a result of management or lack of management that result from plan components. Plan components may not exist or may be few. As described in the Coarse Filter: Habitat section, the threat of dispersed recreation to riparian resources is not addressed forestwide in alternative A. Special areas such as the Verde Wild and Scenic River and wilderness, and the management areas within Flagstaff/Lake Mary Ecosystem Area and the Sedona-Oak Creek Planning Area most specifically address the conflicts and strategies to resolve resource damage in riparian areas. This direction mainly addresses dispersed recreations impact to specific riparian areas where there have been past conflicts and resource

damage, but it provides very limited direction when areas that previously received low use are "discovered" and see unexpected increases in recreation, such as Fossil Creek. As a result, alternative A addresses this threat sporadically compared with alternatives B (modified), C, and D, but it does mitigate some of the areas where the conflict is most pronounced.

The management effect is classified as a 3 for Cottonwood Willow Riparian Forest and Mixed Broadleaf Deciduous Riparian Forest, which means that plan components in alternative A maintain or improve protection and management for some habitat occurrences in the plan area and thus contribute less to the viability of this species than the other alternatives. Alternative A would maintain or improve riparian forests and associated streamcourses because it has a focus on improving riparian areas in any condition, preventing damage to riparian vegetation, stream banks, and channels, and restoring degraded riparian areas to good condition as soon as possible (1987 Plan, pages 65-2, 65-8, 172, and 206-8). Other protective language includes the following: Only beneficial new special uses are allowed in riparian areas and exceptions such as utility line or roads crossing stream courses are designed to minimize the extent and magnitude of impact to riparian (1987 Plan, page 177). Aggressive fire suppression may be used to prevent resource damage utilizing methods that minimize long-term adverse impacts to riparian habitats (1987 Plan, page 177). In addition, acquisition of riparian areas through land exchange is a high priority (1987 Plan, pages 177 and 185). The plan would manage commercial uses, and recreation in some areas, to protect riparian values (1987 Plan, pages 206-10, 22, 26, and 39). This alternative has less potential for improvement to riparian condition compared to the other alternatives because plan language for specific riparian forest types is lacking and there is not a focus on functioning-at-risk and non-functional riparian areas (USDA Forest Service 2016b).

The plan components in alternative A may cause a loss of viability for Gila chub. Management concerns for Gila chub not currently or adequately addressed in alternative A include language to address management of introduced or invasive or invasive species, threatened and endangered species conservation strategies, integration of riparian, water, and aquatic species management strategies, language to support habitat connectivity forestwide, and strategies to address climate change. While alternative A provides some guidance to reduce introductions of non-native species (primarily focused on plant species, 1987 Plan, page 206-72), it is insufficient in scope to maintain viability of Gila chub on the forest (see Non-native or Invasive Species in the Wildlife and Plant Issues and Topics section). Gila Chub occupy the Oak and Beaver Creek watersheds, with some of these areas within existing wilderness areas (15 percent), with protections provided within from pollution, development, and sedimentation; however, invasive species threats exist throughout. Trends in watershed conditions are likely to remain static, with declining flows in perennial streams due to climate change and continued water development on off-Forest lands that impact groundwater and stream volume on the forest (USDA Forest Service 2016j). Populations of this species are very limited within its habitat on the forest, and it is sensitive to habitat disturbances that alter streamflows, macroinvertebrate and macrophyte communities, and introduced or invasive or invasive predators and competitors.

Based on the existing conditions and trend under current implementation of alternative A within the Oak and Fossil Creek watersheds, the continued implementation of alternative A may further changes in habitats that contribute to loss of viability for this species. This includes limited guidance on management of introduced or invasive or invasive species, unmanaged recreational activity in critical habitats of this species contributing to adverse water quality conditions, and limited opportunities for acquisition of additional instream flow rights.

Alternative B (modified)

Consultation under the Endangered Species Act

A BA on the proposed revision of the Coconino LRMP was prepared in 2017 (USDA Forest Service 2017c). The BA concluded that the proposed action “may affect, and would likely adversely affect” the Gila chub and its designated critical habitat “due to potential adverse effects to riparian areas from livestock grazing and increased sediment after thinning and prescribed fire. The implementation of plan components related to the implementation of forest plan revision is expected to result in adverse short-term effects to critical habitat resulting from activities occurring within the watersheds and riparian areas containing Gila chub such as livestock grazing, recreation management, and forest management actions but long term benefits due to improvement of watershed and riparian conditions and cooperative management of non-native species.”

A draft Biological Opinion was received from the Fish and Wildlife Service on August 8, 2017 (USDI Fish and Wildlife Service 2017b). The draft BO did not conduct a jeopardy analysis of Gila chub since there is no such recognized taxonomic entity (82 FR 16981). This is because “although the legal status of the Gila chub is as an endangered species, taxonomically it is now part of a single taxonomic species that includes the roundtail chub and formerly recognized headwater chub.” The Fish and Wildlife Service included a determination that the proposed action (alternative B (modified)) “is not likely to destroy or adversely modify designated critical habitat for Gila chub.” The legal status of designated critical habitat still exists for Gila chub. No incidental take was assigned. The Fish and Wildlife Service provided four discretionary conservation recommendations intended to minimize or avoid adverse effects, help implement recovery plans, or develop information.

Viability

Table 64 shows that under alternative B (modified) perennial streams would remain in poor condition but the trend would be toward desired conditions because of updated plan components (see management effect discussion below).

Cottonwood Willow Riparian Forest would improve to good condition and trend slowly toward desired conditions except portions of the Verde River, Towel Creek, Spring Creek and Dry Beaver Creek would improve faster (i.e., have a trend toward desired conditions).

Mixed Broadleaf Deciduous Riparian Forest would remain in good condition and slowly move toward desired conditions except portions of Fossil Creek and Wet Beaver Creek would remain static in areas of high recreation use. It would improve faster than alternative A in the Beaver Creek, Oak Creek, West Clear Creek, and Fossil Creek 5th code HUCs.

As shown in table 64, the likelihood that habitat on the forest would be a limiting factor for the Gila chub is high to very high depending on the habitat. These likelihoods were derived by combining the Gila chub’s F Rank of F1 with the likelihood of habitat limitation variables for each ERU: perennial streams (high), Cottonwood Willow Riparian Forest (moderate), and Mixed Broadleaf Deciduous Riparian Forest (moderate) (table 9). Low to moderate ratings are considered to be within the natural range of fluctuations for the habitat.

The management effect row shows the relative expected outcome of plan language in terms of minimizing species viability risk. The management effect is classified as a 2 for all the coarse

filter habitats associated with the Gila chub. This means that plan components in alternative B (modified) maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area. For perennial streams, this rating is based on a broad array of plan language. Desired conditions under alternative B (modified) support and trend to improved stream ecosystem function (FW-Water-DC-2 and 3) and collaborative efforts to maintain stream flow (FW-Water-DC-5 and 6; FW-Rip-Strm-DC-4) and reduce or eliminate the impacts of invasive species (FW-Invas-DC-1). Implementation of plan components under alterative B (modified) will likely move large perennial stream habitats more rapidly toward desired conditions (USDA Forest Service 2016j), possibly adding more suitable stream habitats to be available for Gila chub.

Other plan language is designed to mitigate the effects of roads and promoting connectivity within drainages and between streamcourses and upland habitats, (see FW-RdsFac-G-2, 5, 7 and 9 and the Connectivity topic in the Wildlife and Plants Topics and Issues section). Although there are three recommended wildernesses, only the Davey's recommended wilderness area connects to perennial water, Fossil Creek. Guidelines for recommended wilderness would lessen the effects of roads by restricting motorized use except for limited permitted and administrative use and promoting trails for mechanized and non-motorized use (SA-RWild-G-3, 5). This is beneficial for connected waters and habitat for these species because roads can alter natural water flow patterns and natural sediment levels.

More site-specific aquatic management zone guidelines protect riparian function and water quality (FW-Rip-All-G-3; Fw-Rip-Strm-G-2). Also, alternative B (modified) has a guideline that balances recreation activities, permitted uses, and management activities with soil function, riparian vegetation, and water quality at the stream reach scale (FW-Rip-RipType-G-3). This guideline would not apply to fine-scale activities and facilities such as intermittent livestock crossing locations, water gaps, or other infrastructure used to manage impacts to riparian areas at a larger scale. This guideline is intended to protect riparian function, especially in areas of high recreation use such as Oak Creek, Beaver Creek, and Fossil Creek.

Alternative B (modified) has desired conditions that protect riparian resources including soil conditions and water quality while recognizing the demand for and need to properly manage the public's dispersed recreation opportunities. A forestwide desired condition for dispersed recreation supports managing dispersed recreation to avoid resource damage (FW-Rec-Disp-DC-3) Several guidelines about dispersed recreation would manage trails, camping, and recreation types to prevent further resource damage to riparian resources (FW-Rec-Disp-G-1 to 5).

Plan components in alternative B (modified) specify that livestock grazing maintains desired conditions of plant communities (FW-Graz-DC-2; FW-Graz-G-2). They also protect and minimize impacts to riparian areas by recommending that livestock use be restricted to the dormant season, recommending utilization levels on woody vegetation, maintenance of adequate vegetative cover to protect streambanks, and state that riparian areas are rarely negatively impacted by livestock (FW-Graz-G-7). This would maintain riparian structure, composition, and promote proper functioning. Guidelines are in place to reduce cattle concentrations and sedimentation into connected waters by specifying that range improvements should not interfere with riparian function and rare species, and further specifies a minimum distance of salts and supplements from riparian areas (FW-Graz-G-4 and 5).

Alternative B (modified) addresses uncharacteristic flooding by maintaining natural hydrographs through time and by promoting riparian forest composition and structure that would reduce the effects of flooding (FW-Rip-Strm-DC-4, FW-Rip-RipType-DC-2). For stream riparian areas, functional riparian areas and herbaceous vegetation provide protection from uncharacteristic wildfire and flooding disturbance, resiliency, and should filter sediment and protect water quality (FW-Rip-RipType-DC-2, 3, 4). This alternative also contains a guideline protects riparian resources by recommending against issuing a lands and recreation special use permit for activities proposed to occur within 200 feet of perennial streams, springs, or waters that contribute to or support sensitive resources, such as federally listed or Southwestern Region sensitive species (FW-SpecUse-G-3).

For CWRF and MBDRF, this rating is primarily because there are updated desired conditions and guidelines that support the composition, structure, and function of riparian forest types (FW-Rip-RipType-DC-1 to 6, FW-Rip-RipType-G-1 to 4). In addition, riparian functional condition would improve faster than alternative A, especially along the Verde River, Towel Creek, Spring Creek, and Dry Beaver Creek. Plan components manage for vegetation diversity and riparian function (FW-Rip-RipType-DC-1 and 2; FW-Water-G-2; FW-Rip-RipType-O-1). Plan components in the Wildlife, Fish and Plants section also contribute to the viability of species associated with riparian areas by promoting properly functioning ecosystems that have the necessary physical and biological components to meet the needs of associated native species (FW-WFP-DC-1 and 3).

Restoration activities in alternative B (modified) (i.e., installation of non-native species barriers, vegetation treatments that reduce uncharacteristic fires within watersheds, vegetation plantings and riparian restoration and channel stabilization projects) may have short-term negative impacts to Gila chub and its habitat, but they will have long-term benefits to the species. In the long term, this guidance would have positive contributions to maintaining Gila chub viability on the forest. Gila chub populations are at high risk of injury because they are very small, isolated, and are highly susceptible to threats on the forest. These animals occupy perennial streams in highly accessible areas, with much of the effects of habitat changes out of Forest jurisdiction.

Alternative C

Implementation of plan components under alternative C would have similar effects to alternative B (modified) except that alternative C adds the Deadwood Draw Recommended Wilderness Area, increasing the protected acres for Gila chub to 17 percent of their watersheds currently or potentially occupied.

Alternative D

Implementation of plan components under alternative D would have similar effects to alternative B (modified) except that alternative D would designate only the Cottonwood Basin Geological Area (which contains no springs and smaller acreage than the Cottonwood Basin Geological and Botanical Area designated for alternatives B (modified) and C).

Alternative D recommends no new wilderness areas. The effects associated with managing the recommended areas under alternatives B (modified) and C as recommended wilderness would not occur. These areas would still be managed by the other forestwide, management area, and special area direction in alternative B (modified) with the corresponding effects discussed above in the alternative B (modified) section. Implementation would be the same as alternative A with regard to maintenance of existing wilderness. These small changes will not change the conditions and trends in aquatic habitats from those provided by alternatives B (modified) and C for this species.

Findings

Implementation of the plan components under alternatives B (modified), C, and D is not likely to cause declines in viability for Gila chub and would contribute more to the viability of this species than alternative A. This is due to the updated plan components of alternatives B (modified), C, and D for the different riparian forests, for invasive animal species and disease, for updated language for water quality, and for language that addresses rare or endemic species. Although alternative C would have the same effects as alternative B (modified), it would contribute slightly more to the viability of these species due to the additional protection provided in recommended wilderness in the watersheds for this species. Continued management under alternative A would contribute to the viability of this species (see coarse filter analysis) but less so than the other alternatives. Although it has language to maintain the viability of wildlife species, much of the language of alternative A is outdated. For example, it lacks sufficient guidance for invasive animal species or disease; does not distinguish between the different riparian forests; and lacks language that would protect endemic species or those with restricted distributions.

Gila Topminnow

Affected Environment

Distribution

This species has recently been reintroduced into Fossil Creek, Spring Creek, and Sheepshead Canyon (13.7 miles occupied or suitable) on the forest. Topminnow once occupied aquatic habitats in the Gila River drainage in New Mexico and Arizona and Mexico below 1,524 meters (5,000 feet) in elevation (AZGFD 2001).

Habitat

The Gila topminnow is associated with perennial streamcourses, springs, and Cottonwood Willow and Mixed Broadleaf Deciduous Riparian Forests. These habitats are more fully evaluated in the Coarse Filter: Habitat section. Gila topminnow (*Poeciliopsis occidentalis o.*) has historically been found in perennial springs, streams, and vegetated margins of the larger Gila River watershed streams and river and was once a very common species. They are omnivorous, feeding on detritus, algae, and insect larvae—especially mosquito larvae—when available (AZGFD 2001). They prefer shallow warmer waters with moderate currents and dense aquatic vegetation. This species is quite tolerant; however, and can withstand a wide range of water temperatures, salinities, alkalinities, and dissolved oxygen levels (AZGFD 2001c). This species has a unique biology in that it is viviparous (gives birth to live young). The reproductive season normally lasts from April through November, but young may be produced year-round in some thermally stable springs.

Risk Factors

Threats to the species include: spring habitat development, aquifer pumping, habitat destruction, drought, and predation by and competition with non-native fishes. Coconino NF management activities that have contributed to habitat degradation include road construction and maintenance, timber management, fire suppression and subsequent stand-replacing fires, and permitted livestock grazing. Management needs include: protection of existing natural populations, identification of sites for reintroduction, and re-establishment of populations (AZGFD 2001).

Environmental Consequences

Table 65 summarizes the viability analysis for Gila topminnow. This table was developed using the analysis process described under the Species Viability section above. It includes information on the status, F Rank, habitat, habitat condition and trend, likelihood that this species is limited by its habitat, and the projected management effect, by alternative. Management effect categorizes the relative expected outcome of plan language in each alternative in terms of minimizing species viability risk and are the result of plan decisions, including plan objectives. Management effect category values are 1, 2, 3, and 4. The lower the management effects rating for a species' associated habitat, the more effective the alternative is for that species viability. These topics and the effects of the alternatives are explained in greater detail in the discussions on the alternatives that follow.

Table 65. Analysis summary for Gila topminnow

Species and status	Habitat	Alternative A		Alternatives B (modified), C, D	
		Habitat condition and trend relative to desired conditions	Likelihood species is limited	Habitat condition and trend relative to desired conditions	Likelihood species is limited
Gila topminnow (Endangered, Endemic) F Rank = F1*	Perennial streams	Poor, static	VH	Poor, toward	VH
	Springs	Fair**, slowly toward	VH	Fair**, slowly toward	VH
	CWRF	Fair, slowly toward	VH	Good, slowly toward	H
	MBDRF	Good, static to slowly toward	H	Good, slowly toward	H
Management effects		Perennial streams and springs = 4: Decline in habitat quality as a result of management or lack of management that result from plan components. Plan components may not exist or may be few. CWRF and MBDRF = 3: Plan components maintain or improve protection and management for some habitat occurrences in the plan area. Quality of habitat or habitat elements is maintained or improved by providing protection, maintenance, and restoration to some occurrences.		All habitats = 2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.	

*F1 = Very rare on the forest within its habitat – occupies a very small portion of its habitat.

** For analysis, springs were considered in fair condition. However, some springs could be in poor or good condition depending on accessibility, protection, or degree of development.

Common to All Alternatives

Disease, competition, and predation through introductions of non-native species are the greatest fine filter threats to Gila topminnow. There is language under all alternatives that prioritizes habitat improvement and protections for projects for threatened and endangered species such as Gila topminnow (1987 Plan, pages 23, 59, 64-6, and 87; FW-LndAdj-G-1; FW-Minerals-G-3; FW-RdsFac-G-7). Additionally, management applications under alternatives B (modified), C, and D provide recommendations to managers regarding approaches for successful implementation of plan components, such as prioritization of work to benefit threatened and endangered species (Management Approaches for Roads and Facilities, All Riparian Areas, Stream Ecosystems, and Watersheds and Water). Finally, all alternatives contain plan components that provide some guidance to manage introductions of non-native species (see Non-native or Invasive Species in the Wildlife and Plant Issues and Topics section); however, viability of native species is threatened on the forest when the focus is limited solely to introductions because most of the aquatic habitat on the forest already has undesirable non-native species.

There are two existing wilderness areas and three inventoried roadless areas within the Fossil Creek and lower Verde River watersheds where this species is found. These areas provide protections to about 39 percent of the watersheds under all alternatives (USDA Forest Service 2013). However, some of these protections afforded by designated wilderness areas also exclude motorized access needed for fire and invasive animal species treatments (i.e., stream barrier installations) that may reduce the forest's ability to manage these areas and assist with recovery actions.

Plan components in all alternatives contribute to species viability by managing for sustainable populations of native species and improving and protecting habitat for threatened, endangered, and sensitive species (1987 Plan, pages 22-1, 23, 64, 64-1, 66, 95, 108-2, 180, 187, 206-9, 206-11, 206-12, 206-13, 206-23, 206-30, 206-32, 206-66, 206-67, 206-71, 206-72, 206-79, 206-87, 206-89, 206-98, 206-103, 206-105, 206-108, 206-109, 206-114; FW-WFP-DC-1, 2, 3, 4, 5, 6, 8, and FW-Eco-DC-1). See At-risk Species in the Wildlife and Plant Issues and Topics section above for more information.

Alternative A

<u>Prior consultations under the Endangered Species Act</u>

A BA for the continued implementation of forest plans across the region was prepared in 2004 (USDA Forest Service 2004d). The Coconino NF forest plan was not considered for analysis because topminnow were absent from the forest at that time, prior reintroductions had failed, and no further reintroductions were anticipated. Gila topminnow were introduced on the forest in 2007.

There have been two amendments to the current plan. One amendment addresses cultural resources and has no significant effect on the management of Gila topminnow. The second amendment incorporated the direction of the Travel Management Rule decision into the current plan. The Coconino NF prepared a Biological Assessment for the Travel Management Rule in 2010, and amended the assessment in 2011 (USDA Forest Service 2010d, 2011m). The decision closed cross-country motorized travel across the forest, limiting vehicles to designated roadways (USDA Forest Service 2011g). Based on consideration of direct, indirect, and cumulative effects of forest management activities, the determination of effect for Gila topminnow was "may affect

but is not likely to adversely affect Gila topminnow or its habitat." The Fish and Wildlife Service concurred with the finding 2011e, 2011f).

The Southwestern Region prepared another biological assessment for the continued implementation of the forest LRMPs across the region in 2011(USDA Forest Service 2011f). After reviewing the standards and guidelines in the Coconino NF LRMP, the BA contained a "may affect and is likely to adversely affect" finding for the Gila topminnow. The 2012 Biological Opinion concluded that continued implementation of the Coconino NF LRMP is not likely to jeopardize the continued existence of the Gila topminnow (USDI Fish and Wildlife Service 2012d).

Since 2012, there have been no significant changes in the LMRP or significant scientific information to warrant a change in the finding.

<u>Viability</u>

Table 65 shows that under alternative A, perennial streams would remain in poor condition with a static trend in relation to desired conditions. This condition is generally due to most streams having invasive and non-native animal species that are outside of their historic variability.

Springs would remain in fair condition with a trend slowly toward desired conditions. Accessible, unprotected springs would remain in poor condition, while springs that are inaccessible, protected, or undeveloped would remain in good condition.

CWRF would remain in fair condition and have a slow trend toward desired conditions. In CWRF, some portions of the Verde River, Dry Beaver Creek, and Spring Creek, would be static due to high recreation or private land, such as the area around Childs, Spring Creek, Dry Beaver Creek, and private lands.

MBDRF would remain in good condition. Static trends would be associated with the Oak Creek 5th code and West Clear Creek 5th code HUCs. The trend would be static or moving slowly toward desired conditions except in the Beaver Creek, West Clear Creek and Oak Creek 5th code HUCs and portions of Fossil Creek where recreation impacts are high. Areas of private land would remain static as well.

The likelihood that habitat on the forest would be a limiting factor for the Gila topminnow is high to very high depending on the habitat as shown in table 65. These likelihoods were derived by combining the Gila topminnow's F Rank of F1 with the likelihood of habitat limitation variables for each ERU: perennial streams (high), springs (high), CWRF (high), and MBDRF (moderate) (table 9). Low to moderate ratings are considered to be within the natural range of fluctuations for the habitat.

The management effect row shows the relative expected outcome of plan language in terms of minimizing species viability risk. The management effect is classified as a 4 for perennial streams, which means there is a decline in habitat quality as a result of management or lack of management that result from plan components. Plan components may not exist or may be few. For perennial streams, language is largely lacking for invasive and non-native aquatic species that were not present historically. These species can alter the composition, structure and processes of stream ecosystems. As described in the Coarse Filter: Habitat section, the threat of dispersed recreation to riparian resources is not addressed forestwide in alternative A. Special areas such as

the Verde Wild and Scenic River and wilderness, and the management areas within Flagstaff/Lake Mary Ecosystem Area and the Sedona-Oak Creek Planning Area most specifically address the conflicts and strategies to resolve resource damage in riparian areas. This direction mainly addresses dispersed recreations impact to specific riparian areas where there have been past conflicts and resource damage, but it provides very limited direction when areas that previously received low use are “discovered” and see unexpected increases in recreation, such as Fossil Creek. As a result, alternative A addresses this threat sporadically compared with alternatives B (modified), C, and D, but it does mitigate some of the areas where the conflict is most pronounced.

For springs, this management effect rating is because desired conditions and guidelines are largely lacking, therefore, managers do not have clear direction when restoring or protecting springs or to maintain or restore toward desired condition of properly functioning, resilient springs and spring riparian areas (USDA Forest Service 2016b).

The management effect is classified as a 3 for Cottonwood Willow Riparian Forest and Mixed Broadleaf Deciduous Riparian Forest, which means that plan components in alternative A maintain or improve protection and management for some habitat occurrences in the plan area and thus contribute less to the viability of this species than the other alternatives. This is primarily because alternative A does not distinguish between the four different riparian forest types differentiated in alternative B (modified) and lacks plan components relative to composition, structure, and function. In addition, this alternative has the least potential for improvement to riparian condition compared to the other alternatives. This is because plan objectives in alternative A do not prescribe realistic or attainable riparian restoration (1987 Plan, pages 172 and 174) nor is there a focus on watersheds with the greatest need for riparian improvement or Functioning-at-risk and non-functional riparian areas (USDA Forest Service 2016b).

While alternative A provides some guidance to reduce introductions of non-native species (primarily focused on plant species, (1987 Plan, page 206-72), it is insufficient in scope to maintain viability of Gila topminnow on the forest. Management concerns for Gila topminnow not currently addressed under alternative A include language to address management of invasive species, threatened and endangered species conservation strategies, integration of riparian, water, and aquatic species management strategies, language to support habitat connectivity, and strategies to address climate change. Trends in watershed conditions are likely to remain static, with declining flows in perennial streams and springs due to climate change and continued water development of off-Forest lands that impact groundwater and stream volume on the forest (USDA Forest Service 2016j). Populations of this species are very limited within its habitat on the forest and it is sensitive to habitat disturbances that alter base flows, its macroinvertebrate prey base, and introduced or invasive predators and competitors, especially mosquitofish. Alternative A has larger acreages of land designated for motorized use that could allow for future road construction and increasing sediment in small streams and springs that could reduce the viability of topminnow on the forest.

Alternative B (modified)

A BA for the revision of Coconino NF Land Management Plan was prepared in 2017 (USDA Forest Service 2017c). The determination of effect for Gila topminnow was “may affect, not likely to adversely affect due to the protections that are in currently in place to protect occupied habitats of Gila topminnow from adverse effects of forest management actions.” The Fish and

Wildlife Service concurred with this finding in their draft Biological and Conference Opinion received on August 8, 2017 (USDI Fish and Wildlife Service 2017b).

Table 65 shows that under alternative B (modified) perennial streams would remain in poor condition, but the trend would be toward desired conditions because of updated plan components (see management effect discussion below).

Springs would remain in fair condition with a trend slowly toward desired conditions, like alternative A.

Cottonwood Willow Riparian Forest would improve to good condition and trend slowly toward desired conditions, except portions of the Verde River, Towel Creek, Spring Creek and Dry Beaver Creek would improve faster (i.e., have a trend toward desired conditions).

Mixed Broadleaf Deciduous Riparian Forest would remain in good condition and slowly move toward desired conditions, except portions of Fossil Creek and Wet Beaver Creek would remain static in areas of high recreation use. It would improve faster than alternative A in the Beaver Creek, Oak Creek, West Clear Creek, and Fossil Creek 5th code HUCs.

As shown in table 65, the likelihood that habitat on the forest would be a limiting factor for the Gila topminnow is high to very high depending on the habitat. These likelihoods were derived by combining the Gila topminnow's F Rank of F1 with the likelihood of habitat limitation variables for each ERU: perennial streams (high), springs (high), CWRF (moderate), and MBDRF (moderate) (table 9). Low to moderate ratings are considered to be within the natural range of fluctuations for the habitat.

The management effect row shows the relative expected outcome of plan language in terms of minimizing species viability risk. The management effect is classified as a 2 for all the coarse filter habitats associated with the Gila topminnow. This means that plan components in alternative B (modified) maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area. For perennial streams, this rating is based on a broad array of plan language. Desired conditions under alternative B (modified) support and trend to improved stream ecosystem function (FW-Water-DC-2 and 3) and collaborative efforts to maintain stream flow (FW-Water-DC-5 and 6; FW-Rip-Strm-DC-4) and reduce or eliminate the impacts of invasive species (FW-Invas-DC-1). Implementation of plan components under alterative B (modified) would likely move large perennial stream habitats more rapidly toward desired conditions (USDA Forest Service 2016j).

Other plan language is designed to mitigate the effects of roads and promoting connectivity within drainages and between streamcourses and upland habitats, (see FW-RdsFac-G-2, 5, 7 and 9 and the Connectivity topic in the Wildlife and Plants Topics and Issues section). Although there are three recommended wildernesses, only the Davey's recommended wilderness area connects to perennial water, Fossil Creek. The Davey's Recommended Wilderness Area includes 1,779 acres in a watershed occupied by this species and could benefit topminnow habitat through reduced motorized access, stream bank protections, and road construction leading to reductions in erosion and sedimentation. Guidelines for recommended wilderness would lessen the effects of roads by restricting motorized use except for limited permitted and administrative use and promoting trails for mechanized and non-motorized use (SA-RWild-G-3, 5). This is beneficial for connected waters and habitat for these species because roads can alter natural water flow patterns and natural sediment levels.

For springs, this rating is because alternative B (modified) has desired conditions and guidelines to guide spring management on the forest (FW-Rip-Spr-DC-1, 2, 3, 4 and FW-Rip-Spr-G-1, 2, 3, 4) whereas these are largely absent in alternative A.

More site-specific aquatic management zone guidelines protect riparian function and water quality (FW-Rip-All-G-3; Fw-Rip-Strm-G-2). Also, alternative B (modified) has a guideline that balances recreation activities, permitted uses, and management activities with soil function, riparian vegetation, and water quality at the stream reach scale (FW-Rip-RipType-G-3). This guideline would not apply to fine-scale activities and facilities such as intermittent livestock crossing locations, water gaps, or other infrastructure used to manage impacts to riparian areas at a larger scale. This guideline is intended to protect riparian function, especially in areas of high recreation use such as Oak Creek, Beaver Creek, and Fossil Creek.

Alternative B (modified) has desired conditions that protect riparian resources including soil conditions and water quality while recognizing the demand for and need to properly manage the public’s dispersed recreation opportunities. A forestwide desired condition for dispersed recreation supports managing dispersed recreation to avoid resource damage (FW-Rec-Disp-DC-3). Several guidelines about dispersed recreation would manage trails, camping, and recreation types to prevent further resource damage to riparian resources (FW-Rec-Disp-G-1 to 5).

Plan components in alternative B (modified) specify that livestock grazing maintains desired conditions of plant communities (FW-Graz-DC-2; FW-Graz-G-2). They also protect and minimize impacts to riparian areas by recommending that livestock use be restricted to the dormant season, recommending utilization levels on woody vegetation, maintenance of adequate vegetative cover to protect streambanks, and state that riparian areas are rarely negatively impacted by livestock (FW-Graz-G-7). This would maintain riparian structure, composition, and promote proper functioning. Guidelines are in place to reduce cattle concentrations and sedimentation into connected waters by specifying that range improvements should not interfere with riparian function and rare species, and further specifies a minimum distance of salts and supplements from riparian areas (FW-Graz-G-4 and 5).

Alternative B (modified) addresses uncharacteristic flooding by maintaining natural hydrographs through time and by promoting riparian forest composition and structure that would reduce the effects of flooding (FW-Rip-Strm-DC-4, FW-Rip-RipType-DC-2). For stream riparian areas, functional riparian areas and herbaceous vegetation provide protection from uncharacteristic wildfire and flooding disturbance, resiliency, and should filter sediment and protect water quality (FW-RIP-RipType-DC-2, 3, 4). This alternative also contains a guideline protects riparian resources by recommending against issuing a lands and recreation special use permit for activities proposed to occur within 200 feet of perennial streams, springs, or waters that contribute to or support sensitive resources, such as federally listed or Southwestern Region sensitive species (FW-SpecUse-G-3).

For Cottonwood Willow Riparian Forest and Mixed Broadleaf Deciduous Riparian Forest, this rating is primarily because there are updated desired conditions and guidelines that support the composition, structure, and function of riparian forest types (FW-Rip-RipType-DC-1 to 6, FW-Rip-RipType-G-1 to 4). In addition, riparian functional condition would improve faster than alternative A, especially along the Verde River, Towel Creek, Spring Creek, and Dry Beaver Creek. Plan components manage for vegetation diversity and riparian function (FW-Rip-RipType-DC-1 and 2; FW-Water-G-2; FW-Rip-RipType-O-1). Plan components in the Wildlife, Fish and

Plants section also contribute to the viability of species associated with riparian areas by promoting properly functioning ecosystems that have the necessary physical and biological components to meet the needs of associated native species (FW-WFP-DC-1 and 3).

Alternative C

Implementation of plan components under alternative C would have similar effects to alternative B (modified) except that alternative C recommends four wilderness areas (Hackberry, Cimarron-Boulder, Tin Can, and Black Mountain) and expansion of an existing wilderness area to provide wilderness protections on 89 percent of the Fossil and lower Verde watersheds that provide habitat benefits to Gila topminnow. Because this species is very rare, and occupies little of its historic habitat, implementation of alternative C may reduce the forest's ability to implement treatments to secure habitats free of invasive species and reduce likelihood of incidents of uncharacteristic fire. Motor vehicle use would only be allowed in recommended wilderness areas for limited administrative and permitted activities, as long as it is consistent with the area's wilderness character (SA-RWild-G-3); however, if the recommended wildernesses are designated by Congress, then motorized access would be limited as described above.

Alternative D

Implementation of alternative D would have similar effects to alternative B (modified) except that alternative D would designate only the Cottonwood Basin Geological Area (which contains no springs and smaller acreage than the Cottonwood Basin Geological and Botanical Area designated for alternatives B (modified) and C).

Alternative D recommends no new wilderness areas. The effects associated with managing the recommended areas under alternatives B (modified) and C as recommended wilderness would not occur. These areas would still be managed by the other forestwide, management area, and special area direction in alternative B (modified) with the corresponding effects discussed above in the alternative B (modified) section. Implementation would be the same as alternative A with regard to maintenance of existing wilderness. These small changes would not change the conditions and trends in aquatic habitats from those provided by alternatives B (modified) and C for this species.

Findings

Implementation of alternative B (modified) would contribute more to the viability of Gila topminnow than alternative A because of updated plan components for management of the different riparian forest types, for invasive animal species and associated disease management, for updated language for water quality, and for language that addresses endemic species. Although alternative C would have the same effects as alternative B (modified), it would contribute slightly more to the viability of these species due to the additional protection provided in recommended wilderness in the watersheds for this species. Continued management under alternative A would contribute to the viability of this species, but less so than the other alternatives. Although it has language to maintain the viability of wildlife species, much of the plan language is outdated. For example, it lacks sufficient guidance for invasive animal species or disease; does not distinguish between the different riparian forests; and lacks language that would protect endemic species or those with restricted distributions.

Gila Trout

Gila trout (*Oncorhynchus gilae g.*) was considered extirpated from Arizona in 1993 after surveys in Gap Creek and the upper Verde River found no fish. The species was reclassified to Threatened

status in New Mexico and Arizona in 2006, as part of a special rule under section 4(d) of the Endangered Species Act in order to allow production and stocking for recreational fishing in these states (USDI Fish and Wildlife Service 2006). As a recreational fishery that is expected to hybridize with rainbow trout (there is no fish barrier preventing connectivity), this population does not contribute to the recovery of the species.

Affected Environment

Distribution

The Gila trout is currently found in West Fork Oak Creek and likely can be displaced to upper Oak Creek both of which lie within Mixed Broadleaf Deciduous Riparian Forest. Historical habitat in West Clear Creek is found within Mixed Broadleaf Deciduous Riparian Forest. In October, 2015, 1,013 adipose-clipped Gila trout were reintroduced into West Fork Oak Creek under special status regulations for recreational fishing to build public support of rare and native species recovery (USDI Fish and Wildlife Service 2015).

Habitat

The Gila trout is associates with perennial streamcourses and Cottonwood Willow and Mixed Broadleaf Deciduous Riparian Forests. These habitats are more fully evaluated in the Coarse Filter: Habitat section. Gila trout generally use mountain headwater stream habitats, and, like other salmonid species, are sensitive to high stream temperatures, using habitats that rarely exceed 21 °C (70 °F). Stream habitats generally are cobble/gravel substrates with high channel and cover complexity to provide pool depth and cover during stochastic events such as flooding and fire (USDI Fish and Wildlife Service 2005a, AZGFD 2002d). Gila trout generally feed on aquatic invertebrates, and small fishes, but seems to prefer adult and nymph stages of aquatic and terrestrial insects (AZGFD 2002d).

Risk Factors

Gila trout populations are small, isolated and fragmented throughout their range –factors leading to their decline and also increasing their vulnerability to injury due to both natural and anthropogenic disturbances (USDI Fish and Wildlife Service 2006). On the forest, one population has been stocked in West Fork of Oak Creek and habitat loss is a concern. Invasive fish species threaten the population with predation, competition, and hybridization (especially rainbow trout). Many of the small streams and connected springs have had competitive or predatory aquatic species introduced for sport purposes, and also have been subject to water development causing alterations to habitats both within and outside of Forest jurisdiction. Only 69 percent of the riparian forests are under Coconino NF jurisdiction and ownership.

Coconino NF management activities that have contributed to habitat degradation include road construction and maintenance, timber management, fire suppression and subsequent stand-replacing fires, and permitted livestock grazing. Management needs include continuation of delineation and restoration (including removal of non-native fishes) of specific conservation waters and stocking for recovery as well as recreational fishing opportunities.

Environmental Consequences

Table 66 summarizes the viability analysis for Gila trout. This table was developed using the analysis process described under the Species Viability section above. It includes information on the status, F Rank, habitat, habitat condition and trend, likelihood that this species is limited by its habitat, and the projected management effect, by alternative. Management effect categorizes the

relative expected outcome of plan language in each alternative in terms of minimizing species viability risk and are the result of plan decisions, including plan objectives. Management effect category values are 1, 2, 3, and 4. The lower the management effects rating for a species' associated habitat, the more effective the alternative is for that species viability. These topics and the effects of the alternatives are explained in greater detail in the discussions on the alternatives that follow.

Table 66. Analysis summary for Gila trout

Species and status	Habitat	Alternative A		Alternatives B (modified), C, D	
		Habitat condition and trend relative to desired conditions	**Likelihood species is limited**	**Habitat condition and trend relative to desired conditions**	**Likelihood species is limited**
Gila trout (Endangered, Endemic) F Rank = F1*	Perennial streams	Poor, static	VH	Poor, toward	VH
	CWRF	Fair, slowly toward	VH	Good, slowly toward	H
	MBDRF	Good, static to slowly toward	H	Good, slowly toward	H
Management effect		Perennial streams = 4: Decline in habitat quality as a result of management or lack of management that result from plan components. Plan components may not exist or may be few. CWRF and MBDRF = 3: Plan components maintain or improve protection and management for some habitat occurrences in the plan area. Quality of habitat or habitat elements is maintained or improved by providing protection, maintenance, and restoration to some occurrences.		All habitats = 2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.	

*F1 = Very rare on the forest within its habitat – occupies a very small portion of its habitat.

Common to All Alternatives

Plan components in all alternatives contribute to species viability by managing for sustainable populations of native species and improving and protecting habitat for threatened, endangered, and sensitive species (1987 Plan, pages 22-1, 23, 64, 64-1, 66, 95, 108-2, 180, 187, 206-9, 206-11, 206-12, 206-13, 206-23, 206-30, 206-32, 206-66, 206-67, 206-71, 206-72, 206-79, 206-87, 206-89, 206-98, 206-103, 206-105, 206-108, 206-109, 206-114; FW-WFP-DC-1, 2, 3, 4, 5, 6, 8, and FW-Eco-DC-1). See At-risk Species in the Wildlife and Plant Issues and Topics section above for more information.

There is language under all alternatives that prioritizes habitat improvement and protections for projects for threatened and endangered species (1987 Plan, pages 23, 59, 64-6, and 87; FW-LndAdj-G-1; FW-Minerals-G-3; FW-RdsFac-G-7). Additionally, management applications under alternatives B (modified), C, and D provide recommendations to managers regarding approaches

for successful implementation of plan components, such as prioritization of work to benefit threatened and endangered species (Management Approaches for Roads and Facilities, All Riparian Areas, Stream Ecosystems, and Watersheds and Water). Under all alternatives, grazing is currently excluded from West Fork Oak Creek under all alternatives. Finally, all alternatives contain plan components provide for some guidance to manage introductions of non-native species (see Non-native or Invasive Species in the Wildlife and Plant Issues and Topics section); however, viability of native species is threatened on the forest when the focus is limited solely to introductions because most of the aquatic habitat on the forest already has undesirable non-native species.

Occupied and potential habitat overlap three existing wilderness areas and one inventoried roadless area resulting in protection of about 16 percent of the watershed. There is no mechanized or motorized use in wilderness and inventoried roadless areas are managed to maintain the overall roadless character. Consequently, these areas provide for beneficial watershed protections from sediment and bank compaction and erosion (USDA Forest Service 2013, Johnson and Spildie 2014).

Alternative A

<u>Prior consultations under the Endangered Species Act</u>

The Southwestern Region prepared a BA for the Continued Implementation of Forest LRMPs across the region in 2004 (USDA Forest Service 2004d). The 2004 BA found that standards and guidelines within the region may adversely affect Gila trout. In their Biological Opinion, the Fish and Wildlife Service determined that due to ongoing conservation efforts and the status of the species they did “not believe the impacts of the proposed action [including the Coconino NF LRMP] will rise to the level of jeopardy for the species (USDI Fish and Wildlife Service 2005a).

The Coconino NF completed a BA for implementation of the Travel Management Plan in 2010 and amended the assessment in 2011 (USDA Forest Service 2010d, 2011m). Implementation of the Travel Management Plan would close cross-country motorized travel across the forest, limiting vehicles to designated roadways (USDA Forest Service 2011m). The determination of effect for Gila trout was “no effect” as the species was not present on the forest**.** The Fish and Wildlife Service did not address this determination as “no effect” calls do not require review.

The Southwestern Region prepared another Biological Assessment for the Continued Implementation of Forest LRMPs across the region in 2011. The 2011 BA determination of effect on Gila trout was a “may affect, likely to adversely affect” finding (USDA Forest Service 2011f). The 2012 Biological Opinion disagreed with the Forest Service determination and instead the Fish and Wildlife Service determined that continued implementation of the Coconino NF “may affect but is not likely to adversely affect” the Gila trout because the species was absent from the forest and unlikely to be reintroduced during the life of the existing LRMP (USDI Fish and Wildlife Service 2012d).

A population of Gila trout was repatriated into West Fork Oak Creek by Arizona Game and Fish Department and Fish and Wildlife Service in 2015. Communication with the Fish and Wildlife Service indicated this stocking did not require environmental analysis as it was not a Forest Service action. These prior effects determinations made “no effect” calls because of the absence of Gila trout on the forest. The Aquatic Specialist Report described the effect of alternative A on Gila trout by analyzing how the effects of the TMR amendment may alter the “may affect, may adversely affect” determination made in the 2004 and 2011 LMRP BAs (USDA Forest Service

2016d). The “may affect, may adversely affect” Gila trout call in the 2011 BA was due to the mixed effects of forest plan impacts. Wilderness protections, requirements to meet state water quality standards, standards and guidelines that minimize impacts from high recreational use, and some long-term beneficial impacts from several forest programs yielded beneficial impacts that protect and enhance Gila trout habitat. However, some impacts from guidance provided in the LRMP for Fire Management, Rangeland Management, Watershed, and Wildlife, Fish, and Rare Plant programs was determined to be insufficient to avoid activities, carried out for these programs, that may adversely affect the Gila trout in the short term. Furthermore, grazing is permitted in designated wilderness and may impact the watershed. While the Travel Management Rules amendment would potentially close roads in the West Fork Oak Creek watershed and reduce sedimentation in the stream, these effects would not remove or mitigate the impacts that previously yielded a “may affect, may adversely affect” call for Gila trout in both the 2004 and 2011 BAs, therefore implementation of alternative A “may affect, may adversely affect” Gila trout.

<u>Viability</u>

Table 66 shows that under alternative A, perennial streams would remain in poor condition with a static trend in relation to desired conditions. This condition is generally due to most streams having invasive and non-native animal species that are outside of their historic variability.

Cottonwood Willow Riparian Forest would remain in fair condition and have a slow trend toward desired conditions. In Cottonwood Willow, some portions of the Verde River, Dry Beaver Creek, and Spring Creek, would be static due to high recreation or private land, such as the area around Childs, Spring Creek, Dry Beaver Creek, and private lands.

Mixed Broadleaf Deciduous Riparian Forest would remain in good condition. Static trends would be associated with the Oak Creek 5th code and West Clear Creek 5th code HUCs. The trend would be static or moving slowly toward desired conditions except in the Beaver Creek, West Clear Creek and Oak Creek 5th code HUCs and portions of Fossil Creek where recreation impacts are high. Areas of private land would remain static as well.

As shown in table 66, the likelihood that habitat on the forest would be a limiting factor for the Gila trout is high to very high depending on the habitat. These likelihoods were derived by combining the Gila trout’s F Rank of F1 with the likelihood of habitat limitation variables for each ERU: perennial streams (high), Cottonwood Willow Riparian Forest (high), and Mixed Broadleaf Deciduous Riparian Forest (moderate) (table 9). Low to moderate ratings are considered to be within the natural range of fluctuations for the habitat.

The management effect row shows the relative expected outcome of plan language in terms of minimizing species viability risk. The management effect is classified as a 4 for perennial streams, which means there is a decline in habitat quality as a result of management or lack of management that result from plan components. Plan components may not exist or may be few. As described in the Coarse Filter: Habitat section, the threat of dispersed recreation to riparian resources is not addressed forestwide in alternative A. Special areas such as the Verde Wild and Scenic River and wilderness, and the management areas within Flagstaff/Lake Mary Ecosystem Area and the Sedona-Oak Creek Planning Area most specifically address the conflicts and strategies to resolve resource damage in riparian areas. This direction mainly addresses dispersed recreations impact to specific riparian areas where there have been past conflicts and resource damage, but it provides very limited direction when areas that previously received low use are

"discovered" and see unexpected increases in recreation, such as Fossil Creek. As a result, alternative A addresses this threat sporadically compared with alternatives B (modified), C, and D, but it does mitigate some of the areas where the conflict is most pronounced.

The management effect is classified as a 3 for Cottonwood Willow Riparian Forest and Mixed Broadleaf Deciduous Riparian Forest, which means that plan components in alternative A maintain or improve protection and management for some habitat occurrences in the plan area and thus contribute less to the viability of this species than the other alternatives. Alternative A would maintain or improve riparian forests and associated streamcourses because it has a focus on improving riparian areas in any condition, preventing damage to riparian vegetation, stream banks, and channels, and restoring degraded riparian areas to good condition as soon as possible (1987 Plan, pages 65-2, 65-8, 172, and 206-8). Other protective language includes the following: Only beneficial new special uses are allowed in riparian areas and exceptions such as utility line or roads crossing stream courses are designed to minimize the extent and magnitude of impact to riparian (1987 Plan, page 177). Aggressive fire suppression may be used to prevent resource damage utilizing methods that minimize long-term adverse impacts to riparian habitats (1987 Plan, page 177). In addition, acquisition of riparian areas through land exchange is a high priority (1987 Plan, pages 177 and 185). The plan would manage commercial uses, and recreation in some areas, to protect riparian values (1987 Plan, pages 206-10, 22, 26, and 39). This alternative has less potential for improvement to riparian condition compared to the other alternatives because plan language for specific riparian forest types is lacking and there is not a focus on functioning-at-risk and non-functional riparian areas (USDA Forest Service 2016b).

Alternative A provides some guidance to reduce introductions of non-native species (primarily focused on plant species, 1987 Plan, page 206-72), but this language is insufficient in scope to maintain viability of Gila trout on the forest. Currently, some wilderness protections are afforded by the implementation of broad standards, such as complying with Arizona water quality standards that would minimize effects to Gila trout (1987 Plan, pages 23 and 74, including maintaining at least 80 percent of spawning gravels free of inorganic sediment). However, several key management concerns are not currently addressed. These include language to address management of introduced or invasive species, threatened and endangered species conservation strategies, integration of riparian, water, and aquatic species management strategies, language to support habitat connectivity, and strategies to address climate change. Trends in watershed conditions are likely to remain static, with declining flows in perennial streams due to climate change and continued water development of off-Forest lands that impact groundwater and stream volume on the forest. Based on the information provided above and within the Biological Assessment (USDA Forest Service 2016e), the continued implementation of alternative A may continue to provide for changes in habitats that are detrimental for this species, including lack of management of introduced or invasive species, unmanaged recreational activity in key habitats of this species contributing to adverse water quality conditions, and limited opportunities for acquisition of additional instream flow rights.

Alternative B (modified)

<u>Consultation under the Endangered Species Act</u>

A BA for the revision of Coconino NF Land Management Plan was prepared in 2017 (USDA Forest Service 2017c). The determination of effect for Gila trout was "may affect, not likely to adversely affect" due to "the limited distribution of Gila trout on the forest and wilderness and natural area designations of the West Fork Oak Creek making it unlikely that large scale

vegetation management projects or other actions would occur in that watershed." The Fish and Wildlife Service concurred with this finding in their draft Biological and Conference Opinion received on August 8, 2017 (USDI Fish and Wildlife Service 2017b).

Viability

Table 66 shows that under alternative B (modified) perennial streams would remain in poor condition but the trend would be toward desired conditions because of updated plan components (see management effect discussion below).

Cottonwood Willow Riparian Forest would improve to good condition and trend slowly toward desired conditions except portions of the Verde River, Towel Creek, Spring Creek and Dry Beaver Creek would improve faster (i.e., have a trend toward desired conditions).

Mixed Broadleaf Deciduous Riparian Forest would remain in good condition and slowly move toward desired conditions except portions of Fossil Creek and Wet Beaver Creek would remain static in areas of high recreation use. It would improve faster than alternative A in the Beaver Creek, Oak Creek, West Clear Creek, and Fossil Creek 5th code HUCs.

As shown in table 66, the likelihood that habitat on the forest would be a limiting factor for the Gila trout is high to very high depending on the habitat. These likelihoods were derived by combining the Gila trout's F Rank of F1 with the likelihood of habitat limitation variables for each ERU: perennial streams (high), Cottonwood Willow Riparian Forest (moderate), and Mixed Broadleaf Deciduous Riparian Forest (moderate) (table 9). Low to moderate ratings are considered to be within the natural range of fluctuations for the habitat.

The management effect row (table 66) shows the relative expected outcome of plan language in terms of minimizing species viability risk. The management effect is classified as a 2 for all the coarse filter habitats associated with the Gila trout. This means that plan components in alternative B maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area. For perennial streams, this rating is based on a broad array of plan language. Desired conditions under alternative B (modified) support and trend to improved stream ecosystem function (FW-Water-DC-2 and 3) and collaborative efforts to maintain stream flow (FW-Water-DC-5 and 6; FW-Rip-Strm-DC-4) and reduce or eliminate the impacts of invasive species (FW-Invas-DC-1). Implementation of plan components under alterative B (modified) would likely move large perennial stream habitats more rapidly toward desired conditions (USDA Forest Service 2016j).

Other plan language is designed to mitigate the effects of roads and promoting connectivity within drainages and between streamcourses and upland habitats, (see FW-RdsFac-G-2, 5, 7 and 9 and the Connectivity topic in the Wildlife and Plants Topics and Issues section). Although there are three recommended wildernesses, only the Davey's recommended wilderness area connects to perennial water, Fossil Creek. Guidelines for recommended wilderness would lessen the effects of roads by restricting motorized use except for limited permitted and administrative use and promoting trails for mechanized and non-motorized use (SA-RWild-G-3, 5). This is beneficial for connected waters and habitat for these species because roads can alter natural water flow patterns and natural sediment levels.

More site-specific aquatic management zone guidelines protect riparian function and water quality (FW-Rip-All-G-3; Fw-Rip-Strm-G-2). Also, alternative B (modified) has a guideline that

balances recreation activities, permitted uses, and management activities with soil function, riparian vegetation, and water quality at the stream reach scale (FW-Rip-RipType-G-3). This guideline would not apply to fine scale activities and facilities such as intermittent livestock crossing locations, water gaps, or other infrastructure used to manage impacts to riparian areas at a larger scale. This guideline is intended to protect riparian function, especially in areas of high recreation use such as Oak Creek, Beaver Creek, and Fossil Creek.

Alternative B (modified) has desired conditions that protect riparian resources including soil conditions and water quality while recognizing the demand for and need to properly manage the public's dispersed recreation opportunities. A forestwide desired condition for dispersed recreation supports managing dispersed recreation to avoid resource damage (FW-Rec-Disp-DC-3) Several guidelines about dispersed recreation would manage trails, camping, and recreation types to prevent further resource damage to riparian resources (FW-Rec-Disp-G-1 to 5).

Plan components in alternative B (modified) specify that livestock grazing maintains desired conditions of plant communities (FW-Graz-DC-2; FW-Graz-G-2). They also protect and minimize impacts to riparian areas by recommending that livestock use be restricted to the dormant season, recommending utilization levels on woody vegetation, maintenance of adequate vegetative cover to protect streambanks, and state that riparian areas are rarely negatively impacted by livestock (FW-Graz-G-7). This would maintain riparian structure, composition, and promote proper functioning. Guidelines are in place to reduce cattle concentrations and sedimentation into connected waters by specifying that range improvements should not interfere with riparian function and rare species, and further specifies a minimum distance of salts and supplements from riparian areas (FW-Graz-G-4 and 5).

Alternative B (modified) addresses uncharacteristic flooding by maintaining natural hydrographs through time and by promoting riparian forest composition and structure that would reduce the effects of flooding (FW-Rip-Strm-DC-4, FW-Rip-RipType-DC-2). For stream riparian areas, functional riparian areas and herbaceous vegetation provide protection from uncharacteristic wildfire and flooding disturbance, resiliency, and should filter sediment and protect water quality (FW-Rip-RipType-DC-2, 3, 4). This alternative also contains a guideline protects riparian resources by recommending against issuing a lands and recreation special use permit for activities proposed to occur within 200 feet of perennial streams, springs, or waters that contribute to or support sensitive resources, such as federally listed or Southwestern Region sensitive species (FW-SpecUse-G-3).

For Cottonwood Willow Riparian Forest and Mixed Broadleaf Deciduous Riparian Forest, this rating is primarily because there are updated desired conditions and guidelines that support the composition, structure, and function of riparian forest types (FW-Rip-RipType-DC-1 to 6, FW-Rip-RipType-G-1 to 4). In addition, riparian functional condition would improve faster than alternative A, especially along the Verde River, Towel Creek, Spring Creek, and Dry Beaver Creek. Plan components manage for vegetation diversity and riparian function (FW-Rip-RipType-DC-1 and 2; FW-Water-G-2; FW-Rip-RipType-O-1). Plan components in the Wildlife, Fish and Plants section also contribute to the viability of species associated with riparian areas by promoting properly functioning ecosystems that have the necessary physical and biological components to meet the needs of associated native species (FW-WFP-DC-1 and 3).

This species has a recovery plan in place, but does not have critical habitat designated on the forest. Currently, only one population of Gila trout is present on the forest, but recovery criteria

provide for identification and restoration of additional habitats for recovery of the species. Plan language for alternative B (modified) includes guidance for incorporating the recovery actions and conservation strategies for federally listed or candidate species including their critical habitats (FW-WFP-G-1 and 2).

Alternative C

Implementation of plan components under alternative C would have similar effects to alternative B (modified) except that alternative C adds four recommended wilderness areas (20 percent) to the West Clear and Oak Creek watersheds that provide habitat benefits to Gila trout. However, some of the protections afforded by wilderness areas also exclude motorized access needed for fire and invasive species treatments (i.e., stream barrier installations) that may reduce the forest's ability to manage these areas and assist with recovery actions. Because this species is very rare, and occupies little of its historic habitat, implementation of alternative C may reduce the forest's ability to implement treatments to secure habitats free of invasive species and reduce likelihood of incidents of uncharacteristic fire.

Alternative D

Implementation of alternative D would have similar effects to alternative B (modified) except that alternative D recommends no new wilderness areas. The effects associated with managing the recommended areas under alternatives B (modified) and C as recommended wilderness would not occur. These areas would still be managed by the other forestwide, management area, and special area direction in alternative B (modified) with the corresponding effects discussed above in the alternative B (modified) section. Implementation of plan components regarding existing wilderness would be the same as alternative A. These small changes would not change the conditions and trends in aquatic habitats from those provided by alternatives B (modified) and C for this species.

Findings

Implementation of alternatives B (modified) and D would contribute more to the viability of Gila trout than alternative A, because of updated plan components for the different riparian forests, for invasive animal species and disease, for updated language for water quality, and for language that addresses endemic species. Although alternative C would have the same effects as alternative B (modified); however, it would contribute slightly more to the viability of these species due to the additional protection provided in recommended wilderness in the watersheds for this species.

Continued management under alternative A would contribute to the viability of this species, but less so than the other alternatives. Although it has language to maintain the viability of wildlife species, much of the plan language is outdated. For example, it lacks sufficient guidance for invasive animal species or disease; does not distinguish between the different riparian forests; and lacks language that would protect endemic species or those with restricted distributions.

Little Colorado Spinedace

Affected Environment

Distribution

Little Colorado spinedace is endemic to the upper portions of the Little Colorado River and to its north flowing permanent tributaries on the Mogollon Rim and the northern slopes of the White

Mountains in eastern Arizona. This naturally restricted historic range has been extensively reduced in the past 50 years by habitat destruction and the introduction of non-native predatory and competitive fish species. Spinedace populations have fallen to extreme lows multiple times in the last 25 years. On the Coconino NF, the only location known to maintain a population of Little Colorado spinedace is within the East Clear Creek drainage, from Leonard Canyon upstream to C.C. Cragin Reservoir and upstream of the reservoir to Potato Lake, within Montane Riparian Forest (USDI Fish and Wildlife Service 1987).

Habitat

Little Colorado spinedace are associated with perennial streamcourses and Montane Willow Riparian Forests. These habitats are more fully evaluated in the Coarse Filter: Habitat section. Little Colorado spinedace occupy small to medium sized perennial streams, typically using medium-sized pools with gravel and silt-mud substrates in moderate currents. Spinedace are opportunistic feeders and will consume algae and detritus but prefer aquatic and terrestrial insects. These animals spawn in early summer to fall over gravel substrates and can tolerate some sediments, but excessive fine sediment in spawning gravels reduces oxygen content and will kill incubating eggs (USDI Fish and Wildlife Service 1987, AZGFD 2001). This species is desert-adapted with populations that fluctuate, based on periods of drought contrasted by flashy episodic rain events, and uses residual pools and spring habitat to survive drought periods. The deepest pools are thus critical refugia in dry summers and very cold winters.

Critical Habitat

The Lower and Upper Clear Creek 5th HUC watersheds (East Clear Creek) from Leonard Canyon upstream to Blue Ridge Reservoir and upstream from the reservoir to Potato Lake is considered critical habitat for Little Colorado spinedace. This lies within the existing Barbershop and East Clear Creek Inventoried Roadless Areas of the forest (USDA Forest Service 1987b).

The primary constituent elements of critical habitat for Little Colorado spinedace are (USDI Fish and Wildlife Service 1987):

- Clean, perennial flowing water.
- Presence of pools and natural hydrograph
- Free of non-native predators or competitors
- Presence of fine gravel or silt/mud substrates

Risk Factors

Little Colorado spinedace are endemic and sparsely distributed throughout their habitats on the forest. Their historic habitat has been dramatically reduced. Threats include habitat alterations from livestock grazing, water development, road construction and timber harvest operations, stream gravel removal, and chemical treatment of streams for non-native aquatic species (where all natives cannot be salvaged prior to chemical treatment), and introduction of non-native predatory and competitive aquatic species (particularly rainbow trout and crayfish species). More recently, impact of human populations and their increasing demand for water has adversely affected the normal hydrologic regime and thereby the fluctuations of the spinedace populations, resulting in accentuated population lows and reduced population highs (USDI Fish and Wildlife Service 1987). Coconino NF management activities that have contributed to habitat degradation include road construction and maintenance, timber management, fire suppression and subsequent

stand-replacing fires, dam construction (e.g., C.C. Cragin), and permitted livestock grazing (AZGFD 2001).

Environmental Consequences

Table 67 summarizes the viability analysis for Little Colorado spinedace. This table was developed using the analysis process described under the Species Viability section above. It includes information on the status, F Rank, habitat, habitat condition and trend, likelihood that this species is limited by its habitat, and the projected management effect, by alternative. Management effect categorizes the relative expected outcome of plan language in each alternative in terms of minimizing species viability risk and are the result of plan decisions, including plan objectives. Management effect category values are 1, 2, 3, and 4. The lower the management effects rating for a species' associated habitat, the more effective the alternative is for that species viability. These topics and the effects of the alternatives are explained in greater detail in the discussions on the alternatives that follow.

Table 67. Analysis summary for Little Colorado spinedace

Species and status	Habitat	Alternative A		Alternatives B (modified), C, D	
		Habitat condition and trend relative to desired conditions	Likelihood species is limited	Habitat condition and trend relative to desired conditions	Likelihood species is limited
Little Colorado spinedace (Threatened, Endemic) F Rank = F1*	Perennial streams	Poor, static	VH	Poor, toward	VH
	MWRF	Good, static to slowly toward	H	Good, slowly toward	H
Management effect		Perennial streams = 4: Decline in habitat quality as a result of management or lack of management that result from plan components. Plan components may not exist or may be few. MWRF = 3: Plan components maintain or improve protection and management for some habitat occurrences in the plan area. Quality of habitat or habitat elements is maintained or improved by providing protection, maintenance, and restoration to some occurrences.		All habitats = 2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.	

*F1 = Very rare on the forest within its habitat – occupies a very small portion of its habitat.

Common to All Alternatives

Limited and reduced perennial flow, disease, competition, and predation through introductions of non-native species are the greatest fine filter threats to Little Colorado spinedace. There is language under all alternatives that prioritizes habitat improvement and protections for projects for threatened and endangered species (1987 Plan, pages 23, 59, 64-6, and 87; FW-LndAdj-G-1; FW-Minerals-G-3; FW-RdsFac-G-7). In addition, management approaches in the sections for Roads and Facilities remind managers to consider prioritizing areas for road decommissioning where there are impaired or non-attaining riparian areas and habitats for threatened, endangered, or sensitive species for which roads are barriers or mortality hazards. Management approaches for All Riparian Areas, Stream Ecosystems, and Watersheds and Water reminds managers to consider various factors when determining the width of an aquatic management zone including: presence of threatened or endangered species, riparian condition, and threat of contamination. Additionally, all alternatives contain plan components that provide for some guidance to manage introductions of non-native species (see Non-native or Invasive Species in the Wildlife and Plant Issues and Topics section); however, the language in alternative A mainly applies to the Flagstaff Lake Mary Ecosystem Analysis Area and the Sedona/Oak Creek Area, which does not include habitat for this species.

The Clear Creek watershed includes portions of three eligible wild and scenic river segments, which promote protection of outstanding remarkable values, but do not limit recreation. Three percent of the watershed lies within existing inventoried roadless areas. Inventoried roadless areas are managed to maintain the overall roadless character. Consequently, these areas provide for beneficial watershed protections from sediment and bank compaction and erosion (USDA Forest Service 2013, Johnson and Spildie 2014).

Alternative A

Prior consultations under the Endangered Species Act

The Southwestern Region prepared a Biological Assessment for the Continued Implementation of Forest LRMPs across the region in 2004 (USDA Forest Service 2004d). The 2004 BA found that standards and guidelines within the Coconino NF LRMP would adversely affect spinedace and its critical habitat. The Biological Opinion found that the majority of standards and guidelines in the Coconino NF LRMP would benefit spinedace, and the management “is not likely to jeopardize the continued existence of the Little Colorado spinedace, and is not likely to destroy or adversely modify designated critical habitat” (USDI Fish and Wildlife Service 2005a).

The Coconino NF completed a Biological Assessment for implementation of the Travel Management Plan in 2010 and amended the assessment in 2011 (USDA Forest Service 2010d, 2011m). Implementation of the Travel Management Plan would close cross-country motorized travel across the forest, limiting vehicles to designated roadways (USDA Forest Service 2011g). Because of the expected reduced sedimentation and improved habitat for spinedace due to road closures, the determination of effect for Little Colorado spinedace was “may affect but is not likely to adversely affect Little Colorado spinedace or its habitat.” The Fish and Wildlife Service concurred with the finding (USDI Fish and Wildlife Service 2011e, 2011f).

The Southwestern Region prepared another Biological Assessment for the Continued Implementation of Forest LRMPs across the region in 2011 (USDA Forest Service 2011f). The 2011 BA determination of effect was a “may affect, likely to adversely affect.” In their 2012 Biological Opinion, the Fish and Wildlife Service found after “reviewing the current status of the Little Colorado spinedace, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Little Colorado spinedace, is not likely to destroy or adversely modify designated CH, and will not preclude recovery of the species” (USDI Fish and Wildlife Service 2012d).

Since 2012, there have been no significant changes in the LRMP or significant scientific information to warrant a change in the finding.

Viability

Table 67 shows that under alternative A, perennial streams would remain in poor condition with a static trend in relation to desired conditions. This condition is generally due to most streams having invasive and non-native animal species that are outside of their historic variability.

Montane Willow Riparian Forest would remain in good condition with a majority of the habitat either static or trending slowly toward desired conditions, except the Upper Clear Creek 5th code HUC is trending toward desired conditions.

As shown in table 67, the likelihood that habitat on the forest would be a limiting factor the Little Colorado spinedace is high to very high depending on the habitat. These likelihoods were derived by combining the Little Colorado spinedace's F Rank of F1 with the likelihood of habitat limitation variables for each ERU: perennial streams (high) and Montane Willow Riparian Forest (moderate) (table 9). Low to moderate ratings are considered to be within the natural range of fluctuations for the habitat.

The management effect row shows the relative expected outcome of plan language in terms of minimizing species viability risk. The management effect is classified as a 4 for perennial streams, which means there is a decline in habitat quality as a result of management or lack of management that result from plan components. Plan components may not exist or may be few. As described in the Coarse Filter: Habitat section, the threat of dispersed recreation to riparian resources is not addressed forestwide in alternative A nor are invasive or non-native animal species addressed.

The management effect is classified as a 3 for Montane Willow Riparian Forest, which means that plan components in alternative A maintain or improve protection and management for some habitat occurrences in the plan area, and thus, contribute less to the viability of this species than the other alternatives. Alternative A would maintain or improve riparian forests and streamcourses because it has a focus on improving riparian areas in any condition, preventing damage to riparian vegetation, streambanks, and channels, and restoring degraded riparian areas to good condition as soon as possible (1987 Plan, pages 65-2, 65-8, 172, and 206-8). Other protective language includes the following: Only beneficial new special uses are allowed in riparian areas and exceptions such as utility line or roads crossing stream courses are designed to minimize the extent and magnitude of impact to riparian (1987 Plan, page 177). Aggressive fire suppression may be used to prevent resource damage utilizing methods that minimize long-term adverse impacts to riparian habitats (1987 Plan, page 177). In addition, acquisition of riparian areas through land exchange is a high priority (1987 Plan, pages 177 and 185). The plan would manage commercial uses, and recreation in some areas, to protect riparian values (1987 Plan, pages 206-10, 22, 26, and 39). This alternative has less potential for improvement to riparian condition compared to the other alternatives because plan language for specific riparian forest types is lacking and there is not a focus on functioning-at-risk and non-functional riparian areas (USDA Forest Service 2016b).

Although alternative A has language to provide for species viability, language in alternative A for invasive or non-native animal species is insufficient in scope to maintain viability of Little Colorado spinedace on the forest. Alternative A addresses recreation impacts (a threat within Montane Willow Riparian Forest) through forestwide language that would manage dispersed recreation areas for resource protection, capacity monitoring, and public safety. Damaged areas would be closed and restored as necessary (1987 Plan, page 57). Management concerns for Little Colorado spinedace not currently addressed in alternative A include language to address forestwide management of invasive animal species; threatened and endangered species conservation strategies; integration of riparian, water, and aquatic species management strategies; forestwide language to support habitat connectivity; and updated strategies to address climate change. Based on the information provided within Coarse Filter Analysis: Habitat sections for Perennial Streamcourses and Montane Willow Riparian Forests and the Biological Assessment (USDA Forest Service 2017c), the continued implementation of alternative A may continue to provide for changes in habitats that are detrimental for this species, including inadequate management of introduced species, high recreational activity in riparian forests of watersheds

occupied by this species contributing to adverse water quality conditions, and limited opportunities for acquisition of additional instream flow rights.

Other risk factors for this species include: road construction, timber harvest, stream gravel removal (mining), fire suppression, uncharacteristic fires, and livestock grazing. Plan language as it relates to mining, fire suppression, livestock grazing, sediment delivery into connected waters (uncharacteristic fire, timber harvest, road construction) is compared in the Coarse Filter: Habitat section for Perennial Streamcourses. Alternative A does not address chemical treatment of streams for non-natives; however, it would be addressed during site-specific environmental analysis for this treatment. There is little plan direction for dam administration and management except ensuring that Class A dam inspections occur on a 3-year cycle (1987 Plan, page 90). Alternative A also lacks language to protect endemic species. This would not affect Little Colorado spinedace; however, it has protections because it is a federally listed species.

Alternative B (modified)

<u>Consultation under the Endangered Species Act</u>

A BA for the revision of Coconino NF Land Management Plan was prepared in 2017 (USDA Forest Service 2017c). The determination of effect for Little Colorado spinedace was “may affect, likely to adversely affect” due to “adverse effects from livestock grazing and forest management projects in watersheds” containing the species. After “reviewing the current status of the Little Colorado spinedace and its critical habitat, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects,” the Fish and Wildlife Service issued the biological opinion that “implementation of the Coconino NF’s revised LRMP will not jeopardize the continued existence of the Little Colorado spinedace, and will not destroy or adversely modify Little Colorado spinedace…designated critical habitats” in their draft Biological and Conference Opinion received on August 8, 2017 (USDI Fish and Wildlife Service 2017b). No incidental take was assigned. The Fish and Wildlife Service provided four discretionary conservation recommendations intended to minimize or avoid adverse effects, help implement recovery plans, or develop information.

<u>Viability</u>

Table 67 shows that under alternative B (modified) perennial streams would remain in poor condition, but the trend would be toward desired conditions because of updated plan components (see management effect discussion below).

Montane Willow Riparian Forest would remain in good condition and slowly move toward desired conditions. In the Upper Clear Creek 5th code HUC, Montane Willow would move toward desired condition at a faster rate than alternative A.

As shown in table 67, the likelihood that habitat on the forest would be a limiting factor for Little Colorado spinedace is the same as alternative A, high to very high depending on the habitat. These likelihoods were derived by combining the Little Colorado spinedace’s F Rank of F1 with the likelihood of habitat limitation variables for each ERU: perennial streams (high) and MWRF (moderate) (table 9). Low to moderate ratings are considered to be within the natural range of fluctuations for the habitat.

The management effect row shows the relative expected outcome of plan language in terms of minimizing species viability risk. The management effect is classified as a 2 for all the coarse

filter habitats associated with the Little Colorado spinedace. This means that plan components in alternative B (modified) maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area. For perennial streams, this rating is based on a broad array of plan language. Desired conditions under alternative B (modified) support and trend to improved stream ecosystem function (FW-Water-DC-2 and 3) and collaborative efforts to maintain stream flow (FW-Water-DC-5 and 6; FW-Rip-Strm-DC-4) and reduce or eliminate the impacts of invasive species (FW-Invas-DC-1). Implementation of plan components under alterative B (modified) will likely move large perennial stream habitats more rapidly toward desired conditions (USDA Forest Service 2016j).

Other plan language is designed to mitigate the effects of roads and promoting connectivity within drainages and between streamcourses and upland habitats, (See FW-RdsFac-G-2, 5, 7 and 9 and the Connectivity topic in the Wildlife and Plants Topics and Issues section). Although there are three recommended wildernesses, none are within spinedace habitat

More site-specific aquatic management zone guidelines protect riparian function and water quality (FW-Rip-All-G-3; Fw-Rip-Strm-G-2). Also, alternative B (modified) has a guideline that balances recreation activities, permitted uses, and management activities with soil function, riparian vegetation, and water quality at the stream reach scale (FW-Rip-RipType-G-3). This guideline would not apply to fine-scale activities and facilities such as intermittent livestock crossing locations, water gaps, or other infrastructure used to manage impacts to riparian areas at a larger scale. This guideline is intended to protect riparian function.

Alternative B (modified) has desired conditions that protect riparian resources including soil conditions and water quality while recognizing the demand for and need to properly manage the public's dispersed recreation opportunities. A forestwide desired condition for dispersed recreation supports managing dispersed recreation to avoid resource damage (FW-Rec-Disp-DC-3). Several guidelines about dispersed recreation would manage trails, camping, and recreation types to prevent further resource damage to riparian resources (FW-Rec-Disp-G-1 to 5).

Plan components in alternative B (modified) specify that livestock grazing maintains desired conditions of plant communities (FW-Graz-DC-2; FW-Graz-G-2). They also protect and minimize impacts to riparian areas by recommending that livestock use be restricted to the dormant season, recommending utilization levels on woody vegetation, maintenance of adequate vegetative cover to protect streambanks, and state that riparian areas are rarely negatively impacted by livestock (FW-Graz-G-7). This would maintain riparian structure and composition, and promote proper functioning. Guidelines are in place to reduce cattle concentrations and sedimentation into connected waters by specifying that range improvements should not interfere with riparian function and rare species, and further specify a minimum distance of salts and supplements from riparian areas (FW-Graz-G-4 and 5).

Alternative B (modified) addresses uncharacteristic flooding by maintaining natural hydrographs through time and by promoting riparian forest composition and structure that would reduce the effects of flooding (FW-Rip-Strm-DC-4, FW-Rip-RipType-DC-2). For stream riparian areas, functional riparian areas and herbaceous vegetation provide protection from uncharacteristic wildfire and flooding disturbance, resiliency, and should filter sediment and protect water quality (FW-Rip-RipType-DC-2, 3, 4). This alternative also contains a guideline that protects riparian resources by recommending against issuing a lands and recreation special-use permit for activities proposed to occur within 200 feet of perennial streams, springs, or waters that contribute to or

support sensitive resources, such as federally listed or Southwestern Region sensitive species (FW-SpecUse-G-3).

For Montane Willow Riparian Forest, this management effect rating is primarily because there are updated desired conditions and guidelines that support the composition, structure, and function of riparian forest types (FW-Rip-RipType-DC-1 to 6, FW-Rip-RipType-G-1 to 4). In addition, riparian functional condition would improve faster than alternative A. Plan components manage for vegetation diversity and riparian function (FW-Rip-RipType-DC-1 and 2; FW-Water-G-2; FW-Rip-RipType-O-1). Plan components in the Wildlife, Fish and Plants section also contribute to the viability of species associated with riparian areas by promoting properly functioning ecosystems that have the necessary physical and biological components to meet the needs of associated native species (FW-WFP-DC-1 and 3).

Restoration activities in alternative B (modified) (i.e., installation of non-native species barriers, vegetation treatments that reduce uncharacteristic fires within watersheds, vegetation plantings and riparian restoration and channel stabilization projects) may have short-term negative impacts to Little Colorado spinedace and its habitat, but they will have long-term benefits to the species. Restoration activities are designed to improve habitats to be resilient to changes in stream flow and fire regimes associated with climate change that will allow for long-term species persistence and viability on the forest.

This species has a recovery plan in place and also has critical habitat designated on the forest. Plan language for alternative B (modified) includes guidance for incorporating the recovery actions and conservation strategies for federally listed or candidate species including their critical habitats (FW-WFP-G-1 and 2). This guidance has positive contributions to maintaining Little Colorado spinedace viability on the forest. Alternative B (modified) provides for some changes in the recreational use that will benefit spinedace habitat through reduction in motorized access that can encourage decommissioning of roads and reduce sediment in streams for spinedace. These changes would likely benefit spinedace habitats, further contributing to improved conditions for species viability over time.

Unlike alternative A, alternative B (modified) has a guideline to design projects to minimize the negative impact of pesticides, herbicides, or chemicals to species and their habitat (FW-WFP-G-4). However, like alternative A, chemical treatment of streams for non-natives would be addressed during site-specific environmental analysis for this treatment.

Unlike alternative A, alternative B (modified) has plan direction for the C.C. Cragin management area that overlaps the Upper Clear 5th code watershed that supports the Little Colorado spinedace. Management area direction would benefit this species and its habitat by managing this area to reduce the threat of uncharacteristic wildfires, flooding, and sedimentation to maintain water quality and quantity. In addition, roads and trails in this management area would be maintained to prevent erosion and sedimentation (MA-CCCrg-G-1 and 2). This watershed also occurs in the following management areas: East Clear Creek, Long Valley, Anderson Mesa, and Pine Belt. Plan direction would prevent negative impacts to riparian areas and meadows by managing motorized recreation and dispersed camping outside of these area (MA-EastClr-G-1; MA-LongV-G-1).

Alternative B (modified) would additionally contribute to the viability of this species through language that would prevent or reduce the likelihood of introduction or spread of disease and

would protect and provide for narrowly endemic species and species with restricted distributions where they are likely to occur (FW-WFP-G-3, 10, and 12).

Alternative C

Implementation of plan components under alternative C would have similar effects to alternative B (modified), but there are a few meaningful differences. Alternative C includes the addition of two recommended wilderness areas and six management areas in the East Clear Creek watersheds. The management areas have an emphasis on reduced human-related disturbance. All of these areas would provide some habitat benefits to Little Colorado spinedace because they restrict public motorized access that can lead to increased sediment in connected perennial waters. However, some acreages of the recommended wilderness or new management areas overlap with designated inventoried roadless areas or are such a distance from perennial waters, that little increase in protection to perennial stream habitat is likely from implementation of these areas (USDA Forest Service 2013). Alternative C does include the East Clear Creek, Hospital Ridge, Knoll Lake management areas within the Leonard Canyon and Clear Creek watersheds with specific focus on restoration and protection of Little Colorado spinedace habitats. These areas contain 46,511 acres (including the 3,346 acres of existing special areas) that protect spinedace habitat and management direction emphasizes this species. While restoration activities needed to improve habitat would be likely to adversely affect the species and its habitat during the short term, restoration projects will improve conditions and viability for a substantial proportion of spinedace habitat over the long term. Activities such as installation of non-native species barriers, vegetation treatments that reduce uncharacteristic fires within watersheds, vegetation plantings, and riparian forest and stream channel stabilization projects may increase sediments and reduce water quality over a period of a few years, but would have long-term benefits to the species.

The direction in the management areas that emphasize reduced human-related disturbance would benefit this species and its habitat by maintaining the ecological integrity of watersheds, headwater environments and native vegetation; assuring that streams and perennial waters support identified designated beneficial uses; springs, streams and wetlands are protected and restored; river and stream corridors have long-term protection; and Little Colorado spinedace (among other species) are emphasized and able to find properly functioning and restored habitat (Appendix F). Riparian corridors would provide biologically significant corridors for wildlife and fish through the landscape. In addition, recreation activities would be predominantly low disturbance, non-motorized, and would not negatively impact hydrologic flow, soil condition or habitat connectivity (Appendix F, MA-EastClr-DC-1 to 4, 9, and 10; MA-BlueRidge-DC-1 to 4, 6, 10, and 11; MA-HospRdg-DC-1 to 4, 6, and 9; MA-ScndChnc-DC-1 to 4, 6, and 9). Within the Blue Ridge MA and Hospital Ridge MA, watersheds that support Leonard Canyon and East Clear Creek, including the headwaters, would be protected and restored (Appendix F, MA-BlueRidge-DC-9 and 10; MA-ScndChnc-DC-10).

Alternative D

Implementation of plan components under alternative D would have effects similar to alternative B (modified) for Little Colorado spinedace habitats.

Findings

Implementation of alternative B (modified) would contribute more to the viability of Little Colorado spinedace than alternative A because of updated plan components for management of the different riparian forests, for invasive animal species and associated disease management, for

updated language for water quality, and for language that addresses endemic species. Although alternative C would have the same effects as alternative B (modified), it would contribute slightly more to the viability of these species due to the additional protection provided in recommended wilderness in the watersheds for this species. Continued management under alternative A would contribute to the viability of this species, but less so than the other alternatives. Although it has language to maintain the viability of wildlife species, much of the plan language is outdated. For example, it lacks sufficient guidance for invasive animal species or disease; does not distinguish between the different riparian forests; and lacks language that would protect endemic species or those with restricted distributions.

Loach minnow

Affected Environment

Distribution

Historically, the species was endemic to the Gila River basin, upstream of Phoenix in the Agua Fria, Gila, Salt, San Pedro and Verde River systems. Loach minnow occurred on the forest in the Beaver Creek, Cherry Creek-Verde River, Fossil Creek-Verde River, Grindstone Wash-Verde River, Oak Creek, Sycamore Creek, and West Clear Creek 5th HUC watersheds, but has since been considered extirpated. The only known population remaining on the forest is the recently reintroduced population in Fossil Creek, but no evidence of reproduction has been found and stocking attempts have at least temporarily ceased (USDA Forest Service 2017c; AZGFD 2010).

Habitat

Loach minnow and its critical habitat are currently found in perennial streams within Mixed Broadleaf Deciduous and Cottonwood Willow Riparian Forest habitats on the Coconino NF. These habitats are more fully evaluated in the Coarse Filter: Habitat section. Loach minnow is a bottom-dwelling inhabitant of turbulent riffle habitats that contain large cobble/boulder substrates. This species uses the spaces between and in behind larger substrates, spends their entire life history in these habitats, and is rare or absent from habitats where fine sediments fill the interstitial spaces. Depending on elevation, loach minnow spawns from early spring through mid-summer, laying adhesive eggs attached under the downstream side of cobbles. Loach minnow feed exclusively on benthic aquatic insects.

Critical Habitat

Critical habitat was designated in 2012 in Fossil Creek from the Fossil Diversion Dam downstream 13.8 miles. It includes the Verde River from Grindstone Wash downstream to the confluence with Fossil Creek, and the lower portions of Oak Creek, Beaver/Wet Beaver Creeks, and Fossil Creek on the forest (USDI Fish and Wildlife Service 2012c).

The primary constituent elements for loach minnow critical habitat are:

- Habitat to support all life stages (perennial flow, appropriate habitat complexity with gravel, cobble, and rubble substrates, low fine sediments and embeddedness, water temperatures from 46.4 to 77 °Fahrenheit);
- Abundant macroinvertebrate prey base
- Low pollutants

- Perennial flows with at least seasonal corridors between occupied habitats
- Lack of non-native species or low levels to allow persistence
- Normative flow regime

Risk Factors

Loach minnow populations have been impacted by dewatering of stream reaches by water diversions and dams, livestock grazing, habitat alteration, and introduced or invasive or non-native fish, especially catfishes and red shiner (AZGFD 2010). Coconino NF management activities that have contributed to habitat degradation include road construction and maintenance, timber management, fire suppression and subsequent stand-replacing fires, stream diversion, and permitted livestock grazing. Management needs include: conservation, protection, and monitoring of existing populations, reduce or eliminate impacts from non-native predatory and competitive fish species, enhancement or restoration of select habitats within historical range, and reintroduction into select historical habitats.

Environmental Consequences

Table 68 summarizes the viability analysis for loach minnow. This table was developed using the analysis process described under the Species Viability section above. It includes information on the status, F Rank, habitat, habitat condition and trend, likelihood that this species is limited by its habitat, and the projected management effect, by alternative. Management effect categorizes the relative expected outcome of plan language in each alternative in terms of minimizing species viability risk and are the result of plan decisions, including plan objectives. Management effect category values are 1, 2, 3, and 4. The lower the management effects rating for a species' associated habitat, the more effective the alternative is for that species viability. These topics and the effects of the alternatives are explained in greater detail in the discussions on the alternatives that follow.

Table 68. Analysis summary for loach minnow

Species and status	Habitat	Alternative A		Alternatives B (modified), C, D	
		Habitat condition and trend relative to desired conditions	Likelihood species is limited	Habitat condition and trend relative to desired conditions	Likelihood species is limited
Loach minnow (Endangered, Endemic)	Perennial streams	Poor, static	VH	Poor, toward	VH
F Rank = F1*	CWRF	Fair, slowly toward	VH	Good, slowly toward	H
	MBDRF	Good, static to slowly toward	H	Good, slowly toward	H

Species and status	Habitat	Alternative A		Alternatives B (modified), C, D	
		Habitat condition and trend relative to desired conditions	Likelihood species is limited	Habitat condition and trend relative to desired conditions	Likelihood species is limited
	MWRF	Good, static to slowly toward	H	Good, slowly toward	H
Management effect		Perennial streams = 4: Decline in habitat quality as a result of management or lack of management that result from plan components. Plan components may not exist or may be few. CWRF, MBDRF, and MWRF = 3: Plan components maintain or improve protection and management for some habitat occurrences in the plan area. Quality of habitat or habitat elements is maintained or improved by providing protection, maintenance, and restoration to some occurrences.		All habitats = 2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.	

*F1 = Very rare on the forest within its habitat – occupies a very small portion of its habitat.

Common to All Alternatives

Plan components in all alternatives contribute to species viability by managing for sustainable populations of native species and improving and protecting habitat for threatened, endangered, and sensitive species (1987 Plan, pages 22-1, 23, 64, 64-1, 66, 95, 108-2, 180, 187, 206-9, 206-11, 206-12, 206-13, 206-23, 206-30, 206-32, 206-66, 206-67, 206-71, 206-72, 206-79, 206-87, 206-89, 206-98, 206-103, 206-105, 206-108, 206-109, 206-114; FW-WFP-DC-1, 2, 3, 4, 5, 6, 8, and FW-Eco-DC-1). See At-risk Species in the Wildlife and Plant Issues and Topics section above for more information.

Disease, competition, and predation through introductions of non-native species the greatest fine filter threats to loach minnow. There is language under all alternatives that prioritizes habitat improvement and protections for projects for threatened and endangered species (1987 Plan, pages 23, 59, 64-6, and 87; FW-LndAdj-G-1; FW-Minerals-G-3; FW-RdsFac-G-7). Additionally, management applications under alternatives B (modified), C, and D provide recommendations to managers regarding approaches for successful implementation of plan components, such as prioritization of work to benefit threatened and endangered species (Management Approaches for Roads and Facilities, All Riparian Areas, Stream Ecosystems, and Watersheds and Water). Finally, all alternatives contain plan components provide for some guidance to manage introductions of non-native species (see Non-native or Invasive Species in the Wildlife and Plant Issues and Topics section); however, viability of native species is threatened on the forest when the focus is limited solely to introductions, because most of the aquatic habitat on the forest already has undesirable non-native species.

Currently, 19 percent of the 5 watersheds with loach minnow habitat lie within inventoried roadless area or designated wilderness. There is no mechanized or motorized use in wilderness and inventoried roadless areas are managed to maintain the overall roadless character.

Consequently, these areas provide for beneficial watershed protections from sediment and bank compaction and erosion (USDA Forest Service 2013, Johnson and Spildie 2014).

The Fossil Creek Wild and Scenic River Comprehensive River Management Plan (CRMP) is being developed concurrently with this forest plan revision effort. The CRMP will provide detailed direction, implementation actions, and monitoring to protect or enhance outstandingly remarkable values of the wild and scenic river. The proposed action is designed to include the most flexibility to increase capacity and recreation infrastructure—maximizing recreation opportunities in the future—while providing protection for sensitive river and Tribal values at the same time through both a management plan and site-specific actions. Project actions would address recreation capacity, corridor access, recreation facilities, services, and public health and safety. Even if an alternative to the proposed action is selected, it is likely to include managing recreation to prevent resource damage in the river corridor. Management actions under the CRMP would contribute positively to species associated with Fossil Creek, including loach minnow.

Alternative A

<u>Prior consultations under the Endangered Species Act</u>

The Southwestern Region prepared a Biological Assessment for the Continued Implementation of Forest LRMPs across the region in 2004 (USDA Forest Service 2004d). The 2004 BA determined that forest plans, including the Coconino NF LRMP, were likely to adversely affect loach minnow and its critical habitat. The Fish and Wildlife Service did not include the Coconino NF LRMP in their 2005 Biological Opinion (perhaps because loach minnow were absent from the forest), but determined that the Apache-Sitgreaves, Coronado, and Gila NF LRMPs would not jeopardize the continued existence of loach minnow (USDI Fish and Wildlife Service 2005a).

The Coconino NF completed a Biological Assessment for implementation of the Travel Management Plan in 2010 and amended the assessment in 2011 (USDA Forest Service 2010d, 2011m). Implementation of the Travel Management Plan would close cross-country motorized travel across the forest, limiting vehicles to designated roadways (USDA Forest Service 2011g). Based on analysis of road closures, the determination of effect was “may affect, but is not likely to adversely affect” for both loach minnow and its critical habitat. The Fish and Wildlife Service concurred with the finding (USDI Fish and Wildlife Service 2011e, 2011f).

The Southwestern Region prepared another Biological Assessment for the Continued Implementation of forest LRMPs across the region in 2011. The 2011 BA determination of effect was again “likely to adversely affect” loach minnow and its critical habitat due to “at least short-term adverse effects to aquatic habitats” (USDA Forest Service 2011f). After reviewing the current status of the loach minnow, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, the Fish and Wildlife Service determined that the Coconino LRMP would “not jeopardize the continued existence of the loach minnow” (USDI Fish and Wildlife Service 2012d).

Since 2012, there have been no significant changes in the LRMP or significant scientific information to warrant a change in the finding.

Table 68 shows that under alternative A, perennial streams would remain in poor condition with a static trend in relation to desired conditions. This condition is generally due to most streams having invasive and non-native animal species that are outside of their historic variability.

Cottonwood Willow Riparian Forest would remain in fair condition and have a slow trend toward desired conditions. In Cottonwood Willow, some portions of the Verde River, Dry Beaver Creek, and Spring Creek, would be static due to high recreation or private land, such as the area around Childs, Spring Creek, Dry Beaver Creek, and private lands.

Mixed Broadleaf Deciduous Riparian Forest would remain in good condition. Static trends would be associated with the Oak Creek 5th code and West Clear Creek 5th code HUCs. The trend would be static or moving slowly toward desired conditions except in the Beaver Creek, West Clear Creek and Oak Creek 5th code HUCs, and portions of Fossil Creek where recreation impacts are high. Areas of private land would remain static as well.

Montane Willow Riparian Forest would remain in good condition with a majority of the habitat either static or trending slowly toward desired conditions, except the Upper Clear Creek 5th code HUC is trending toward desired conditions.

As shown in table 68, the likelihood that habitat on the forest would be a limiting factor for loach minnow is high to very high depending on the habitat. These likelihoods were derived by combining loach minnow’s F Rank of F1 with the likelihood of habitat limitation variables for each ERU: perennial streams (high), Cottonwood Willow Riparian Forest (high), Mixed Broadleaf Deciduous Riparian Forest (moderate), and Montane Willow Riparian Forest (moderate, except the Upper Clear Creek 5th code HUC is high) (table 9). Low to moderate ratings are considered to be within the natural range of fluctuations for the habitat.

The management effect row shows the relative expected outcome of plan language in terms of minimizing species viability risk. The management effect is classified as a 4 for perennial streams, which means there is a decline in habitat quality as a result of management or lack of management that result from plan components. Plan components may not exist or may be few. As described in the Coarse Filter: Habitat section, the threat of dispersed recreation to riparian resources is not addressed forestwide in alternative A. Special areas such as the Verde Wild and Scenic River and wilderness, and the management areas within Flagstaff/Lake Mary Ecosystem Area and the Sedona-Oak Creek Planning Area most specifically address the conflicts and strategies to resolve resource damage in riparian areas. This direction mainly addresses dispersed recreations impact to specific riparian areas where there have been past conflicts and resource damage, but it provides very limited direction when areas that previously received low use are “discovered” and see unexpected increases in recreation, such as Fossil Creek. As a result, alternative A addresses this threat sporadically compared with alternatives B (modified), C, and D, but it does mitigate some of the areas where the conflict is most pronounced.

The management effect is classified as a 3 for Cottonwood Willow Riparian Forest, Mixed Broadleaf Deciduous Riparian Forest, and Montane Willow Riparian Forest, which means that plan components in alternative A maintain or improve protection and management for some habitat occurrences in the plan area, and thus, contribute less to the viability of this species than the other alternatives. Alternative A would maintain or improve riparian forests and associated streamcourses because it has a focus on improving riparian areas in any condition, preventing damage to riparian vegetation, stream banks, and channels, and restoring degraded riparian areas to good condition as soon as possible (1987 Plan, pages 65-2, 65-8, 172, and 206-8). Other protective language includes the following: Only beneficial new special uses are allowed in riparian areas and exceptions such as utility line or roads crossing stream courses are designed to minimize the extent and magnitude of impact to riparian (1987 Plan, page 177). Aggressive fire

suppression may be used to prevent resource damage utilizing methods that minimize long-term adverse impacts to riparian habitats (1987 Plan, page 177). In addition, acquisition of riparian areas through land exchange is a high priority (1987 Plan, pages 177 and 185). The plan would manage commercial uses, and recreation in some areas, to protect riparian values (1987 Plan, pages 206-10, 22, 26, and 39). This alternative has less potential for improvement to riparian condition compared to the other alternatives because plan language for specific riparian forest types is lacking and there is not a focus on functioning-at-risk and non-functional riparian areas (USDA Forest Service 2016b).

Disease, competition, and predation through introductions of non-native species are the greatest fine filter threats to loach minnow. Alternative A provides some guidance to reduce introductions of non-native species (primarily focused on plant species) (1987 Plan, page 206-72), but this language is insufficient in scope to maintain viability of loach minnow on the forest. Currently, some watershed protections are afforded by the implementation of broad standards, such as complying with Arizona water quality standards that would minimize impacts to loach minnow (1987 Plan, pages 23 and 74). However, several key management concerns are not currently addressed. These include language to address management of introduced or invasive species, threatened and endangered species conservation strategies, integration of riparian, water, and aquatic species management strategies, language to support habitat connectivity, and strategies to address climate change.

Alternative A maintains much of the acreage currently designated as motorized use with the Cherry Creek-Verde River and Grindstone Wash-Verde River watersheds and could, therefore, have watershed impacts associated with both increased recreational access and roads that increase sediments, compact soils, and damage vegetation. Loach minnow are very sensitive to increased sediments in streams, so these conditions would have adverse effects.

Alternative B (modified)

<u>Consultation under the Endangered Species Act</u>

A Biological Assessment for the revision of Coconino NF Land Management Plan was prepared in 2017 (USDA Forest Service 2017c). The lack of loach minnow on the forest resulted in a “may affect, not likely to adversely affect” determination for loach minnow. Due to adverse effects on riparian vegetation and increases in sediment delivery from potential forest plan projects, the forest determined that the LRMP “may affect, is likely to adversely affect” critical habitat for loach minnow. The Fish and Wildlife Service concurred with the “may affect, not likely to adversely affect” finding for loach minnow in their draft Biological and Conference Opinion received on August 8, 2017 (USDI Fish and Wildlife Service 2017b). Despite short-term adverse effects from Forest projects, the long-term effects of the LRMP would minimize impacts or improve loach minnow habitat, so the Fish and Wildlife Service determined that the Coconino LRMP would not “diminish the ability of critical habitat to contribute to the conservation and recovery [of]… loach minnow” (USDI Fish and Wildlife Service 2017b). No incidental take was assigned. The Fish and Wildlife Service provided four discretionary conservation recommendations intended to minimize or avoid adverse effects, help implement recovery plans, or develop information.

Viability

Table 68 shows that under alternative B (modified) perennial streams would remain in poor condition, but the trend would be toward desired conditions because of updated plan components (see management effect discussion below).

Cottonwood Willow Riparian Forest would improve to good condition and trend slowly toward desired conditions except portions of the Verde River, Towel Creek, Spring Creek and Dry Beaver Creek would improve faster (i.e., have a trend toward desired conditions).

Mixed Broadleaf Deciduous Riparian Forest would remain in good condition and slowly move toward desired conditions except portions of Fossil Creek and Wet Beaver Creek would remain static in areas of high recreation use. It would improve faster than alternative A in the Beaver Creek, Oak Creek, West Clear Creek, and Fossil Creek 5th code HUCs.

Montane Willow Riparian Forest would remain in good condition and slowly move toward desired conditions. In the Upper Clear Creek 5th code HUC, Montane Willow would move toward desired condition at a faster rate than alternative A.

As shown in table 68, the likelihood that habitat on the forest would be a limiting factor for loach minnow is high to very high depending on the habitat. These likelihoods were derived by combining loach minnow’s F Rank of F1 with the likelihood of habitat limitation variables for each ERU: perennial streams (high if accessible), Cottonwood Willow Riparian Forest (moderate), Mixed Broadleaf Deciduous Riparian Forest (moderate), and Montane Willow Riparian Forest (moderate) (table 9). Low to moderate ratings are considered to be within the natural range of fluctuations for the habitat.

The management effect row shows the relative expected outcome of plan language in terms of minimizing species viability risk. The management effect is classified as a 2 for all the coarse filter habitats associated with loach minnow. This means that plan components in alternative B (modified) maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area. For perennial streams, this rating is based on a broad array of plan language. Desired conditions under alternative B (modified) support and trend to improved stream ecosystem function (FW-Water-DC-2 and 3) and collaborative efforts to maintain stream flow (FW-Water-DC-5 and 6; FW-Rip-Strm-DC-4) and reduce or eliminate the impacts of invasive species (FW-Invas-DC-1). Implementation of plan components under alterative B (modified) will likely move large perennial stream habitats more rapidly toward desired conditions (USDA Forest Service 2016j).

Other plan language is designed to mitigate the effects of roads and promoting connectivity within drainages and between streamcourses and upland habitats, (See FW-RdsFac-G-2, 5, 7 and 9 and the Connectivity topic in the Wildlife and Plants Topics and Issues section). Although there are three recommended wildernesses, only the Davey’s recommended wilderness area connects to perennial water, Fossil Creek. Guidelines for recommended wilderness would lessen the effects of roads by restricting motorized use except for limited permitted and administrative use and promoting trails for mechanized and non-motorized use (SA-RWild-G-3, 5). This is beneficial for connected waters and habitat for these species because roads can alter natural water flow patterns and natural sediment levels.

More site-specific aquatic management zone guidelines protect riparian function and water quality (FW-Rip-All-G-3; Fw-Rip-Strm-G-2). Also, alternative B (modified) has a guideline that balances recreation activities, permitted uses, and management activities with soil function, riparian vegetation, and water quality at the stream reach scale (FW-Rip-RipType-G-3). This guideline would not apply to fine scale activities and facilities such as intermittent livestock crossing locations, water gaps, or other infrastructure used to manage impacts to riparian areas at a larger scale. This guideline is intended to protect riparian function, especially in areas of high recreation use such as Oak Creek, Beaver Creek, and Fossil Creek.

Alternative B (modified) has desired conditions that protect riparian resources including soil conditions and water quality while recognizing the demand for and need to properly manage the public's dispersed recreation opportunities. A forestwide desired condition for dispersed recreation supports managing dispersed recreation to avoid resource damage (FW-Rec-Disp-DC-3) Several guidelines about dispersed recreation would manage trails, camping, and recreation types to prevent further resource damage to riparian resources (FW-Rec-Disp-G-1 to 5).

Plan components in alternative B (modified) specify that livestock grazing maintains desired conditions of plant communities (FW-Graz-DC-2; FW-Graz-G-2). They also protect and minimize impacts to riparian areas by recommending that livestock use be restricted to the dormant season, recommending utilization levels on woody vegetation, maintenance of adequate vegetative cover to protect streambanks, and state that riparian areas are rarely negatively impacted by livestock (FW-Graz-G-7). This would maintain riparian structure, composition, and promote proper functioning. Guidelines are in place to reduce cattle concentrations and sedimentation into connected waters by specifying that range improvements should not interfere with riparian function and rare species, and further specifies a minimum distance of salts and supplements from riparian areas (FW-Graz-G-4 and 5).

Alternative B (modified) addresses uncharacteristic flooding by maintaining natural hydrographs through time and by promoting riparian forest composition and structure that would reduce the effects of flooding (FW-Rip-Strm-DC-4, FW-Rip-RipType-DC-2). For stream riparian areas, functional riparian areas and herbaceous vegetation provide protection from uncharacteristic wildfire and flooding disturbance, resiliency, and should filter sediment and protect water quality (FW-Rip-RipType-DC-2, 3, 4). This alternative also contains a guideline protects riparian resources by recommending against issuing a lands and recreation special use permit for activities proposed to occur within 200 feet of perennial streams, springs, or waters that contribute to or support sensitive resources, such as federally listed or Southwestern Region sensitive species (FW-SpecUse-G-3).

For Cottonwood Willow, Mixed Broadleaf Deciduous, and Montane Willow riparian forest types, this management effect rating is primarily because there are updated desired conditions and guidelines that support the composition, structure, and function of riparian forest types (FW-Rip-RipType-DC-1 to 6, FW-Rip-RipType-G-1 to 4). In addition, riparian functional condition would improve faster than alternative A, especially along the Verde River, Towel Creek, Spring Creek, and Dry Beaver Creek. Plan components manage for vegetation diversity and riparian function (FW-Rip-RipType-DC-1 and 2; FW-Water-G-2; FW-Rip-RipType-O-1). Plan components in the Wildlife, Fish and Plants section also contribute to the viability of species associated with riparian areas by promoting properly functioning ecosystems that have the necessary physical and biological components to meet the needs of associated native species (FW-WFP-DC-1 and 3).

This species has both a recovery plan and critical habitat designated on the forest, some of which is accessible to grazing and recreational impacts. Plan language for alternative B (modified) includes guidance for incorporating the recovery actions and conservation strategies for federally listed or candidate species including their critical habitats (FW-WFP-G-1 and 2).

Alternative C

Implementation of plan components under alternative C would have similar effects to alternative B (modified). Alternative C adds the Walker Mountain Recommended Wilderness Area, which includes 1,930 acres of the West Clear Creek watershed. This recommended wilderness area would include about 15 percent of the loach minnow habitat on the forest. Three other recommended wilderness areas would add three percent more of the watersheds occupied or with designated critical habitat for loach minnow. However, the Walker Mountain Recommended Wilderness Area overlaps with the Walker Mountain Inventoried Roadless Area. Inventoried roadless areas are managed to maintain the overall roadless character. Consequently, the Walker Mountain Inventoried Roadless Area already provides for beneficial watershed protections from sediment and bank compaction and erosion (USDA Forest Service 2013, Johnson and Spildie 2014). Accordingly, the Walker Mountain Recommended Wilderness Area would provide little added protections for loach minnow habitat compared to alternatives A or B (modified).

Alternative D

Implementation of alternative D would have similar effects to alternative B (modified) except that alternative D would designate only the Cottonwood Basin Geological Area (which contains no springs and smaller acreage than the Cottonwood Basin Geological and Botanical Area designated for alternatives B (modified) and C).

Alternative D recommends no new wilderness areas. The effects associated with managing the recommended areas under alternatives B (modified) and C as recommended wilderness would not occur. These areas would still be managed by the other forestwide, management area, and special area direction in alternative B (modified) with the corresponding effects discussed above in the alternative B (modified) section. Implementation would be the same as alternative A with regard to maintenance of existing wilderness.

Findings

Implementation of alternative B (modified) would contribute more to the viability of loach minnow than alternative A because of updated plan components for management of the different riparian forests, for invasive animal species and associated disease management, for updated language for water quality, and for language that addresses endemic species. Although alternative C would have the same effects as alternative B (modified), it would contribute slightly more to the viability of these species due to the additional protection provided in recommended wilderness in the watersheds for this species. Continued management under alternative A would contribute to the viability of this species (see coarse filter analysis and Forestwide Language), but less so than the other alternatives. Although it has language to maintain the viability of wildlife species, much of the plan language is outdated. For example, it lacks sufficient guidance for invasive animal species or disease; does not distinguish between the different riparian forest types; and lacks language that would protect endemic species or those with restricted distributions.

Razorback Sucker

Affected Environment

Distribution

The razorback sucker is currently present on the Coconino NF in the Cherry Creek-Verde River, Fossil Creek-Verde River, and Grindstone Wash-Verde River 5th HUC watersheds within Cottonwood Willow and Mixed Broadleaf Deciduous Riparian Forests (11.9 potential perennial stream miles). The species has been reintroduced into Fossil Creek (10.7 potential perennial stream miles). This species was once common throughout the Colorado River Basin, but now it exists sporadically in only about 750 miles of river in the upper basin. In the lower basin, a substantial population exists only in Lake Mohave with occasional individuals occurring both upstream in Lake Mead and the Grand Canyon and downstream in the Colorado River mainstem and associated impoundments (AZGFD 2002e). With the exception of reintroduced individuals in Fossil Creek, there is no evidence of razorback sucker inhabiting any tributaries on the forest, but it is speculated they may have occasionally used the lower reaches of the larger tributaries.

Habitat

Razorback sucker is associated with perennial streamcourses and Cottonwood Willow and Mixed Broadleaf Deciduous Riparian Forests. These habitats are more fully evaluated in the Coarse Filter: Habitat section. Razorback sucker use a variety of habitats within large rivers s in the Colorado River basin. During spring, adult suckers use deep runs, eddies, backwaters and flooded off-channel environments, shallow runs and pools often associated with submerged sandbars in summer, and low-velocity runs, eddies, and pools in winter (AZGFD 2002e). Spawning typically occurs at temperatures greater than 14 °C over bars of cobble, gravel, and sand substrates in rivers and over rocky shoals and shorelines in reservoirs. Nursery habitat typically occurs in quiet, warm, shallow water such as tributary mouths, backwaters, inundated floodplain habitats in rivers, and coves or shorelines of reservoirs (NatureServe 2015).

Critical Habitat

Critical habitat was designated in 1994, and includes portions of the Verde, Gila, and Salt Rivers (USDI Fish and Wildlife Service 1994). Designated critical habitat in the Verde River extends from Horseshoe Reservoir upstream to Sullivan Lake (USDI Fish and Wildlife Service 1994). Critical habitat on the Coconino NF is the section of the Verde River from Fossil Creek upstream to Perkinsville. The primary constituent elements of critical habitat for razorback sucker are:

- Perennial waters of appropriate quality, quantity, and following a normative hydrograph
- Suitable habitat for all life stages, including larger river channels, with bottomlands, side channels, and backwaters that provide larval rearing habitats.
- Suitable prey for all life stages with reduced influence from non-native predators or competitors.

Risk Factors

Threats to the species include: altered flow hydrology and cold tailwater releases from reservoirs, water diversion, and predation by and competition with non-native fishes (AZGFD 2002e). Coconino NF management activities that have contributed to habitat degradation include road construction and maintenance, timber management, fire suppression and subsequent stand-

replacing fires, stream diversion, and permitted livestock grazing. Management needs include: amelioration of effects of reservoirs and non-native fish species, and continued monitoring of populations.

Environmental Consequences

Table 69 summarizes the viability analysis for razorback sucker. This table was developed using the analysis process described under the Species Viability section above. It includes information on the status, F Rank, habitat, habitat condition and trend, likelihood that this species is limited by its habitat, and the projected management effect, by alternative. Management effect categorizes the relative expected outcome of plan language in each alternative in terms of minimizing species viability risk and are the result of plan decisions, including plan objectives. Management effect category values are 1, 2, 3, and 4. The lower the management effects rating for a species' associated habitat, the more effective the alternative is for that species viability. These topics and the effects of the alternatives are explained in greater detail in the discussions on the alternatives that follow.

Table 69. Analysis summary for razorback sucker

Species and status	Habitat	Alternative A		Alternatives B (modified), C, D	
		Habitat condition and trend relative to desired conditions	Likelihood species is limited	Habitat condition and trend relative to desired conditions	Likelihood species is limited
Razorback sucker (Endangered) F Rank = F2*	Perennial streams	Poor, static	H	Poor, toward	H
	CWRF	Fair, slowly toward	H	Good, slowly toward	M-H
	MBDRF	Good, static to slowly toward	M-H	Good, slowly toward	M-H
Management effect		Perennial streams = 4: Decline in habitat quality as a result of management or lack of management that result from plan components. Plan components may not exist or may be few. CWRF and MBDRF = 3: Plan components maintain or improve protection and management for some habitat occurrences in the plan area. Quality of habitat or habitat elements is maintained or improved by providing protection, maintenance, and restoration to some occurrences.		All habitats = 2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.	

*F2 = Rare on the forest within its habitat - occupies a small portion of its habitat.

Common to All Alternatives

Plan components in all alternatives contribute to species viability by managing for sustainable populations of native species and improving and protecting habitat for threatened, endangered, and sensitive species (1987 Plan, pages 22-1, 23, 64, 64-1, 66, 95, 108-2, 180, 187, 206-9, 206-

11, 206-12, 206-13, 206-23, 206-30, 206-32, 206-66, 206-67, 206-71, 206-72, 206-79, 206-87, 206-89, 206-98, 206-103, 206-105, 206-108, 206-109, 206-114; FW-WFP-DC-1, 2, 3, 4, 5, 6, 8, and FW-Eco-DC-1). See At-risk Species in the Wildlife and Plant Issues and Topics section above for more information.

Disease, competition, and predation through introductions of non-native species the greatest fine filter threats to razorback sucker. There is language under all alternatives that prioritizes habitat improvement and protections for projects for threatened and endangered species (1987 Plan, pages 23, 59, 64-6, and 87; FW-LndAdj-G-1; FW-Minerals-G-3; FW-RdsFac-G-7). Additionally, management applications under alternatives B (modified), C, and D provide recommendations to managers regarding approaches for successful implementation of plan components, such as prioritization of work to benefit threatened and endangered species (Management Approaches for Roads and Facilities, All Riparian Areas, Stream Ecosystems, and Watersheds and Water). Finally, all alternatives contain plan components provide for some guidance to manage introductions of non-native species (see Non-native or Invasive Species in the Wildlife and Plant Issues and Topics section); however, viability of native species is threatened on the forest when the focus is limited solely to introductions because most of the aquatic habitat on the forest already has undesirable non-native species.

The three 5th code watersheds (Cherry Creek-Verde River, Fossil Creek-Verde River, and Grindstone Wash-Verde River) have three wilderness areas and three inventoried roadless areas that are adjacent, providing protections for 32 percent of the watersheds. There is no mechanized or motorized use in wilderness and inventoried roadless areas are managed to maintain the overall roadless character. These three watersheds also have portions of five existing or eligible wild and scenic river areas, some with corresponding river management plans that provide for protections of remarkable values and limit motorized and recreational access. Consequently, management of these areas provides for beneficial watershed protections from sediment and bank compaction and erosion (USDA Forest Service 2013, Johnson and Spildie 2014).

Alternative A

Prior consultations under the Endangered Species Act

The Southwestern Region prepared a Biological Assessment for the Continued Implementation of Forest LRMPs across the region in 2004 (USDA Forest Service 2004d). The 2004 BA found that standards and guidelines within the Coconino NF LRMP were “not likely to adversely affect” both razorback sucker and its critical habitat. The Biological Opinion concurred with the finding for razorback suckers of “may affect, not likely to adversely affect” (USDI Fish and Wildlife Service 2005a).

The Coconino NF completed a Biological Assessment for implementation of the Travel Management Plan in 2010 and amended the assessment in 2011 (USDA Forest Service 2010d, 2011m). Implementation of the Travel Management Plan would close cross-country motorized travel across the forest, limiting vehicles to designated roadways (USDA Forest Service 2011g). The determination of effect for both razorback sucker and its critical habitat was “may affect but is not likely to adversely affect” based on the potential for reduced sedimentation into waterways. The Fish and Wildlife Service again concurred with the finding (USDI Fish and Wildlife Service 2011e, 2011f).

The Southwestern Region prepared another Biological Assessment for the Continued Implementation of Forest LRMPs across the region in 2011. The 2011 BA determination of effect

was a “may affect, not likely to adversely affect” finding for razorback sucker and “will not destroy or adversely modify” its critical habitat (USDA Forest Service 2011f). The 2012 Biological Opinion concurred with the finding (USDI Fish and Wildlife Service 2012d).

Since 2012, there have been no significant changes in the LMRP or significant scientific information to warrant a change in the finding.

Viability

Table 69 shows that under alternative A, perennial streams would remain in poor condition with a static trend in relation to desired conditions. This condition is generally due to most streams having invasive and non-native animal species that are outside of their historic variability.

Cottonwood Willow Riparian Forest would remain in fair condition and have a slow trend toward desired conditions. In Cottonwood Willow, some portions of the Verde River, Dry Beaver Creek, and Spring Creek, would be static due to high recreation or private land, such as the area around Childs, Spring Creek, Dry Beaver Creek, and private lands.

Mixed Broadleaf Deciduous Riparian Forest would remain in good condition. Static trends would be associated with the Oak Creek 5th code and West Clear Creek 5th code HUCs. The trend would be static or moving slowly toward desired conditions except in the Beaver Creek, West Clear Creek and Oak Creek 5th code HUCs and portions of Fossil Creek where recreation impacts are high. Areas of private land would remain static as well.

As shown in table 69, the likelihood that habitat on the forest would be a limiting factor for the razorback sucker is moderate-high to high depending on the habitat. These likelihoods were derived by combining the razorback sucker’s F Rank of F2 with the likelihood of habitat limitation variables for each ERU: perennial streams (high), Cottonwood Willow Riparian Forest (high), and Mixed Broadleaf Deciduous Riparian Forest (moderate) (table 9). Low to moderate ratings are considered to be within the natural range of fluctuations for the habitat.

The management effect row shows the relative expected outcome of plan language in terms of minimizing species viability risk. The management effect is classified as a 4 for perennial streams, which means there is a decline in habitat quality as a result of management or lack of management that result from plan components. Plan components may not exist or may be few. As described in the Coarse Filter: Habitat section, the threat of dispersed recreation to riparian resources is not addressed forestwide in alternative A. Special areas such as the Verde Wild and Scenic River and wilderness, and the management areas within Flagstaff/Lake Mary Ecosystem Area and the Sedona-Oak Creek Planning Area most specifically address the conflicts and strategies to resolve resource damage in riparian areas. This direction mainly addresses dispersed recreations impact to specific riparian areas where there have been past conflicts and resource damage, but it provides very limited direction when areas that previously received low use are “discovered” and see unexpected increases in recreation, such as Fossil Creek. As a result, alternative A addresses this threat sporadically compared with alternatives B (modified), C, and D, but it does mitigate some of the areas where the conflict is most pronounced.

The management effect is classified as a 3 for Cottonwood Willow and Mixed Broadleaf Deciduous Riparian Forests, which means that plan components in alternative A maintain or improve protection and management for some habitat occurrences in the plan area and thus contribute less to the viability of this species than the other alternatives. Alternative A would

maintain or improve riparian forests and associated streamcourses because it has a focus on improving riparian areas in any condition, preventing damage to riparian vegetation, stream banks, and channels, and restoring degraded riparian areas to good condition as soon as possible (1987 Plan, pages 65-2, 65-8, 172, and 206-8). Other protective language includes the following: Only beneficial new special uses are allowed in riparian areas and exceptions such as utility line or roads crossing stream courses are designed to minimize the extent and magnitude of impact to riparian (1987 Plan, page 177). Aggressive fire suppression may be used to prevent resource damage utilizing methods that minimize long-term adverse impacts to riparian habitats (1987 Plan, page 177). In addition, acquisition of riparian areas through land exchange is a high priority (1987 Plan, pages 177 and 185). The plan would manage commercial uses, and recreation in some areas, to protect riparian values (1987 Plan, pages 206-10, 22, 26, and 39). This alternative has less potential for improvement to riparian condition compared to the other alternatives because plan language for specific riparian forest types is lacking and there is not a focus on functioning-at-risk and non-functional riparian areas (USDA Forest Service 2016b).

Alternative A provides some guidance to reduce introductions of non-native species (primarily focused on plant species, 1987 Plan, page 206-72), but this language is insufficient in scope to maintain species viability on the forest. Currently, some watershed protections are afforded by the implementation of broad standards, such as complying with Arizona water quality standards that would minimize impacts to razorback sucker (1987 Plan, pages 23 and 74). However, several key management concerns are not currently addressed.

However, alternative A maintains most of the acreage currently designated as motorized use with the Cherry Creek-Verde River and Grindstone Wash-Verde River watersheds and could, therefore, have watershed impacts associated with both increased recreational access and roads that increase sediments, compact soils, and damage vegetation. This impact is likely small relative to the normative hydrology and water quantity threats that lie outside of Forest jurisdiction for these large river species.

Alternative B (modified)

Consultation under the Endangered Species Act

A Biological Assessment for the revision of Coconino NF Land Management Plan was prepared in 2017 (USDA Forest Service 2017c). The determination of effect for razorback sucker was “may affect, not likely to adversely affect” due to insignificant effects from forest management activities to water quality and stream habitat they may inhabit. The forest also concluded that the LRMP “may affect, is not likely to adversely affect” critical habitat for razorback sucker. The Fish and Wildlife Service concurred with both findings in their draft Biological and Conference Opinion received on August 8, 2017 (USDI Fish and Wildlife Service 2017b).

Viability

Table 69 shows that under alternative B (modified) perennial streams would remain in poor condition, but the trend would be toward desired conditions because of updated plan components (see management effect discussion below).

Cottonwood Willow Riparian Forest would improve to good condition and trend slowly toward desired conditions except portions of the Verde River would improve faster (i.e., have a trend toward desired conditions).

Mixed Broadleaf Deciduous Riparian Forest would remain in good condition and slowly move toward desired conditions except portions of Fossil Creek and Wet Beaver Creek would remain static in areas of high recreation use. It would improve faster than alternative A in the Beaver Creek, Oak Creek, West Clear Creek, and Fossil Creek 5th code HUCs.

As shown in table 69, the likelihood that habitat on the forest would be a limiting factor for the razorback sucker is moderate-high to high depending on the habitat. These likelihoods were derived by combining the razorback sucker's F Rank of F2 with the likelihood of habitat limitation variables for each ERU: perennial streams (high), Cottonwood Willow Riparian Forest (moderate), and Mixed Broadleaf Deciduous Riparian Forest (moderate) (table 9). Low to moderate ratings are considered to be within the natural range of fluctuations for the habitat.

The management effect row shows the relative expected outcome of plan language in terms of minimizing species viability risk. The management effect is classified as a 2 for all the coarse filter habitats associated with the razorback sucker. This means that plan components in alternative B (modified) maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area. For perennial streams, this rating is based on a broad array of plan language. Desired conditions under alternative B (modified) support and trend to improved stream ecosystem function (FW-Water-DC-2 and 3) and collaborative efforts to maintain stream flow (FW-Water-DC-5 and 6; FW-Rip-Strm-DC-4) and reduce or eliminate the impacts of invasive species (FW-Invas-DC-1). Implementation of plan components under alterative B (modified) would likely move large perennial stream habitats more rapidly toward desired conditions (USDA Forest Service 2016j).

Other plan language is designed to mitigate the effects of roads and promote connectivity within drainages and between streamcourses and upland habitats (FW-RdsFac-G-2, 5, 7 and 9 and the Connectivity topic in the Wildlife and Plants Topics and Issues section). Although there are three recommended wildernesses, only the Davey's recommended wilderness area connects to perennial water, Fossil Creek. Guidelines for recommended wilderness would lessen the effects of roads by restricting motorized use except for limited permitted and administrative use and promoting trails for mechanized and non-motorized use (SA-RWild-G-3, 5). This is beneficial for connected waters and habitat for these species because roads can alter natural water flow patterns and natural sediment levels.

More site-specific aquatic management zone guidelines protect riparian function and water quality (FW-Rip-All-G-3; Fw-Rip-Strm-G-2). Also, alternative B (modified) has a guideline that balances recreation activities, permitted uses, and management activities with soil function, riparian vegetation, and water quality at the stream reach scale (FW-Rip-RipType-G-3). This guideline would not apply to fine-scale activities and facilities such as intermittent livestock crossing locations, water gaps, or other infrastructure used to manage impacts to riparian areas at a larger scale. This guideline is intended to protect riparian function, especially in areas of high recreation use such as Oak Creek, Beaver Creek, and Fossil Creek.

Alternative B (modified) has desired conditions that protect riparian resources including soil conditions and water quality while recognizing the demand for and need to properly manage the public's dispersed recreation opportunities. A forestwide desired condition for dispersed recreation supports managing dispersed recreation to avoid resource damage (FW-Rec-Disp-DC-3). Several guidelines about dispersed recreation would manage trails, camping, and recreation types to prevent further resource damage to riparian resources (FW-Rec-Disp-G-1 to 5).

Plan components in alternative B (modified) specify that livestock grazing maintains desired conditions of plant communities (FW-Graz-DC-2; FW-Graz-G-2). They also protect and minimize impacts to riparian areas by recommending that livestock use be restricted to the dormant season, recommending utilization levels on woody vegetation, maintenance of adequate vegetative cover to protect streambanks, and state that riparian areas are rarely negatively impacted by livestock (FW-Graz-G-7). This would maintain riparian structure and composition, and promote proper functioning. Guidelines are in place to reduce cattle concentrations and sedimentation into connected waters by specifying that range improvements should not interfere with riparian function and rare species, and further specifies a minimum distance of salts and supplements from riparian areas (FW-Graz-G-4 and 5).

Alternative B (modified) addresses uncharacteristic flooding by maintaining natural hydrographs through time and by promoting riparian forest composition and structure that would reduce the effects of flooding (FW-Rip-Strm-DC-4, FW-Rip-RipType-DC-2). For stream riparian areas, functional riparian areas and herbaceous vegetation provide protection from uncharacteristic wildfire and flooding disturbance, resiliency, and should filter sediment and protect water quality (FW-Rip-RipType-DC-2, 3, 4). This alternative also contains a guideline protects riparian resources by recommending against issuing a lands and recreation special use permit for activities proposed to occur within 200 feet of perennial streams, springs, or waters that contribute to or support sensitive resources, such as federally listed or Southwestern Region sensitive species (FW-SpecUse-G-3).

For Cottonwood Willow and Mixed Broadleaf Deciduous Riparian Forests, this management effect rating is primarily because there are updated desired conditions and guidelines that support the composition, structure, and function of riparian forest types (FW-Rip-RipType-DC-1 to 6, FW-Rip-RipType-G-1 to 4). In addition, riparian functional condition would improve faster than alternative A, especially along the Verde River, Towel Creek, Spring Creek, and Dry Beaver Creek. Plan components manage for vegetation diversity and riparian function (FW-Rip-RipType-DC-1 and 2; FW-Water-G-2; FW-Rip-RipType-O-1). Plan components in the Wildlife, Fish and Plants section also contribute to the viability of species associated with riparian areas by promoting properly functioning ecosystems that have the necessary physical and biological components to meet the needs of associated native species (FW-WFP-DC-1 and 3).

This species has both a recovery plan and critical habitat designated on the forest, some of which is accessible to grazing and recreational impacts. Plan language for alternative B (modified) includes guidance for incorporating the recovery actions and conservation strategies for federally listed or candidate species including their critical habitats (FW-WFP-G-1 and 2).

Finally, alternative B (modified) add the Davey's recommended wilderness area in the Fossil Creek-Lower Verde River watershed (1,779 acres). Recommended wilderness areas are managed to maintain or enhance the primitive and undeveloped characteristics of the area (SA-RWild-DC-1).With this recommended wilderness area, special protections would increase cover 33 percent of the occupied watersheds for razorback sucker. Given the added recommended wilderness area protections, the comprehensive river management plan being developed for the Fossil Creek Wild and Scenic River, increasing emphasis and comprehensive guidance for invasive species, and comprehensive guidance for protection of federally listed species, implementation of plan components under alternative B (modified) will maintain viability on the forest.

Alternative C

Implementation of plan components under alternative C would have similar effects to alternative B (modified) except alternative C adds four recommended wilderness areas in the Fossil Creek-Verde River watershed, increasing protected special areas to 67 percent of potentially occupied watersheds.

Alternative D

Implementation of alternative D would have similar effects to alternative B (modified) except that alternative D would designate only the Cottonwood Basin Geological Area (which contains no springs and smaller acreage than the Cottonwood Basin Geological and Botanical Area designated for alternatives B (modified) and C).

Alternative D recommends no new wilderness areas. The effects associated with managing the recommended areas under alternatives B (modified) and C as recommended wilderness would not occur. These areas would still be managed by the other forestwide, management area, and special area direction in alternative B (modified) with the corresponding effects discussed above in the alternative B (modified) section. Implementation would be the same as alternative A with regard to maintenance of existing wilderness. These small changes would not change the conditions and trends in aquatic habitats from those provided by alternatives B (modified) and C for this species.

Findings

Implementation of alternative B (modified) would contribute more to the viability of razorback sucker than alternative A because of updated plan components for management of the different riparian forests, for invasive animal species and associated disease management, for updated language for water quality, and for language that addresses endemic species. Although alternative C would have the same effects as alternative B (modified), it would contribute slightly more to the viability of these species due to the additional protection provided in recommended wilderness in the watersheds for this species. Continued management under alternative A would contribute to the viability of this species (see coarse filter analysis and Forestwide Language) but less so than the other alternatives. Although it has language to maintain the viability of wildlife species, much of the plan language is outdated. For example, it lacks sufficient guidance for invasive animal species or disease; does not distinguish between the different riparian forest types; and lacks language that would protect endemic species or those with restricted distributions.

Spikedace

Affected Environment

Distribution

Historically, the spikedace was common and locally abundant throughout the upper Gila River Basin of Arizona and New Mexico. Its distribution was widespread in large and moderate-sized rivers and streams in Arizona, including the Gila, Salt, and Verde Rivers and their major tributaries. It was present in the Beaver Creek, Cherry Creek-Verde River, Fossil Creek-Verde River, Grindstone Wash-Verde River, Oak Creek, Sycamore Creek and West Clear Creek 5th HUC watersheds (73.2 potential perennial stream miles). Spikedace now occurs in only Fossil Creek, as a result of recent repatriation efforts.

Habitat

Spikedace and its critical habitat are currently found in perennial streams within all Cottonwood Willow and Mixed Broadleaf Deciduous riparian forests. These habitats are more fully evaluated in the Coarse Filter: Habitat section. Spikedace occupy mid-elevation medium-sized perennial stream habitats usually less than 1 meter deep, with slow to moderate water velocities over sand, gravel, or cobble substrates. Adults often aggregate in shear zones along gravel-sand bars where rapid water borders slower flow, quiet eddies on the downstream edges of riffles, and broad shallow areas above gravel-sand bars. In winter, the species congregates along stream margins with cobble substrates. The erratic flow patterns of southwestern streams that include periodic spates and recurrent flooding are essential to the feeding and reproduction of the spikedace by scouring the sands and keeping gravels clean. Spikedace larvae and juveniles tend to occupy shallow, peripheral portions of streams that have slow currents and sand or fine gravel substrates, but will also occupy backwater habitats. The young typically occupy stream margin habitats, where the water velocity is less than 0.16 foot per second (5 centimeters per second) and the depth is less than 1.96 inches (5 centimeters). Spawning extends from mid-March into June and occurs in shallow (less than 15 centimeters [5.9 inches] deep) riffles with gravel and sand bottoms and moderate flow. By mid-May, most spawning has occurred, although in years of high water flows, spawning may continue into late May or early June. Spikedace feed primarily on aquatic and terrestrial insects (AZGFD 2013b, USDI Fish and Wildlife Service 2012c).

Critical Habitat

Critical habitat designated on the forest includes perennial reaches of the Verde River from Fossil Creek confluence upstream, Granite Creek, Oak Creek, Beaver Creek, West Clear Creek, and Fossil Creek (USDI Fish and Wildlife Service 2012c). The primary constituent elements of critical habitat for spikedace are:

- Suitable perennial flow habitat for all life stages, including variable stream flows, glides, runs, riffles, the margins of pools and eddies, and backwater components over sand, gravel, and cobble substrates with low or moderate amounts of fine sediment and substrate embeddedness.
- Suitable and abundant aquatic macroinvertebrate prey
- Streams with no or no more than low levels of pollutants
- Perennial waters of appropriate quality, quantity, connectivity.
- Reduced or eliminated impacts from non-native predators or competitors.
- Perennial flows following a normative hydrograph

Risk Factors

Threats to the species include: stream flow depletion, diversion, habitat alteration and competition with non-native crayfishes, and predation by and competition with non-native fishes, especially red shiner (*Cyprinella lutrensis*). Coconino NF management activities that have contributed to habitat degradation include road construction and maintenance, timber management, fire suppression and subsequent stand-replacing fires, stream diversion, and permitted livestock grazing. Management needs include: conservation, protection, and monitoring of existing populations, amelioration of impacts from non-native predatory and competitor species, enhancement or restore select habitats within its historical range, and further reintroduce into select historical habitats (AZGFD 2013b).

Environmental Consequences

Table 70 summarizes the viability analysis for spikedace. This table was developed using the analysis process described under the Species Viability section above. It includes information on the status, F Rank, habitat, habitat condition and trend, likelihood that this species is limited by its habitat, and the projected management effect, by alternative. Management effect categorizes the relative expected outcome of plan language in each alternative in terms of minimizing species viability risk and are the result of plan decisions, including plan objectives. Management effect category values are 1, 2, 3, and 4. The lower the management effects rating for a species' associated habitat, the more effective the alternative is for that species viability. These topics and the effects of the alternatives are explained in greater detail in the discussions on the alternatives that follow.

Table 70. Analysis summary for spikedace

Species and status	Habitat	Alternative A		Alternatives B (modified), C, D	
		Habitat condition and trend relative to desired conditions	Likelihood species is limited	Habitat condition and trend relative to desired conditions	Likelihood species is limited
Spikedace (Endangered) F Rank = F1*	Perennial streams	Poor, static	VH	Poor, toward	VH
	CWRF	Fair, slowly toward	VH	Good, slowly toward	H
	MBDRF	Good, static to slowly toward	H	Good, slowly toward	H
Management effect		Perennial streams = 4: Decline in habitat quality as a result of management or lack of management that result from plan components. Plan components may not exist or may be few. CWRF and MBDRF = 3: Plan components maintain or improve protection and management for some habitat occurrences in the plan area. Quality of habitat or habitat elements is maintained or improved by providing protection, maintenance, and restoration to some occurrences.		All habitats = 2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.	

*F1 = Very rare on the forest within its habitat – occupies a very small portion of its habitat.

Common to All Alternatives

Plan components in all alternatives contribute to species viability by managing for sustainable populations of native species and improving and protecting habitat for threatened, endangered, and sensitive species (1987 Plan, pages 22-1, 23, 64, 64-1, 66, 95, 108-2, 180, 187, 206-9, 206-11, 206-12, 206-13, 206-23, 206-30, 206-32, 206-66, 206-67, 206-71, 206-72, 206-79, 206-87, 206-89, 206-98, 206-103, 206-105, 206-108, 206-109, 206-114; FW-WFP-DC-1, 2, 3, 4, 5, 6, 8, and FW-Eco-DC-1). See At-risk Species in the Wildlife and Plant Issues and Topics section above for more information.

Disease, competition, and predation through introductions of non-native species are the greatest fine filter threats to spikedace. There is language under all alternatives that prioritizes habitat improvement and protections for projects for threatened and endangered species (1987 Plan, pages 23, 59, 64-6, and 87; FW-LndAdj-G-1; FW-Minerals-G-3; FW-RdsFac-G-7). Additionally, management applications under alternatives B (modified), C, and D provide recommendations to managers regarding approaches for successful implementation of plan components, such as prioritization of work to benefit threatened and endangered species (Management Approaches for Roads and Facilities, All Riparian Areas, Stream Ecosystems, and Watersheds and Water). Finally, all alternatives contain plan components provide for some guidance to manage introductions of non-native species (see Non-native or Invasive Species in the Wildlife and Plant Issues and Topics section); however, viability of native species is threatened on the forest when the focus is limited solely to introductions because most of the aquatic habitat on the forest already has undesirable non-native species.

Restoration activities are foreseeable under all alternatives and may have short-term negative impacts to spikedace habitat. But increased motorized access in Oak and Beaver Creeks may continue to cause adverse impacts from loss of streamside vegetation, compaction of soils, and increased sedimentation within the highly accessible areas. Vegetation treatments in Ponderosa Pine and Pinyon Juniper ERUs in the Upper and Lower Verde and West Clear Creek watersheds may cause short-term increases in the amount of sediment that enters these drainages. The rate and scope of future treatments is unknown. However, restoration activities are designed to improve habitats to be resilient to changes in stream flow and fire regimes associated with climate change that will allow for long-term species persistence and viability on the forest.

One existing wilderness area provides some watershed protections (1 percent) within the following two 5th code HUCs: the Cherry Creek-Verde River and Grindstone Wash-Verde River watersheds. Currently, 16 percent of the 6 watersheds occupied or designated critical habitat for spikedace lie within inventoried roadless area or wilderness protections. There is no mechanized or motorized use in wilderness and inventoried roadless areas are managed to maintain the overall roadless character. Consequently, management of these areas provides for beneficial watershed protections from sediment and bank compaction and erosion (USDA Forest Service 2013, Johnson and Spildie 2014).

The Fossil Creek Wild and Scenic River Comprehensive River Management Plan (CRMP) is being developed concurrently with this forest plan revision effort. The CRMP will provide detailed direction, implementation actions, and monitoring to protect or enhance outstandingly remarkable values of the Wild and Scenic River. The proposed action is designed to include the most flexibility to increase capacity and recreation infrastructure—maximizing recreation opportunities in the future—while providing protection for sensitive river and tribal values at the same time through both a management plan and site-specific actions. Project actions would address recreation capacity, corridor access, recreation facilities, services, and public health and safety. Even if an alternative to the proposed action is selected, it is likely to include managing recreation to prevent resource damage in the river corridor. Management actions under the CRMP would contribute positively to species associated with Fossil Creek, including spikedace.

Alternative A

Prior consultations under the Endangered Species Act

The Southwestern Region prepared a Biological Assessment for the Continued Implementation of Forest LRMPs across the region in 2004 (USDA Forest Service 2004d). The 2004 BA found that standards and guidelines within the Coconino NF LRMP were "likely to adversely affect" both spikedace and its critical habitat. The Biological Opinion determined that the region's LRMPs (including the Coconino NF) were not likely to jeopardize the continued existence of the spikedace (USDI Fish and Wildlife Service 2005a).

The Coconino NF completed a Biological Assessment for implementation of the Travel Management Plan in 2010 and amended the assessment in 2011 (USDA Forest Service 2010d, 2011m). Implementation of the Travel Management Plan would close cross-country motorized travel across the forest, limiting vehicles to designated roadways (USDA Forest Service 2011gt likely to adversely affect" based on the potential for reduced sedimentation into waterways. The Fish and Wildlife Service again concurred with the finding (USDI Fish and Wildlife Service 2011e, 2011f).

The Southwestern Region prepared another Biological Assessment for the Continued Implementation of Forest LRMPs across the region in 2011. The 2011 BA determination of effect was a "likely to jeopardize" finding for spikedace and its habitat due to variety of habitat impacts, including impacts from grazing and fire (USDA Forest Service 2011f). The 2012 Biological Opinion of the Fish and Wildlife Service concluded that after reviewing the anticipated impacts of standards and guidelines in the Coconino NF LRMP, the forest action would "not jeopardize the continued existence of the spikedace nor destroy or adversely modify proposed CH" (USDI Fish and Wildlife Service 2012d).

Since 2012, there have been no significant changes in the LRMP or significant scientific information to warrant a change in the finding.

Viability

Table 70 shows that under alternative A, perennial streams would remain in poor condition with a static trend in relation to desired conditions. This condition is generally due to most streams having invasive and non-native animal species that are outside of their historic variability.

Cottonwood Willow Riparian Forest would remain in fair condition and have a slow trend toward desired conditions. In Cottonwood Willow, some portions of the Verde River, Dry Beaver Creek, and Spring Creek, would be static due to high recreation or private land, such as the area around Childs, Spring Creek, Dry Beaver Creek, and private lands.

Mixed Broadleaf Deciduous Riparian Forest would remain in good condition. Static trends would be associated with the Oak Creek 5th code and West Clear Creek 5th code HUCs. The trend would be static or moving slowly toward desired conditions except in the Beaver Creek, West Clear Creek and Oak Creek 5th code HUCs and portions of Fossil Creek where recreation impacts are high. Areas of private land would remain static as well.

As shown in table 70, the likelihood that habitat on the forest would be a limiting factor for spikedace is high to very high depending on the habitat. These likelihoods were derived by combining the spikedace's F Rank of F1 with the likelihood of habitat limitation variables for each ERU: perennial streams (high), Cottonwood Willow Riparian Forest (high), and Mixed Broadleaf Deciduous Riparian Forest (moderate) (table 9). Low to moderate ratings are considered to be within the natural range of fluctuations for the habitat.

The management effect row shows the relative expected outcome of plan language in terms of minimizing species viability risk. The management effect is classified as a 4 for perennial streams, which means there is a decline in habitat quality as a result of management or lack of management that result from plan components. Plan components may not exist or may be few. As described in the Coarse Filter: Habitat section, the threat of dispersed recreation to riparian resources is not addressed forestwide in alternative A. Special areas such as the Verde Wild and Scenic River and wilderness, and the management areas within Flagstaff/Lake Mary Ecosystem Area and the Sedona-Oak Creek Planning Area most specifically address the conflicts and strategies to resolve resource damage in riparian areas. This direction mainly addresses dispersed recreations impact to specific riparian areas where there have been past conflicts and resource damage, but it provides very limited direction when areas that previously received low use are "discovered" and see unexpected increases in recreation, such as Fossil Creek. As a result, alternative A addresses this threat sporadically compared with alternatives B (modified), C, and D, but it does mitigate some of the areas where the conflict is most pronounced.

The management effect is classified as a 3 for Cottonwood Willow and Mixed Broadleaf Deciduous Riparian Forests, which means that plan components in alternative A maintain or improve protection and management for some habitat occurrences in the plan area, and thus, contribute less to the viability of this species than the other alternatives. Alternative A would maintain or improve riparian forests and associated streamcourses because it has a focus on improving riparian areas in any condition, preventing damage to riparian vegetation, stream banks, and channels, and restoring degraded riparian areas to good condition as soon as possible (1987 Plan, pages 65-2, 65-8, 172, and 206-8). Other protective language includes the following: Only beneficial new special uses are allowed in riparian areas and exceptions such as utility line or roads crossing stream courses are designed to minimize the extent and magnitude of impact to riparian (1987 Plan, page 177). Aggressive fire suppression may be used to prevent resource damage utilizing methods that minimize long-term adverse impacts to riparian habitats (1987 Plan, page 177). In addition, acquisition of riparian areas through land exchange is a high priority (1987 Plan, pages 177 and 185). The plan would manage commercial uses, and recreation in some areas, to protect riparian values (1987 Plan, pages 206-10, 22, 26, and 39). This alternative has less potential for improvement to riparian condition compared to the other alternatives because plan language for specific riparian forest types is lacking and there is not a focus on functioning-at-risk and non-functional riparian areas (USDA Forest Service 2016b).

Alternative A provides some guidance to reduce introductions of non-native species (primarily focused on plant species, 1987 Plan, page 206-72), but this language is insufficient in scope to maintain viability of spikedace on the forest. Currently, some wilderness protections are afforded by the implementation of broad standards, such as complying with Arizona water quality standards that would minimize affects to spikedace (1987 Plan, pages 23 and 74, including maintaining at least 80 percent of spawning gravels free of inorganic sediment).

Alternative A provides some guidance to reduce introductions of non-native species (primarily focused on plant species, 1987 Plan, page 206-72), but this language is insufficient in scope to maintain viability of spikedace on the forest. Currently, some wilderness protections are afforded by the implementation of broad standards, such as complying with Arizona water quality standards that would minimize effects to spikedace (1987 Plan, pages 23 and 74, including maintaining at least 80 percent of spawning gravels free of inorganic sediment). However, several key management concerns are not currently addressed. Alternative A maintains much of the acreage currently designated as motorized use with the Cherry Creek-Verde River and Grindstone

Wash-Verde River watersheds and could therefore have watershed impacts associated with both increased recreational access and roads that increase sediments, compact soils, and damage vegetation. Spikedace are sensitive to increased sediments and embeddedness in streams, so these conditions will have adverse effects and will further adversely impact viability of Spikedace on the forest. Additionally, under alternative A, the Oak and Beaver Creek watersheds, of which the Cottonwood Willow Riparian Forest is highly departed in accessible areas, has the greatest acreages reserved for motorized vehicle access that contributes to adverse conditions in watersheds (USDA Forest Service 2016b).

Alternative B (modified)

<u>Consultation under the Endangered Species Act</u>

A Biological Assessment for the revision of Coconino NF Land Management Plan was prepared in 2017 (USDA Forest Service 2017c). The determination of effect for spikedace was “may affect, not likely to adversely affect” because “the implementation of plan components are expected to have insignificant effects to spikedace in occupied portions of Fossil Creek and Spring Creek due to livestock exclosures in those areas and a low percentage of the watersheds containing ERU types such as ponderosa that are a high priority for management actions.” The forest concluded that the LRMP “may affect, is likely to adversely affect” critical habitat for spikedace because of “potential short-term effects due to projects that affect riparian vegetation or increase sediment delivery in the short or long term to streams containing Spikedace Critical Habitat.” The Fish and Wildlife Service concurred with the finding for spikedace and determined that implementation of the Coconino NF’s revised LRMP…will not destroy or adversely modify…spikedace designated critical habitats in their draft Biological and Conference Opinion received on August 8, 2017 (USDI Fish and Wildlife Service 2017b). No incidental take was assigned. The Fish and Wildlife Service provided four discretionary conservation recommendations intended to minimize or avoid adverse effects, help implement recovery plans, or develop information.

<u>Viability</u>

Table 70 shows that under alternative B (modified) perennial streams would remain in poor condition, but the trend would be toward desired conditions because of updated plan components (see management effect discussion below).

Cottonwood Willow Riparian Forest would improve to good condition and trend slowly toward desired conditions except portions of the Verde River, Towel Creek, Spring Creek and Dry Beaver Creek would improve faster (i.e., have a trend toward desired conditions).

Mixed Broadleaf Deciduous Riparian Forest would remain in good condition and slowly move toward desired conditions except portions of Fossil Creek and Wet Beaver Creek would remain static in areas of high recreation use. It would improve faster than alternative A in the Beaver Creek, Oak Creek, West Clear Creek, and Fossil Creek 5th code HUCs.

As shown in table 70, the likelihood that habitat on the forest would be a limiting factor for spikedace is high to very high depending on the habitat. These likelihoods were derived by combining spikedace’s F Rank of F1 with the likelihood of habitat limitation variables for each ERU: perennial streams (high), Cottonwood Willow Riparian Forest (moderate), and Mixed Broadleaf Deciduous Riparian Forest (moderate) (table 9). Low to moderate ratings are considered to be within the natural range of fluctuations for the habitat.

The management effect row shows the relative expected outcome of plan language in terms of minimizing species viability risk. The management effect is classified as a 2 for all the coarse filter habitats associated with spikedace. This means that plan components in alternative B (modified) maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area. For perennial streams, this rating is based on a broad array of plan language. Desired conditions under alternative B (modified) support and trend to improved stream ecosystem function (FW-Water-DC-2 and 3) and collaborative efforts to maintain stream flow (FW-Water-DC-5 and 6; FW-Rip-Strm-DC-4) and reduce or eliminate the impacts of invasive species (FW-Invas-DC-1). Implementation of plan components under alterative B (modified) would likely move large perennial stream habitats more rapidly toward desired conditions (USDA Forest Service 2016j).

Other plan language is designed to mitigate the effects of roads and promoting connectivity within drainages and between streamcourses and upland habitats, (See FW-RdsFac-G-2, 5, 7 and 9 and the Connectivity topic in the Wildlife and Plants Topics and Issues section). Although there are three recommended wildernesses, only the Davey's Recommended Wilderness Area connects to perennial water, Fossil Creek. The Davey's Recommended Wilderness Area adds 1,779 acres of protected habitats to Fossil Creek-Verde river watershed, or 17 percent total of occupied watersheds. Guidelines for recommended wilderness would lessen the effects of roads by restricting motorized use except for limited permitted and administrative use and promoting trails for mechanized and non-motorized use (SA-RWild-G-3, 5). This is beneficial for connected waters and habitat for these species because roads can alter natural water flow patterns and natural sediment levels.

More site-specific aquatic management zone guidelines protect riparian function and water quality (FW-Rip-All-G-3; Fw-Rip-Strm-G-2). Also, alternative B (modified) has a guideline that balances recreation activities, permitted uses, and management activities with soil function, riparian vegetation, and water quality at the stream reach scale (FW-Rip-RipType-G-3). This guideline would not apply to fine scale activities and facilities such as intermittent livestock crossing locations, water gaps, or other infrastructure used to manage impacts to riparian areas at a larger scale. This guideline is intended to protect riparian function, especially in areas of high recreation use such as Oak Creek, Beaver Creek, and Fossil Creek.

Alternative B (modified) has desired conditions that protect riparian resources including soil conditions and water quality while recognizing the demand for and need to properly manage the public's dispersed recreation opportunities. A forestwide desired condition for dispersed recreation supports managing dispersed recreation to avoid resource damage (FW-Rec-Disp-DC-3) Several guidelines about dispersed recreation would manage trails, camping, and recreation types to prevent further resource damage to riparian resources (FW-Rec-Disp-G-1 to 5).

Plan components in alternative B (modified) specify that livestock grazing maintains desired conditions of plant communities (FW-Graz-DC-2; FW-Graz-G-2). They also protect and minimize impacts to riparian areas by recommending that livestock use be restricted to the dormant season, recommending utilization levels on woody vegetation, maintenance of adequate vegetative cover to protect streambanks, and state that riparian areas are rarely negatively impacted by livestock (FW-Graz-G-7). This would maintain riparian structure, composition, and promote proper functioning. Guidelines are in place to reduce cattle concentrations and sedimentation into connected waters by specifying that range improvements should not interfere

with riparian function and rare species, and further specifies a minimum distance of salts and supplements from riparian areas (FW-Graz-G-4 and 5).

Alternative B (modified) addresses uncharacteristic flooding by maintaining natural hydrographs through time and by promoting riparian forest composition and structure that would reduce the effects of flooding (FW-Rip-Strm-DC-4, FW-Rip-RipType-DC-2). For stream riparian areas, functional riparian areas and herbaceous vegetation provide protection from uncharacteristic wildfire and flooding disturbance, resiliency, and should filter sediment and protect water quality (FW-Rip-RipType-DC-2, 3, 4). This alternative also contains a guideline protects riparian resources by recommending against issuing a lands and recreation special-use permit for activities proposed to occur within 200 feet of perennial streams, springs, or waters that contribute to or support sensitive resources, such as federally listed or Southwestern Region sensitive species (FW-SpecUse-G-3).

For Cottonwood Willow and Mixed Broadleaf Deciduous Riparian Forests, this rating is primarily because there are updated desired conditions and guidelines that support the composition, structure, and function of riparian forest types (FW-Rip-RipType-DC-1 to 6, FW-Rip-RipType-G-1 to 4). In addition, riparian functional condition would improve faster than alternative A, especially along the Verde River, Towel Creek, Spring Creek, and Dry Beaver Creek. Plan components manage for vegetation diversity and riparian function (FW-Rip-RipType-DC-1 and 2; FW-Water-G-2; FW-Rip-RipType-O-1). Plan components in the Wildlife, Fish and Plants section also contribute to the viability of species associated with riparian areas by promoting properly functioning ecosystems that have the necessary physical and biological components to meet the needs of associated native species (FW-WFP-DC-1 and 3).

This species has both a recovery plan and critical habitat designated on the forest, some of which is accessible to grazing and recreational impacts. Plan language for alternative B (modified) includes guidance for incorporating the recovery actions and conservation strategies for federally listed or candidate species including their critical habitats (FW-WFP-G-1 and 2).

Alternative C

Implementation of plan components under alternative C would have similar effects to alternative B (modified) except that alternative C provides recommendations for five new recommended wilderness areas. These recommended wilderness areas would protect 20 percent of the total watersheds occupied or with designated critical habitat for spikedace. However, some of the protections afforded by wilderness areas also exclude motorized access needed for fire and invasive species treatments (i.e., stream barrier installations) that may reduce the forest’s ability to manage these areas and assist with recovery actions.

Alternative D

Implementation of alternative D would have similar effects to alternative B (modified) except that alternative D would designate only the Cottonwood Basin Geological Area (which contains no springs and smaller acreage than the Cottonwood Basin Geological and Botanical Area designated for alternatives B (modified) and C).

Alternative D recommends no new wilderness areas.

Alternative D recommends no new wilderness areas. The effects associated with managing the recommended areas under alternatives B (modified) and C as recommended wilderness would not

occur. These areas would still be managed by the other forestwide, management area, and special area direction in alternative B (modified) with the corresponding effects discussed above in the alternative B (modified) section. Implementation would be the same as alternative A with regard to maintenance of existing wilderness. These small changes will not change the conditions and trends in aquatic habitats from those provided by alternatives B (modified) and C for this species.

Findings

Implementation of alternative B (modified) would contribute more to the viability of spikedace than alternative A because of updated plan components for management of the different riparian forests, for invasive animal species and associated disease management, for updated language for water quality, and for language that addresses endemic species. Although alternative C would have the same effects as alternative B (modified), it would contribute slightly more to the viability of these species due to the additional protection provided in recommended wilderness in the watersheds for this species. Continued management under alternative A would contribute to the viability of this species (see coarse filter analysis and Forestwide Language), but less so than the other alternatives. Although it has language to maintain the viability of wildlife species, much of the plan language is outdated. For example, it lacks sufficient guidance for invasive animal species or disease; does not distinguish between the different riparian forests; and lacks language that would protect endemic species or those with restricted distributions.

Threatened and Endangered: Mammals

Black-footed Ferret

The black-footed ferret was listed as Endangered in on March 11, 1967 without critical habitat (32 Federal Register 4001). Experimental nonessential populations were designated on March 20, 1996 (61 Federal Register 11320).

Affected Environment

Distribution

Historically, black-footed ferrets were found in western Coconino County eastward north of the Mogollon Rim in the range of the Gunnison’s prairie dog, and it possibly ranged south of the Rim in the habitat of the black-tailed prairie dog in Graham, Apache, and Cochise Counties (AZGFD 2001).

Habitat

Black-footed ferret habitat is the same grassland habitat used by prairie dogs (Great Basin Grasslands, Montane/Subalpine Grasslands, and Pinyon Juniper with Grass ERUs). They are nearly always associated with prairie dogs, and live in prairie dog towns and raise their young in the prairie dog burrows (AZGFD 2001).

Risk Factors

The black-footed ferret was extirpated from virtually all of its range because of prairie dogs and predator control programs. Prairie dogs were poisoned relentlessly in the 1930s. Since that time, the prairie dog has been able to reestablish itself in areas poisoned decades ago. It is now locally common in areas like the Coconino Plateau. The ferret evidently was not able to survive this “bottleneck’ in prairie dog numbers (Belitsky 1993 in AZGFD 2001)

Environmental Consequences

Common to All Alternatives

Since black-footed ferrets have been extirpated from the Coconino NF and there are no plans for reintroductions, there will be no effects to the ferret from implementation of any of the alternatives. If black-footed ferrets are reintroduced sometime in the future, a Biological Assessment will be completed and consultation with the Fish and Wildlife Service will occur.

Mexican Gray Wolf

Affected Environment

Distribution

The last reported wolf from northern Arizona was trapped in 1942, either on the forest or nearby on the Apache-Sitgreaves National Forests. Mexican gray wolves have been reintroduced in Arizona and New Mexico, beginning in 1998. The final rule for establishment of a nonessential experimental population of the Mexican gray wolf in Arizona and New Mexico (USDI Fish and Wildlife Service 1998b) designated primary recovery zones, secondary zones, and an experimental population area (EPA). All of the Coconino NF south of Interstate 40 is within the experimental population area, but outside the recovery zones. Under the final rule, wolves will only be reestablished in the recovery zones and will not be allowed to establish territories on public lands wholly outside the designated recovery areas. Wolves that occasionally make forays onto public lands outside the nonessential experimental population area are fully protected under the Endangered Species Act. Wolves have ventured on the forest at least twice, once in 2000 and once in 2001, but did not remain.

Habitat

Mexican gray wolves probably occupied forested habitats above the Mogollon Rim and around the San Francisco Peaks. They are not associated with desert habitats and do not have specific vegetative habitat requirements

Risk Factors

Prey and water availability are probably the most important determinants in habitat use by wolves. They primarily feed on deer and elk, which are managed by the Arizona Game and Fish Department. They are primarily influenced by reintroduction and management activities on the Apache-Sitgreaves and Gila National Forests in Arizona and New Mexico.

Environmental Consequences

Table 71 summarizes the viability analysis for Mexican gray wolf. This table was developed using the analysis process described under the Species Viability section above. It includes information on the status, F Rank, habitat, habitat condition and trend, likelihood that this species is limited by its habitat, and the projected management effect, by alternative. Management effect categorizes the relative expected outcome of plan language in each alternative in terms of minimizing species viability risk and are the result of plan decisions, including plan objectives. Management effect category values are 1, 2, 3, and 4. The lower the management effects rating for a species' associated habitat, the more effective the alternative is for that species viability. These topics and the effects of the alternatives are explained in greater detail in the discussions on the alternatives that follow.

Table 71. Analysis summary for the Mexican gray wolf

Species and status	Habitat	Alternative A		Alternatives B (modified), C, and D	
		Habitat condition and trend relative to desired conditions	Likelihood species is limited	Habitat condition and trend relative to desired conditions	Likelihood species is limited
Mexican gray wolf (Experimental non-essential, Endangered) Endemic	MWRF	Good, static to slowly toward	M	Good, slowly toward	M
F Rank = FN*	GBG	Good, away at short term then Fair, away at long term	Short term: L Long term: M	Low and high objectives: Good, static	L
	MSG	Good at short term then fair, away	Short term: L Long term: M	Good, toward	L
	PJG	Fair, toward at short term then away at long term	L-M	Low and high objectives: Fair, toward at short term then slowly away at long term	L-M
	PJES	Fair, away	L-M	Fair, away	L-M
	PJW	Good, static	L	Good, static	L
	PP	Low objective: Poor, toward at short term then Fair, toward at long term High objective: Fair, toward	Low objective short term: M Low objective long term: L-M High objective: L-M	Low objective: Poor, toward at short term then Fair, toward at long term High objective: Fair, toward	Low objective short term: M Low objective long term: L-M High objective: L-M
	MCFF	Fair, toward at short term then fair, static at long term	M	Low objective: Fair, toward at short term then Fair, static at long term High objective: Good, toward at short term then Good, static at long term	Low objective: M High objective: L
	MCIF	Fair, away at short term then Poor, away at long term	Short term: M Long term: H	Fair, static	M
	SF	Fair, toward	H	Fair, toward	H

Management Effect	All habitats except SF = 3: Plan components maintain or improve protection and management for some habitat occurrences in the plan area. Quality of habitat is maintained or improved by providing protection, maintenance, and restoration to some occurrences. SF = 4: Decline in habitat quality as a result of management or lack of management that result from plan components. Plan components may not exist or may be few.	All habitats = 2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.

* FN: Occurs on the forest, but no breeding population is documented on the forest.

Common to All Alternatives

Plan components in all alternatives contribute to species viability by managing for sustainable populations of native species and improving and protecting habitat for threatened, endangered, and sensitive species (1987 Plan, pages 22-1, 23, 64, 64-1, 66, 95, 108-2, 180, 187, 206-9, 206-11, 206-12, 206-13, 206-23, 206-30, 206-32, 206-66, 206-67, 206-71, 206-72, 206-79, 206-87, 206-89, 206-98, 206-103, 206-105, 206-108, 206-109, 206-114; FW-WFP-DC-1, 2, 3, 4, 5, 6, 8, and FW-Eco-DC-1). See At-risk Species in the Wildlife and Plant Issues and Topics section above for more information.

Alternative A

<u>Prior consultations under the Endangered Species Act</u>

Table 71 shows that under alternative A, Montane Willow Riparian Forest would remain in good condition with a trend that is static or slowly toward desired conditions, except in the Upper Clear Creek 5th code HUC where it would be trending toward.

Great Basin Grassland ERU would remain in good condition and continue trending away from desired conditions in the short term because tree and shrub cover would continue to increase and understory would decrease in abundance and vigor. In the long term, this ERU would be in fair condition and continue trending away from desired conditions.

The Montane/Subalpine Grasslands ERU would remain in good condition in the short term, but move to fair condition in the long term, and continue trending away from desired conditions due to an increase in tree and shrub establishment, especially along the periphery due to a continued lack of fire’s natural role in the ecosystem.

The Pinyon Juniper with Grass ERU would remain in fair condition, but would trend toward desired conditions in the short term due to expected mechanical treatments and burning using wildfire for resource objectives. However, the trend for the Pinyon Juniper with Grass ERU is expected to move away from desired conditions in the long term because generally the treatment level is insufficient to offset the negative effects of excess regeneration and closing canopies.

Pinyon Juniper Evergreen Shrub would remain in fair condition, but would trend away from desired conditions due to departure in the fire return interval and increases in trees and shrubs. Increased density of trees, shrubs, and understory could increase competition with these species and facilitate a higher fire severity than these plants evolved with thereby degrading the habitat.

Pinyon Juniper Woodlands would remain in good condition with a static trend.

Ponderosa Pine would remain in poor condition in the short term at the low treatment objectives (50,000 acres mechanical, 100,000 acres prescribed burn), then improve to fair condition and trend toward desired conditions under all alternatives. The improved vegetation structure and composition would reduce the risk of uncharacteristic fire. Under the high treatment objectives (260,500 acres mechanical, 200,000 acres prescribed burn), vegetation quality would improve faster (than the low objective) over existing condition because more acres would be treated. It would be in fair condition and trending toward desired conditions in both the short and long term. Cliffs would be in good condition with a static trend related to desired conditions.

Mixed Conifer with Frequent Fire would remain in fair condition and trend toward desired conditions in the short term. In the long term, the trend would become static relative to desired conditions as treatment levels would not be able to keep up with growth and regeneration; seedlings and saplings would make gains through excess regeneration where openings are created and medium and large trees would lose ground in open stands as canopy gaps are filled in.

Mixed Conifer with Infrequent Fire would remain in fair condition and continue trending away from desired conditions in the short term due contradictory direct related to the management of wildfires in wilderness areas. In the long term, the condition would become poor and the trend would continue to move away from desired conditions.

Spruce-Fir would remain in fair condition with a trend toward desired conditions.

As shown in table 71, the likelihood that Mexican gray wolf would be limited by the quality of its habitat on the forest is low to high depending on the habitat. These likelihoods were derived by combining the Mexican gray wolf's F Rank of FN with the likelihood of habitat limitation variables for each ERU: Montane Willow Riparian Forest (moderate, except the Upper Clear Creek 5th code HUC is high), Great Basin Grassland (low in the short term, moderate in the long term), Montane/Subalpine Grasslands (low in the short term, moderate in the long term), Pinyon Juniper with Grass (low-moderate), Pinyon Juniper Evergreen Shrub (low-moderate), Pinyon Juniper Woodland (low), Ponderosa Pine (moderate in short term and low-moderate in long term for low treatment objective; low-moderate for high treatment objective), Mixed Conifer with Frequent Fire (moderate), Mixed Conifer with Infrequent Fire (moderate in short term and high in the long term), and Spruce-Fir (high) (table 9). Low to moderate ratings are considered to be within the natural range of fluctuations for the habitat.

The management effect row shows the relative expected outcome of plan language in terms of minimizing species viability risk. The management effect is classified as a 3 for all the coarse filter habitats associated with Mexican gray wolf. This means that plan components in alternative A maintain or improve protection and management for some habitat occurrences in the plan area and thus contribute less to the viability of this species than the other alternatives. For Montane Willow Riparian Forest, this rating is primarily because alternative A does not distinguish between the three different riparian forest types differentiated in alternative B (modified) and lacks plan components relative to composition, structure, and function. Alternative A would

maintain or improve riparian forests because it has a focus on improving riparian areas in any condition, preventing damage to riparian vegetation, stream banks, and channels, and restoring degraded riparian areas to good condition as soon as possible (1987 Plan, pages 65-2, 65-8, 172, and 206-8). Other protective language includes the following: Only beneficial new special uses are allowed in riparian areas and exceptions such as utility line or roads crossing streamcourses are designed to minimize the extent and magnitude of impact to riparian areas (1987 Plan, page 177). Aggressive fire suppression may be used to prevent resource damage utilizing methods that minimize long-term adverse impacts to riparian habitats (1987 Plan, page 177). In addition, acquisition of riparian areas through land exchange is a high priority (1987 Plan, pages 177 and 185). The plan would manage commercial uses, and recreation in some areas, to protect riparian values (1987 Plan, pages 206-10, 22, 26, and 39). This alternative has less potential for improvement to riparian condition compared to the other alternatives because plan language for specific riparian forest types is lacking and there is not a focus on functioning-at-risk and non-functional riparian areas (USDA Forest Service 2016b).

For Great Basin Grassland and Montane/Subalpine Grassland, this rating is because alternative A lacks plan language for the different grassland types and is outdated; for example, there is an emphasis on forage species rather than ecological conditions. Alternative A contains language in MA 9 - Mountain Grassland and MA 10 - Grassland and Sparse Pinyon Juniper Above the Rim to emphasize wildlife habitat in these areas (1987 Plan, pages 158 and 162), and it includes one standard and guideline to control the invasion of undesirable plant species to improve and protect wildlife values (1987 Plan, page 164).

For Pinyon Juniper with Grass, Pinyon Juniper Evergreen Shrub, and Pinyon Juniper Woodland, this rating is because alternative A does not distinguish between the three pinyon juniper types that differ in composition, structure, and processes. The plan provides little direction on desired conditions for these ERUs as it is lumped into the broad vegetation category of Pinyon Juniper, and plan direction varies only by slope. Consequently, vegetation structure, including seed-bearing pinyon trees would not be equitably distributed across the landscape.

For Ponderosa Pine ERU, this rating is because much of the plan language is outdated; however, some of it is positive. The plan direction emphasizes uneven-aged structure and canopy cover retention as well as snag, minimum levels for logs and woody debris for various habitat categories (1987 Plan, pages 65-9 to 65-11). General direction is provided to manage for old age trees such that as much old forest structure as possible is sustained over time across the landscape and to sustain a mosaic of vegetation densities (overstory and understory), age classes and species composition across the landscape (1987 Plan, pages 65-7, 70-1, and 70-2).

For the Mixed Conifer with Frequent Fire and Mixed Conifer with Infrequent Fire ERUs, this rating is primarily because alternative A does not distinguish between these two mixed conifer types whose composition and structure can differ because they have different fire regimes. Consequently management direction for these two ERUs is unclear.

The management effect for Spruce-Fir under alternative A is 4, which suggests that a decline in habitat quality could occur as a result of management or lack of management that result from plan components. Alternative A lacks plan components specific to Spruce-Fir and existing plan components make it difficult to implement fire treatments in wilderness, which overlaps the majority of Spruce-Fir vegetation on the forest. This alternative also lacks plan components that would contribute to the maintenance or sustainability of Spruce-Fir.

Plan components in this alternative would support habitat for Mexican gray wolves and their prey. Plan components emphasize management and cooperation for recovery of listed species, the reintroduction of extirpated species in accordance with recovery plans (1987 Plan, pages 22-1, 64), and the management of habitat to maintain viable populations of wildlife and fish (1987 Plan, page 22-1). Management for wolves is essentially management for the habitat of their prey, and ungulate populations are most productive in ecosystems that contain a variety of forest successional stages (Groebner et al. 1995). Management activities that may benefit prey include water development and vegetation management by using prescribed fire, managed wildfire, timber harvest, and seeding and planting of desired vegetation according to the recovery plan (USDI Fish and Wildlife Service 1982a). Alternative A has standards and guidelines to establish and maintain stand diversity through timber harvest to provide suitable habitat for wildlife while maintaining or enhancing timber production and age class distribution (p. 70, par 6), to use prescribed fire to improve wildlife habitat (1987 Plan, pages 92 to 96). There are also forestwide standards and guidelines that provide direction for big game winter range management, management of forage for wildlife, and for improvements such as water developments (1987 Plan, pages 64 to 66).

The 1987 plan emphasizes management and cooperation for recovery of listed species and reintroduction of extirpated species. Forestwide goals and objectives are to cooperate with the Arizona Game and Fish Department on proposals to reintroduce species (1987 Plan, page 22-1). Forestwide standards and guidelines call for reintroducing species in accordance with recovery plans (1987 Plan, page 64).

Management for wolves is essentially management for their prey. Habitat type and condition is only important for wolves in its ability to support prey, and ungulate populations are most productive in ecosystems that contain a variety of forest successional stages (Groebner et al. 1995). The Recovery Plan (USDI Fish and Wildlife Service 1982b) lists management activities that may benefit prey, such as water development and vegetative management, by using prescribed fire, managed wildfire, timber harvest, and seeding and planting of desired vegetation. The 1987 Plan goals and objectives for wildlife are to manage habitat to maintain viable populations of wildlife and fish (1987 Plan, page 22-1). The 1987 Plan has standards and guidelines to establish and maintain stand diversity through timber harvest to provide suitable habitat for wildlife while maintaining or enhancing timber production and age class distribution (1987 Plan, page 70). Prescribed fire is another way to meet resource objectives and to improve wildlife habitat (1987 Plan, pages 92 to 96). Specifically for game species, forestwide standards and guidelines provide direction for big game winter range management, management of forage for wildlife, and for improvements such as water developments (1987 Plan, pages 64 to 66).

Alternative B (modified)

Table 71 shows that under alternative B (modified), Montane Willow Riparian Forest would be in good condition and trending slowly toward desired conditions, except in the Upper Clear Creek 5th code HUC where it would be trending toward desired conditions at a faster rate than alternative A.

Great Basin Grasslands ERU would be in good condition (like alternative A), but the trend would improve to static. The condition and trend of Montane/Subalpine Grasslands ERU would improve to good with a trend toward desired conditions.

The condition and trend for the Pinyon Juniper with Grass ERU would be the same as alternative A. The condition of the Pinyon Juniper with Grass ERU would remain fair, but the trend would be toward desired conditions in the short term, then trend slowly away from desired conditions in the long term because the treatment levels (FW-TerrERU-PJ-O-1 and 2) are not sufficient to offset the negative effects of excess regeneration and closing canopies.

Pinyon Juniper Evergreen Shrub ERU would remain in fair condition, but would trend away from desired conditions, like alternative A. Like alternative A, Pinyon Juniper Woodland would remain in good condition with a static trend.

Ponderosa Pine ERU would be similar to alternative A, remaining in poor condition with a trend toward desired conditions in the short term under low treatment objectives (50,000 acres mechanical, 150,000 acres prescribed fire). However, in the short term under the high vegetation treatment objectives (260,050 acres mechanical, 200,000 acres prescribed fire) and in the long term under both the low and high vegetation treatment objectives, the condition would improve to fair and trend toward desired conditions.

Like alternative A, under the low treatment objectives (2,900 acres mechanical, 8,000 acres prescribed fire) Mixed Conifer with Frequent Fire ERU would remain in fair condition with a trend toward desired conditions in the short term, then become static relative to desired conditions in the long term. Under the high treatment objectives (15,000 mechanical, 8,000 prescribed fire), Mixed Conifer with Frequent Fire ERU would improve to good condition and initially trend toward desired conditions, but then become static relative to desired conditions in the long term. The Mixed Conifer with Infrequent Fire ERU would remain in fair condition, but the trend would improve to static.

Spruce-Fir would remain in fair condition with a trend toward desired conditions.

As shown in table 71, the likelihood that Mexican gray wolf would be limited by the quality of its habitat on the forest is low to high, depending on the habitat. These likelihoods were derived by combining the Mexican gray wolf’s F Rank of FN with the likelihood of habitat limitation variables for each ERU: Montane Willow Riparian Forest (moderate), Great Basin Grassland (low), Montane/Subalpine Grasslands (low), Pinyon Juniper with Grass (low-moderate), Pinyon Juniper Evergreen Shrub (low-moderate), Pinyon Juniper Woodland (low), Ponderosa Pine (moderate in short term and low-moderate in long term for low treatment objective; low-moderate for high treatment objective), Mixed Conifer with Frequent Fire (moderate under the low treatment objective, low under the high treatment objective), Mixed Conifer with Infrequent Fire (moderate), and Spruce-Fir (high) (table 9). Low to moderate ratings are considered to be within the natural range of fluctuations for the habitat.

The management effect row shows the relative expected outcome of plan language in terms of minimizing species viability risk. The management effect is classified as a 2 for all the coarse filter habitats associated with Mexican gray wolf. This means that plan components in alternative B maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area. For Montane Willow Riparian Forest, this rating is primarily because there are updated desired conditions and guidelines that distinguish between the riparian forest types and that support their respective composition, structure, and function (FW-Rip-RipType-DC-1 to 6 FW-Rip-RipaType-G-1 to 4). In addition, riparian functional condition would improve faster than alternative A, especially along the Verde

River, Towel Creek, Spring Creek, and Dry Beaver Creek, which is habitat for bald eagles, beavers, common black hawks, and western red bats. The desired conditions manage for vegetation diversity and riparian function including in priority watersheds (FW-Rip-RipType-DC-1 and 2; FW-Water-G-2; FW-Rip-RipType-O-1). More site-specific aquatic management zone guidelines protect riparian function and water quality (FW-Rip-All-G-3; Fw-Rip-Strm-G-2) (USDA Forest Service 2016b). Plan components in the Wildlife, Fish and Plant section also contribute to the viability of species associated with riparian areas by promoting properly functioning ecosystems that have the necessary physical and biological components to meet the needs of associated native species (FW-WFP-DC-1 and 3).

For Great Basin Grasslands and Montane/Subalpine Grasslands, this rating is because alternatives B (modified), C, and D distinguish between the different grassland types and has additional language to protect this ERU that is not present in alternative A: Prescribed fires and wildfires managed for resource objectives should not be used on areas with clayey soils until natural vegetative ground cover is near potential (FW-TerrERU-Grass-G-1); this would promote satisfactory and functional soils. There is also an objective to restore/enhance between 10,800 and 12,400 acres of this ERU every 10-year period during the life of the plan (FW-TerrERU-Grass-O-2).

For Pinyon Juniper with Grass, Pinyon Juniper Evergreen Shrub, and Pinyon Juniper Woodland, this rating is because these alternatives clearly distinguish between different Pinyon Juniper types on the forest and provides desired conditions, objectives and guidance that are specific to the each type. Management direction would promote properly functioning ecosystems that are resilient to natural disturbances and climate change; promote characteristic disturbances and reduce the threat of uncharacteristic disturbances, and promote balance between desirable non-native species and subspecies and properly functioning ecosystems, thereby furthering sustainability and adaptability (FW-Eco-DC-1 to 4, FW-TerrERU-All-DC-2) ERU specific direction would provide for a variety of native species with varying seral stages in natural patterns of abundance and distribution that support natural disturbances (FW-TerrERU-PJ-DC-5-9; G-1, 2, 3, 5). There is additional direction for this ERU within the wildland-urban interface. Within wildland-urban interface, fire and vegetation management would favor low-intensity surface fires despite the historic fire regime that favors high-severity (and typically high-intensity) fires (FW-WUI-DC-8). This is intended to mitigate the risks to surrounding communities.

For Ponderosa Pine, this rating is because alternative B (modified) emphasizes ecological conditions and composition, structure, and function of this ERU using current science, in contrast to alternative A (Reynolds et al.2013). Particularly beneficial guidelines provide sideboards that would promote or sustain old-growth forest attributes, uneven-aged conditions, pre-settlement trees, occupancy of small wildlife species, and reduce the risk of uncharacteristic bark beetle outbreaks (FW-TerrERU-PP-G-1 to 7). Although alternative B (modified) promotes an open uneven-aged structure similar to historic conditions, it also has provisions for denser areas such as on steep slopes and in canyons and larger tree groups in areas managed for bald eagles (FW-TerrERU-PP-DC-8 and 13).

For Mixed Conifer with Frequent Fire and Mixed Conifer with Infrequent Fire, this rating is primarily because alternative A does not distinguish between these two mixed conifer types whose composition and structure can differ because they have different fire regimes. Consequently management direction for these two ERUs is unclear.

For Spruce-Fir, this rating is because these alternatives have plan components specific to Spruce-Fir and existing plan components facilitate fire treatments in wilderness, which overlaps the majority of Spruce-Fir vegetation on the forest.

All of the desired conditions for the forested ERUs aspire to move habitats toward reference conditions (see the "Vegetation and Fire" section in chapter 2 of the proposed revised plan). Guidance under the section on Wildlife, Fish, and Plants emphasizes thriving wildlife populations supported by the diversity, quantity, quality, and capability of habitats; dispersal and migration of wildlife so they can meet their life history requirements (FW-WFP-DC-1 to 9; FW-WFP-O-1, 3; FW-WFP-S-1; FW-WFP-G-1, 3, 4, 6, 10, 11); and guidance for road management also emphasizes habitat connectivity and minimization of disturbance impacts to wildlife (FW-RdsFac-DC-1, 4; FW-RdsFac-G-1, 2, 5).

One of the three recommended wilderness areas (Davey's) is in the Mexican Wolf Experimental Population Area (MWEPA) identified in the 2015 Final Rule on the endangered status of this species (USDI Fish and Wildlife Service 2015b). This recommended wilderness area would provide additional habitat (1,739 acres) where disturbance from motorized vehicles is minimized by limiting motorized use to administrative and permitted uses to maintain the area's wilderness character (SA-Rwild-G-3).

Although the Mexican gray wolf does not currently occupy the forest, the revised regulations for managing the nonessential experimental population within the MWEPA support the potential for wolves to naturally disperse onto the forest as populations increase in its original experimental population area. The revised rule also allows for translocations of wolves onto the forest (within the MWEPA), first only east of Highway 87 on the Mogollon Rim Ranger District, and could also be expanded farther west later on.

The conservation agreement (USDI Fish and Wildlife Service 2010) identifies large area size, adequate prey, and security from human exploitation as the three basic ecological needs of the Mexican gray wolf. Land adjustments are likely under the LRMP, and can include acquisition or disposal. Plan components provide direction that is expected to consider listed species in future adjustments and the acreage of the forest is not expected to change significantly.

Where Mexican gray wolves have been reintroduced in Arizona and New Mexico, prey does not appear to be limiting (USDI Fish and Wildlife Service 2010). Reintroduced wolves show a strong preference for elk (USDI Fish and Wildlife Service 2015b). While mule deer populations may not be doing as well, elk populations on the forest, including along the Mogollon Rim, are relatively abundant. The implementation of the plan can influence ungulate prey populations both positively and negatively through impacts to habitat and through state hunting regulations. Overall, by striving toward desired conditions, the LRMP is expected to maintain prey population habitat.

Where their ranges overlap, wolves are known to prey on domestic livestock. Livestock grazing can be compatible with managing Mexican wolf populations, but when depredations occur, it can lead to lethal removal of wolves, or permanent removal from the population.

Contact with humans can result in permanent removal or mortality of Mexican gray wolves. Illegal shooting is the greatest source of Mexican gray wolf mortality. Collisions with vehicles also results in mortality. While illegal shooting is not directly in Forest Service control, management of roads that provide access to areas wolves inhabit can influence the potential for illegal shooting and vehicle collisions. The LRMP provides management guidance that can limit

the potential for intrusions into wolf areas in the roads program, and guidance for wildernesses and special areas.

Alternative C

Alternative C is similar to alternative B (modified) in most aspects; however, there are some important differences. This alternative proposes a total of 13 wilderness areas (including the ones discussed in alternative B (modified)). Of the 13, 11 are in the MWEPA and would provide additional habitat. This would provide 84,763 acres of habitat with reduced disturbance from motorized use and activities in order to maintain the area’s wilderness character (SA-Rwild-G-3). The other two recommended wilderness areas (Strawberry Crater and Abineau) are north of Interstate 40 and outside of the MWEPA.

Alternative C proposes eight management areas that emphasize reduced human-related disturbance, wildlife, and restoring habitat using establishment of natural fire regimes and reduction of road densities. The Upper Clear Creek watershed along the Mogollon Rim is the closest forest habitat to the western edge of the Blue Range Recovery Area. There are five management areas in the Upper Clear Creek watershed including East Clear, Hospital Ridge, Knoll Lake, Limestone Pasture, and Second Chance, and all eight are within the Mexican gray wolf experimental population area. Guidelines for these management areas would reduce disturbance associated with recreation and public motorized access compared to alternative A or B (modified). This would positively impact wolves that wander outside of recovery zones by reducing disturbance impacts from recreational and motorized uses.

Although the findings do not differ, alternative C is more favorable to recovery of wolves on the forest through guidance contained within several MAs that emphasizes habitat for ungulate prey species, especially within the area east of Highway 87. Wolves are most likely to naturally disperse into and occupy this part of the forest first, because it is closest to the reintroduced population. Additionally, translocations of wolves are allowed into this area.

Alternative D

Alternative D is similar to alternative B (modified) in most aspects; however, there are some important differences. Alternative D does not recommend new wilderness areas. The effects associated with managing those areas as recommended wilderness would not occur. These areas would still be managed by the other forestwide, management area, and special area direction in alternative B (modified) with the corresponding effects discussed above in the alternative B (modified) section. This difference between the alternatives would not result in a change in the condition or trend of the riparian habitats from those provided by alternative B (modified) for this species. The designation of additional wilderness areas in alternatives B (modified) and alternative C would make them slightly more beneficial to Mexican gray wolf.

Alternative D adjusts scenic resources direction to allow for expansion along two powerline corridors. One corridor is approximately 21 miles between Sycamore and Red Rock-Secret Mountain wildernesses, and the other is approximately 11 miles along State Highway 87. Both powerline corridors occur within the MWEPA on the forest. The corridor along Highway 87 is adjacent to the area where wolves currently could be translocated to, along with being allowed to naturally disperse and occupy. Additional development could cause disturbance to wolves if activities occur during the denning season. But the limited extent of the corridors minimizes the potential effect.

Guidance in alternative D is similar to alternatives A, B (modified), and C in supporting re-introduction activities and providing diverse habitats that can support prey habitat. Overall, not adding any new wilderness areas or adding MAs that emphasize prey species habitat makes the effects of this alternative similar for wolves to alternative A.

Findings

All alternatives are "not likely to jeopardize" the continued existence of Mexican gray wolves because all alternatives support reintroduction activities and provide diverse habitats that can support prey habitat. The final rule states that wolves are not allowed to establish territories outside of recovery zones. By definition, a nonessential experimental population is not essential to the continued existence of the species, therefore, none of the alternatives could lead to a jeopardy determination for the species.

Threatened and Endangered: Plants

Arizona Cliffrose

Arizona cliffrose was listed as Endangered in 1984 (USDI Fish and Wildlife Service 1984). The Recovery Plan for the species was prepared in 1995 (USDI Fish and Wildlife Service 1995a).

Affected Environment

Distribution

Arizona cliffrose is a long-lived shrub, endemic to the Verde Formation, which is a white Tertiary (Miocene and Pliocene) limestone lakebed deposit that is high in lithium, nitrates, and magnesium (Anderson 1996; AZGFD 2001). Arizona cliffrose occurs in four disjunct populations spread across an area of approximately 200 miles in central Arizona. Population areas include Burro Creek in Mohave and Yavapai counties, Cottonwood in Yavapai County, Horseshoe Lake in Maricopa and Yavapai counties, and near Bylas in Graham County (USDI Fish and Wildlife Service 1995).There are four recovery units for Arizona cliffrose. These include the Cottonwood, Burro Creek, Bylas and Horseshoe Lake areas. The Cottonwood Recovery Unit is the only one within the boundary of the Coconino National Forest and is the largest of the four units covering about 1,000 acres. The Recovery Unit occurs on the Coconino National Forest, adjacent state and county land with some habitat and plants on private lands. Most of the population is on the Coconino National Forest, with the majority of plants occurring in the Verde Valley Botanical Area, Dead Horse Ranch State Park and adjacent forest, State and private lands. The Cottonwood Recovery Unit supports a relatively large number of established seedlings. Recruitment rates to maintain viable populations of Arizona cliffrose are not well documented (USDA Forest Service 2004). Recovery actions must be fulfilled in all four units to reach the goal of the Recovery Plan. The goal is to downgrade species to "threatened."

Habitat

Arizona cliffrose is restricted to nutrient-deficient calcareous soils of the Verde Formation soils, which are arid soft ancient lakebed soils that have a high level of pH, high amounts of calcium, and erode easily. The Verde Formation soil type defines a large portion of the plant life in the Verde Valley area. The harsh soils that support Arizona cliffrose serve an important function in excluding more common species from the habitat occupied by Arizona cliffrose (Anderson 1996) as well as other endemic species. Soil moisture during wet periods aids in recruitment of young

Arizona cliffrose plants (Maschinski et al. 2006). This soil type occupies about 70 percent of the Desert Communities and about 53 percent of the Semi-desert Grassland ERU. The Verde Formation extends from the Cottonwood area across the forest to east of Camp Verde. The Cottonwood Recovery Unit population and its habitat are dissected by two high-use roads, U.S. Highway 89A and State Route 179, which have numerous weed infestations, and it is located near some Verde Valley communities with typical wildland-urban interface activities occurring in the surrounding areas. These habitats (Desert Communities and Semi-desert Grassland ERUs and the Verde Formation soil in those ERUs) are more fully evaluated in the Coarse Filter: Habitat section.

Critical habitat has not been established for Arizona cliffrose.

Risk Factors

Landscape-level primary habitat threats are addressed in the Coarse Filter: Habitat section and summarized below:

- Desert Communities is threatened by invasive plants, particularly exotic annual grasses, uncharacteristic fire and recreation. Invasive plants compete with native species for scarce moisture. If they become well established, they can cause a change in fire frequency or fire severity to which native species would not be adapted. The potential for uncharacteristic fire has increased due to the proximity to the growing communities in the Verde Valley and increased recreation.
- Semi-desert Grasslands are fragmented due to human development. The current conditions in Semi-desert Grasslands are highly departed due to fragmentation and departure in composition and structure as a result of fire exclusion. Due in large part to fire exclusion, about 30 percent of the Semi-desert Grassland on the south end of the forest have become so shrub and tree invaded that they have likely undergone a vegetation type conversion with little potential to be restored to open native grassland condition (USDA Forest Service 2009a). A few, widely distributed invasive exotic plant species are present, including red brome.
- The recovery plan for this species cites grazing and mining as threats to the Cottonwood population. The increase in recreational use in the Verde Valley Area has led to increased threats to Arizona cliffrose and its habitat. Mountain biking on the Lime Kiln Trail has impacted the soil and crushed some cliffrose plants in the Verde Valley Botanical Area.

Other threats include: roads construction and maintenance, utility corridors, and land exchanges (USDI Fish and Wildlife Service 1995a). Construction and maintenance of roads and utility corridors could decrease the amount of habitat, change hydrology, contribute to erosion, and introduce invasive weeds. Land exchanges from Federal ownership to other entities could contribute to urbanization or other actions causing habitat loss or degradation, and would be contradictory to plan direction in all alternatives and the Recovery Plan.

The effects of roads, utility lines, and livestock grazing on Forest Service controlled lands within the Cottonwood Recovery Unit have been mitigated by past management actions. For more information on these actions refer to the Biological Opinion for State Route 89A Cottonwood to Sedona Construction Segment 2 (USDI Fish and Wildlife Service 1996), Mingus Avenue Bypass Project (USDI Fish and Wildlife Service 2001) Phase II powerline (USDA Forest Service 2008a),

Travel Management FEIS (USDA Forest Service 2011e), and Windmill West Biological Assessment (USDA Forest Service 2014b).

Threats from the expanding human population and resulting urbanization are not under Forest Service control, but are anticipated to continue into the future.

There is no livestock grazing in the Verde Valley Botanical Area and South Gyberg pasture, which has most of the population. These areas were permanently removed from the Windmill West Allotment in 2014. Grazing still occurs in other pastures containing Arizona cliffrose in the allotment but these areas have been brought into compliance for grazing outlined in the Recovery Plan (USDI Fish and Wildlife Service 1995a).

Although the Recovery Plan cites mining as a threat to Arizona cliffrose, most mining and exploration has been in the Burro Creek and Horseshoe Lake populations, which are outside the Coconino NF. The Cottonwood Recovery Unit has low potential and mining is unlikely to occur there (see Mineral Resources in volume 1 of this FEIS).

Environmental Consequences

The scope of this analysis includes Desert Communities and Semi-desert Grassland ERUs, and the Verde Formation soil type in each of those ERUs. The previous coarse filter section compares the alternatives in regards to threats to Desert Communities, Semi-desert Grasslands, the Verde Formation, and overall habitat for Arizona cliffrose. The analysis below focuses on those risk factors and program areas that would be most consequential in terms of maintaining viability for Arizona cliffrose.

Table 72 summarizes the viability analysis for Arizona cliffrose. This table was developed using the analysis process described under the Species Viability section above. It includes information on the status, F Rank, habitat, habitat condition and trend, likelihood that this species is limited by its habitat, and the projected management effect, by alternative. Management effect categorizes the relative expected outcome of plan language in each alternative in terms of minimizing species viability risk and are the result of plan decisions, including plan objectives. Management effect category values are 1, 2, 3, and 4. The lower the management effects rating for a species' associated habitat, the more effective the alternative is for that species viability. These topics and the effects of the alternatives are explained in greater detail in the discussions on the alternatives that follow.

Table 72. Analysis summary for Arizona cliffrose

Species, status and F Rank	Habitat	Alternative A		Alternatives B (modified), C, D	
		Habitat condition and trend relative to desired conditions	Likelihood species is limited	Habitat condition and trend relative to desired conditions	Likelihood species is limited
Arizona cliffrose (Endangered, Narrow Endemic) F Rank = F1	DC	Poor, away	VH	Poor, away	VH
	SDG	Poor, away	VH	Poor, slightly toward	VH

Species, status and F Rank	Habitat	Alternative A		Alternatives B (modified), C, D	
		Habitat condition and trend relative to desired conditions	Likelihood species is limited	Habitat condition and trend relative to desired conditions	Likelihood species is limited
	Verde Formation soil in DC	Fair, static	H	Fair, static	H
	Verde Formation soil in SDG	Poor, slowly toward	VH	Poor, toward	VH

Management Effect	DC, Verde Formation in DC, SDG, and Verde Formation in SDG = 3: Plan components maintain or improve protection and management for some habitat occurrences in the plan area. Quality of habitat or habitat elements is maintained or improved by providing protection, maintenance, and restoration to some occurrences.	All habitats = 2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.

Note: F1= Very rare on the forest within its habitat – occupies a very small portion of its habitat.

Common to All Alternatives

Plan components in all alternatives contribute to species viability by managing for sustainable populations of native species and improving and protecting habitat for threatened, endangered, and sensitive species (1987 Plan, pages 22-1, 23, 64, 64-1, 66, 95, 108-2, 180, 187, 206-9, 206-11, 206-12, 206-13, 206-23, 206-30, 206-32, 206-66, 206-67, 206-71, 206-72, 206-79, 206-87, 206-89, 206-98, 206-103, 206-105, 206-108, 206-109, 206-114; FW-WFP-DC-1, 2, 3, 4, 5, 6, 8, and FW-Eco-DC-1). See At-risk Species in the Wildlife and Plant Issues and Topics section above for more information.

Plan components in all alternatives support managing for viable self-sustaining populations of special status species, contributing to the survival and recovery of listed species, and allowing for the repatriation of extirpated species (1987 Plan, page 22-2; FW-WFP-DC 1, 2). All alternatives have a standard such that direction for species listed as threatened, endangered, proposed, or candidate take precedence over direction for species not listed by the Fish and Wildlife Service as well as direction to comply with approved recovery plans (1987 Plan, page 64; FW-WFP-S-1, FW-WFP-G-1, 2).

All alternatives would manage botanical areas to protect their unique qualities (1987 Plan, pages 25, 79, 195; SA-RNABotGeo-DC-5, 6). The Verde Valley Botanical Area is managed to preserve a unique limestone-dependent vegetative community containing Arizona cliffrose (1987 Plan, page 195; SA-RNABotGeo-DC-5).

Mining was identified as a threat in the Recovery Plan. Alternative A provides direction to seek withdrawal from locatable mineral entry in special areas including the Verde Valley Botanical

Area (1987 Plan, pages 86, 196). Mining is addressed in Alternatives B (modified), C and D through the regulation of surface occupancy. A guideline provides for no surface occupancy or mineral leasing in areas such as the Verde Valley Botanical Area and for endangered species including Arizona cliffrose (FW-Minerals-G-3). This guidance will help protect all Arizona cliffrose plants including those not occurring within the boundaries of the Verde Valley Botanical Area. This guidance is strengthened by Forest Service Manual direction for mineral management (FSM 2761.03). The manual also provides alternatives to mineral withdrawal including using the provisions of the Endangered Species Act (1973). Refer to FSM 2761.4 for additional information.

Livestock grazing was identified as threat to Arizona cliffrose in the Recovery Plan (1995a). All alternatives contain guidance for livestock grazing. All alternatives have plan components that direct allotment management plans to have provisions that protect the uniqueness and ecological condition of special areas such as the Verde Valley Botanical Area (1987 Plan, page 195; SA-RNABotGeo-G-4). Particularly beneficial plan components include the following;

- A standard in the current forest plan that requires forage use by grazing ungulates be maintained at or above a condition that assures recovery and continued existence of threatened and endangered species (1987 Plan, page 66-1).
- Desired conditions in the section on Wildlife, Fish, and Plants that promote habitat conditions that contribute to the survival and recovery of listed species and a guideline that requires that habitat management objectives and species protection measures from approved recovery plans should be applied to activities within federally listed species habitat to promote recovery of the species (FW-WFP-DC-2, FW-WFP-G-1).
- A guideline in the section on Livestock Grazing that requires livestock grazing to be managed to meet, or move toward, the desired conditions for forest resources such as soil, water, vegetation, and species (FW-Graz-G-2).

In addition, the Recovery Plan contains a series of recovery actions to regulate grazing. These actions must be addressed during grazing planning and implementation to comply with the Recovery Plan.

All alternatives specify that fire suppression tactics should have minimal damage to special areas (1987 Plan, page 196; SA-RNABotGeo-G-3). Fire line construction could damage or kill individual plants, increase the calcium content of the soil (making it less suitable for cliffrose), or cause accelerated soil erosion. These plan components would contribute to the viability of this species by minimizing damage to habitat and individual plants from fire suppression activities.

Alternative A

Prior consultations under the Endangered Species Act

A Biological Assessment for the continued implementation of forest LRMPs across the region was prepared in 2004 (USDA Forest Service 2004d). The determination of effect for Arizona cliffrose was “may affect and likely to adversely affect the Arizona cliffrose.” This finding was based on the lack of specific protection measures, specifically for the Arizona cliffrose, in the Coconino and Tonto National Forest plans, specifically for the Cottonwood population where the document mentioned a wide variety of activities. The Biological Opinion concurred with the finding (USDI Fish and Wildlife Service 2005a). A similar biological assessment was prepared in

2011 and again contained a “may affect, likely to adversely affect” finding. There had been no significant changes in LMRP or significant scientific information to warrant a change in the finding (USDA Forest Service 2011f). The Biological Opinion concurred with the finding (USDI Fish and Wildlife Service 2012d).

Since then, there have been two amendments to the current plan. One amendment addresses cultural resources and has no significant effect on the management of Arizona cliffrose. The second incorporates the direction of the Travel Management EIS (2012) into the current plan. The decision closed cross-country motorized travel across the forest, limiting vehicles to designated roadways (USDA Forest Service 2011g). This decision was consistent with the already existing off road vehicle closure in Management Area 17 (Special Areas). The MA 17 closure includes the Verde Valley Botanical Area. This decision also closed MA 11 (Verde Valley) to off-road vehicle travel. This provides a higher level of protection for the portion of the Arizona cliffrose population outside of the Verde Valley Botanical Area than was afforded by the LMRP before the Travel Management decision. The Biological Assessment and the associated amendment for Travel Management determined that the effect for Arizona cliffrose was “may affect but is not likely to adversely affect Arizona cliffrose or its habitat” (USDA Forest Service 2010d, 2011m). This finding was based on the generally beneficial effects to the species by reducing the risks of negative impacts from motorized vehicles and strengthening existing closures within and near the Verde Valley Botanical Area and nearby habitat. The TMR decision officially closed a series of roads under Forest Service control that were previously designated as “high clearance” but were not in use. The Biological Opinion concurred with this finding (USDI Fish and Wildlife Service 2012d).

Since then, there have been no significant changes in LRMP or significant scientific information to warrant a change in the finding

<u>Viability</u>

Table 72 shows that under alternative A, Desert Communities and Semi-desert Grassland would remain in poor condition and trend away from desired conditions. Alternative A has no specific desired conditions for Desert Communities. Plan direction focuses on watershed condition, range management, and recreation.

The increased abundance and distribution of non-native invasive grasses in the Desert Communities ERU increases the risk of uncharacteristic wildfires in a plant community not adapted to wildfire. Fragmentation of the Semi-desert Grasslands due to urbanization and past land use has contributed to departure from the historic fire regime. The frequent low-intensity fires that formed and maintained the community structure of the ERU, limiting the numbers and densities of trees and shrubs are no longer able to burn across the landscape. These departures are likely to continue into the future.

The likelihood that habitat on the forest would be a limiting factor for the Arizona cliffrose is very high for Desert Communities and Semi-desert Grassland, and high to very high for the Verde Formation. These likelihoods were derived by combining Arizona cliffrose’s F Rank of F1 with the likelihood of habitat limitation variables for each ERU: Desert Communities (high), Semi-desert Grasslands (high), Verde Formation in Desert Communities (moderate), and Verde Formation in Semi-desert Grasslands (high) (table 9). Low to moderate ratings are considered to be within the natural range of fluctuations for the habitat.

The management effect row shows the relative expected outcome of plan language in terms of minimizing species viability risk. The management effect is classified as a 3 for Desert Communities, Verde Formation in Desert Communities, and Verde Formation in Semi-desert Grassland, which means that plan components in alternative A maintain or improve protection and management for some habitat occurrences in the plan area, and thus, contribute less to the viability of this species than the other alternatives. This is primarily because alternative A provides little to no direction on specific desired conditions for these two ERUs and little explicit direction for the Verde Formation.

The management effect is classified as a 3 for Semi-desert Grassland, which means there is a decline in habitat quality as a result of management or lack of management that result from plan components. Plan components may not exist or may be few. Alternative A lacks guidance for the different grassland types, which have different species compositions and structure.

Alternative A is the most permissive of the alternatives and would not preclude dispersed recreation or off-trail use in botanical areas. Bicycle use has increased in the Verde Valley Botanical Area over time. Increased use in general increases the risk to plants growing along the trails. Alternative A has guidance that would protect cliffrose by regulating bicycling if conflicts are identified, but this would require conflicts to occur before preventative action is taken (1987 Plan, page 59).

Alternative B (modified)

Consultation under the Endangered Species Act

A Biological Assessment for the revision of Coconino NF Land Management Plan was prepared in 2017 (USDA Forest Service 2017c). The determination of effect for Arizona cliffrose was "may affect, likely to adversely affect." Although beneficial effects are expected from adoption of plan guidance, adverse effects could still occur, primarily from recreation, non-native grass expansion, and livestock grazing. Urbanization was identified as a threat in the Recovery Plan and in the Cottonwood area will continue, but it and its associated effects are not under Forest Service control.

The Fish and Wildlife Service concurred with this finding in their draft Biological and Conference Opinion received on August 8, 2017 (USDI Fish and Wildlife Service 2017b). No incidental take was assigned. The Fish and Wildlife Service provided two discretionary conservation recommendations intended to minimize or avoid adverse effects, help implement recovery plans, or develop information.

Viability

Table 72 shows that under alternative B (modified), Desert Communities would remain in poor condition with a trend away from desired conditions, like alternative A.

Semi-desert Grassland ERU would remain in poor condition, but unlike alternative A, this ERU would trend toward desired conditions due to plan objectives that would restore or improve at least 3,500 acres of Semi-desert Grassland ERU during each 10-year period over the life of the plan (FW-TerrERU-Grass-O-1). The plan objective would remove tree and shrub cover and create more open conditions. Increased fragmentation from urbanization would be expected to continue.

The condition of Verde Formation soil in the Desert Communities and Semi-desert Grasslands ERUs would be the same as alternative A (fair and poor, respectively), but there would be slight

improvements in the trend (slowly toward and toward desired conditions, respectively) under alternative B (modified). These improved trends would be a result of integrated protection of sensitive resources from the impacts of motorized and non-motorized recreation; rehabilitation of unauthorized trails so as to prevent accelerated erosion; and potential restrictions on national forest visitor activities where they would inhibit site restoration or cannot be made compatible through appropriate mitigations (FW-Rec-All-DC-6, FW-Rec-All-G-1, FW-Rec-All-G-2, FW-Rec-Trails-DC-3, FW-Rec-Trails-DC-4, FW-Rec-Trails-DC-11, FW-Rec-Trails-G-1, FW-Rec-Trails-G-3).

Table 72 shows that the likelihood that habitat on the forest would be a limiting factor for the Arizona cliffrose is very high for Desert Communities and Semi-desert Grassland ERUs and for Verde Formation soil in the Semi-desert Grassland ERU, and high for Verde Formation soil in the Desert Communities ERU. These likelihoods were derived by combining the Arizona cliffrose's F Rank of F1 with the likelihood of habitat limitation variables for each ERU: Desert Communities (high), Semi-desert Grasslands (moderate), Verde Formation in soil Desert Communities (moderate), Verde Formation soil in Semi-desert Grasslands (high) (table 9). Low to moderate ratings are considered to be within the natural range of fluctuations for the habitat.

The management effect is classified as a 2 for all the habitats in this group, which means that plan components in alternative B (modified) maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area. For Desert Communities and Semi-desert Grasslands ERUs, this rating is due to this alternative distinguishing between the grassland habitats on the forest and containing explicit and updated direction on the composition, structure, and processes for these ERUs (FW-TerrERU-Grass-DC-1, 8), compared to alternative A which has a more forage-based approach.

Soil is a limiting factor for plant communities on the Verde Formation soil type (Anderson 1996; AZGFD 2001). The soils of the Verde Formation are generally not suited to intensive disturbance. For Verde Formation soil, there are no specific components in the Desert Communities or Semi-desert Grasslands ERUs. However, the management effect rating is a 2 for Verde Formation because the forestwide guidance for soil applies and would be beneficial for Verde Formation soil. Application of the desired condition for soil (FW-Soil-DC-1 to 4) would improve soil condition slowly over time when used in project planning. One of the desired conditions (FW-Soil-DC-1) provides for proper soil function, water distribution and nutrient cycling for all vegetation. Forestwide soil guidelines would avoid excessive ground disturbance, limit accelerated erosion, and minimize bringing more calcareous soil to the surface, which could limit soil plant nutrient availability (FW-Soil-G-1, 2, 3).

Threats to Arizona cliffrose and its habitat on lands under Forest Service control within the Cottonwood Recovery Unit, including roads, utility line construction, and livestock grazing, have been addressed through forest actions or change in management (as described under Risk Factors) but are addressed and strengthened in alternative B (modified) (FW-Graz-DC-2, 5, FW-SpecUse-DC-2, FW-RdsFac-DC-3, FW-RdsFac-G-3, FW-SpecUse-G-1, FW-SpecUse-G-10).

This alternative would provide protection for the plant community and soil components essential to the Arizona cliffrose. Alternative B (modified) provides desired conditions for the Desert Communities and Semi-desert Grasslands ERUs that are largely absent from alternative A. Collectively, these address community conditions, natural processes, and habitat components absent from alternative A. The guidance for All Ecosystems, Desert Communities, and Semi-

desert Grasslands address the conditions in the ERUs, and therefore, benefit the species inhabiting them, including Arizona cliffrose. Forestwide guidance for soils recognizes the need to assure proper soil function of all soil types across the forest including the specialized soils such as the Verde Formation.

The plan components for all ecosystems (FW-Eco-DC-1 to 4) and All Terrestrial ERUs (FW-TerrERU-All-DC-2) provide desired conditions for ecosystems across the forest to assure proper function and are resilient to the frequency, extent, intensity, and severity of disturbances. Additional beneficial components can be found in the Desert Communities and Semi-desert Grasslands ERU sections.

Forestwide guidance in Wildlife, Fish, and Plants provides desired conditions for properly functioning ecosystems and ecologically responsible activities that support native plants and animals (FW-WFP-DC-1) where ERUs provide the habitat components for sensitive and/or endemic species to carry out their life cycle (FW-WFP-DC-3, FW-WFP-G-10).

A desired condition for the Desert Communities ERU (FW-TerrERU-DC-DC-2) focuses on preserving the inherently sparse vegetation that is characteristic of Desert Communities including native shrubs, cacti, forbs and grasses in various seral stages and fine- and mid-scales as they naturally occur. The vegetation community may vary considerably depending on site capability (as determined by TEUI or other appropriate ecological classification system) and climate, topography, soils, and smaller scale disturbances. These varying scales are important for all plants, especially rare plants including Arizona cliffrose. Arizona cliffrose is tied to the Verde Formation, which is limited to specific soil units.

A portion of the occurrences of Arizona cliffrose is within the Semi-desert Grassland ERU. Desired conditions support soil and plant community structure at a variety of scales, providing the ability for native plants to regenerate successfully, depending on climatic conditions (FW-TerrERU-Grass-DC-1) and addressing the need for native understory vegetation to support the frequent surface fires that were part of the historic fire regime (FW-TerrERU-Grass-DC-2). This desired condition addresses non-native species, stating that they should not facilitate the spread, intensity, or severity of uncharacteristic fire.

With the growing population of the Verde Valley, recreation on National Forest System lands has also increased. Forestwide direction for recreation integrates the need to protect sensitive resources from the impacts of motorized and non-motorized recreation; the need to rehabilitate unauthorized trails so as to prevent accelerated erosion; and the need to potentially restrict national forest visitor activities where they would inhibit site restoration or cannot be made compatible through appropriate mitigations (FW-Rec-All-DC-6, FW-Rec-All-G-1, 2, FW-Rec-Trails-DC-3, 4, 11, FW-Rec-Trails-G-3).

Land exchange is another potential threat for this species. Guidelines in alternative B (modified) require that the forest consider habitat for threatened or endangered species when considering acquiring other lands and require that lands that leave forest ownership do not contain unique ecological resources (FW-LndAdj-G-1, 2).

In this alternative, mechanized use in the Verde Valley Botanical Area would not be suitable except on designated trails (Chapter 4 of the draft Revised Plan). Bicycle use on trails within the Botanical Area is currently on-going and this language would strengthen the plan direction while still allowing an existing use (FW-Rec-Trails-DC-11) and addressing potential impacts from users

leaving the established treads. A guideline is included to support the need to balance conflicts between recreational use and other resources (FW-Rec-All-G-2) including the soil components and Arizona cliffrose plants along the trails. This alternative would provide better protection for Arizona cliffrose and its habitat than alternative A, which does not include a recreation or transportation suitability determination for this botanical area.

Additional information on the plan components related to Desert Communities and Semi-desert Grassland ERUs and the Verde Formation soil in these ERUS is discussed further the Coarse Filter: Habitat section by ERU.

Alternative C

Implementation of plan components under alternative C would have similar effects to alternative B (modified) with a few meaningful exceptions. Alternative C would determine that mechanized travel is not suitable in research natural areas, botanical areas, and geological areas. This would be the most restrictive of all alternatives, and would likely result in prohibiting bicycles within the Verde Valley Botanical Area. It would add an additional layer of protection for Arizona cliffrose plants and the fragile Verde Formation. It could remove bicycle use from 1.1 miles of the Lime Kiln Trail and from 1.4 miles of the 1.8-mile-long Bill Ensign Trail within the botanical area. These trails and others in the area currently provide longer distance loops for users accessing the trails from the Deadhorse Ranch State Park and similar areas. These connections would be removed for bicycle riders if this alternative is selected, but only after a decision is made to do so, based on project-level analysis. These areas and trails would remain an option for hikers and horseback riders.

Alternative D

The effects to Arizona cliffrose from alternative D are the same as alternative B (modified).

Findings

Arizona cliffrose is vulnerable to perturbations in the environment because of small population sizes and localized habitat due to unique and specific soil conditions. The reasons for these findings are described above as well as in the Coarse Filter: Habitat section on Desert Communities and Semi desert Grasslands. Implementation of plan components related to vegetation treatments, livestock grazing, recreation management, watershed management, wildlife, fish or rare plants management, or land acquisition in any of the alternatives may have short-term effects, but would produce long-term benefits to the maintenance and improvement of habitat and Arizona cliffrose populations on the Coconino NF. Although actions could be implemented under these alternatives that would result in impacts to individuals, all alternatives would result in contributing to the viability and persistence of the populations of this species because:

- Plan guidance in the Wildlife, Fish, and Plants section provides protections for this species by directing the forest to follow recovery plans and improve habitat to promote the recovery of species (1987 Plan, page 64; FW-WFP-DC-2, FW-WFP-G-1). This strengthens existing Federal law, policy, and Forest Service Manual direction; and
- All alternatives maintain the unique qualities of the Verde Valley Botanical Area, which contains habitat for the majority of Arizona cliffrose.

Alternative C would likely remove bicycle travel on trails within the Verde Valley Botanical Area over time, based on project-level decisions. This would reduce effects such as trail widening on

tight turns, specifically along the Lime Kiln Trail. Alternatives B (modified), C, and D would better maintain the viability of this species because plan components for the Desert Communities and Semi-desert Grasslands ERUs would contribute to the maintenance of habitat components needed to maintain Arizona cliffrose habitat and protect its population in the Verde Valley. These plan components are largely absent in alternative A.

San Francisco Peaks Ragwort

Affected Environment

San Francisco Peaks ragwort was listed as threatened in 1983, and has designated critical habitat. The recovery plan for the species was prepared in 1987.

Distribution

San Francisco Peaks ragwort is an endemic species occurring only on the San Francisco Peaks. The species has 213 acres of occupied habitat, which all occurs within the Kachina Peaks Wilderness with part of the population within the San Francisco Peaks Research Natural Area (USDA Forest Service 2012).

Habitat

San Francisco Peaks ragwort is restricted to portions of the Alpine Tundra (161 occupied acres) and-Fir (72 occupied acres) ERUs. This restricted distribution makes it especially vulnerable to perturbations and disturbance. Three broad habitats occur in the alpine tundra of the San Francisco Peaks: boulder field, fellfield-snow-bed communities, and fellfield (USDA Forest Service 1984). Large expanses of the alpine tundra consist of boulder fields and do not support vascular plants. San Francisco Peaks ragwort occurs only in the fellfields. There are only a few plant occurrences in the upper edges of the Spruce Fir ERU in small openings. Talus slopes are also important habitat features for San Francisco Peaks ragwort. It is a small clonal species that can also reproduce sexually by producing seeds. Frost action and soil gravitational movement break up the clones, producing independent plants. The total population of San Francisco Peaks ragwort is estimated at 100,000 (USDI Fish and Wildlife Service 1987) to 180,000 clones (Fowler and Sieg 2010) or 90,000 to 135,000 plants (USDA Forest Service 2012).

The habitat is dissected by several heavily used trails, one of which leads to Humphrey’s Peak, the highest point in Arizona. The alpine tundra on the San Francisco Peaks has been closed to off-trail hiking since 1984. A portion of the habitat overlaps the Snowbowl Ski Area.

Critical Habitat: Critical habitat has been designated for San Francisco Peaks ragwort. Areas designated as critical habitat are the summits of Agassiz and Humphries Peaks and the surrounding slopes and alpine areas, San Francisco Peaks, Coconino National Forest, Coconino County, Arizona (Township 22 North, Range 7 East N ½ of the NW ¼ of Section 5, Township 23 North, Range 7 East, W ½ Section 32 and W ½ Section 29) covering approximately 720 acres.

The primary constituent elements for San Francisco Peaks ragwort’s designated critical habitat are the loose cinder talus slopes of the San Francisco Peaks alpine tundra system. Unnatural disturbance from human activities and damage from hikers was the main concern during listing. Management of this area to reduce disturbance of the talus slopes is necessary to protect the species (USDI Fish and Wildlife Service 1983). The components cited below that protect the species also protect the critical habitat.

Risk Factors

Off-trail hiking reduces the vigor, maintenance, and survival of tundra plant species. Avalanche abatement reduces slope stability and may result in loss of plants from landslides. Avalanche abatement affects approximately 12 percent of the species' habitat (Dexter 2007) and is controlled through the current special-use permit for the Arizona Snowbowl.

San Francisco Peaks ragwort is a narrow endemic whose distribution is limited to the San Francisco Peaks. This single location makes it more vulnerable to perturbations and extinction than more widespread species. Threats to the species include off-trail hiking and the expansion of the Snowbowl Ski Area, leading to higher visitor use in the habitat (USDI Fish and Wildlife Service 2010). It is speculated that San Francisco Peaks ragwort numbers will decline and the species could possibly go extinct from climate change (Fowler and Sieg 2010). Climate change is a threat, especially to this species because there is no replacement habitat for it on the forest or within several hundred miles.

Additional threats include those to the Alpine Tundra and Spruce-Fir ERUs. Additional information on the threats to these ERUs is available in the Coarse Filter: Habitat sections. There is some risk, although minor, of loss of individuals to fire in the upper portions of the Spruce-Fir ERU. These losses are difficult to mitigate due to the natural fire regime, which is infrequent but stand-replacing, and the presence of wilderness that restricts the options for fire suppression in these areas. Fire in the Alpine Tundra is unlikely.

Environmental Consequences

The scope of this analysis includes Alpine Tundra and Spruce-Fir ERUs. The Coarse Filter: Habitat section compares the alternatives in regard to threats to Alpine Tundra and Spruce-Fir ERUs and overall habitat for San Francisco Peaks ragwort. The analysis below focuses on those risk factors and program areas that would be most consequential in terms of maintaining viability for San Francisco Peaks ragwort.

Table 73 summarizes the viability analysis for San Francisco Peaks ragwort. This table was developed using the analysis process described under the Species Viability section above. It includes information on the status, F Rank, habitat, habitat condition and trend, likelihood that this species is limited by its habitat, and the projected management effect, by alternative. Management effect categorizes the relative expected outcome of plan language in each alternative in terms of minimizing species viability risk and are the result of plan decisions, including plan objectives. Management effect category values are 1, 2, 3, and 4. The lower the management effects rating for a species' associated habitat, the more effective the alternative is for that species viability. These topics and the effects of the alternatives are explained in greater detail in the discussions on the alternatives that follow.

Table 73. Analysis summary for San Francisco Peaks ragwort

Species and status	Habitat	Alternative A		Alternatives B (modified), C, and D	
		Habitat condition and trend relative to desired conditions	Likelihood species is limited	Habitat condition and trend relative to desired conditions	Likelihood species is limited
San Francisco Peaks ragwort (Threatened, Narrowly Endemic) F Rank = F1*	AT	Good, away	H	Good, away	H
	SF	Fair, toward	VH	Fair, toward	VH
	Talus Slopes	Good, static	M	Good, static	M
Management effect		AT = 2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area. SF = 4: Decline in habitat quality as a result of management or lack of management that result from plan components. Plan components may not exist or may be few. Talus slopes = 3: Plan components maintain or improve protection and management for some habitat occurrences in the plan area. Quality of habitat or habitat elements is maintained or improved by providing protection, maintenance, and restoration to some occurrences.		All habitats = 2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.	

*F1: Very rare on the forest within its habitat – occupies a very small portion of its habitat.

Common to All Alternatives

Plan components in all alternatives contribute to species viability by managing for sustainable populations of native species and improving and protecting habitat for threatened, endangered, and sensitive species (1987 Plan, pages 22-1, 23, 64, 64-1, 66, 95, 108-2, 180, 187, 206-9, 206-11, 206-12, 206-13, 206-23, 206-30, 206-32, 206-66, 206-67, 206-71, 206-72, 206-79, 206-87, 206-89, 206-98, 206-103, 206-105, 206-108, 206-109, 206-114; FW-WFP-DC-1, 2, 3, 4, 5, 6, 8, FW-Eco-DC-1). See At-risk Species in the Wildlife and Plant Issues and Topics section above for more information.

Under all alternatives, management and guidance for San Francisco Peaks ragwort would be subject to consultation with the Fish and Wildlife Service and continue to follow the recovery

plan (1987 Plan, page 64-1; FW-WFP-G-1). All alternatives provide protections for this species by directing the forest to follow recovery plans and improve habitat to promote the recovery of species (1987 Plan, page 64; FW-WFP-DC-2, FW-WFP-G-1).

All alternatives close the area above tree line to off-trail hiking during snow-free periods (1987 Plan, pages 108, 110; SA-Wild-S-3). All alternatives also prohibit horse and pack stock (except for limited administrative use) on the Humphrey's Trail and Weatherford Trail above Doyle Saddle and recreational livestock above tree line or in the watersheds draining into the Inner Basin (1987 Plan, page 108; MA-Peaks-S-1, 2, 3, MA-InBsn-S-1, SA-Wild-S-4). Camping would be prohibited above tree line under all alternatives (1987 Plan, page 108; SA-Wild-S-4). Use in the City of Flagstaff watershed (draining into Inner Basin) is limited to day use foot traffic under all alternatives, and the area may be closed if unacceptable damage occurs as determined by a degradation of water quality (1987 Plan, pages 108, 191; MA-InBsn-S-1, MA-InBsn-G-7, MA-Peaks-S-1, 2). Collectively, this plan direction protects this species and its habitat by removing the ground-disturbing impacts associated with dispersed recreation.

Grazing in Alpine Tundra and the upper slopes of Mixed Conifer forests is prohibited in all alternatives. The Alpine Tundra and upper Mixed Conifer/Spruce-Fir slopes within the Kachina Peaks Wilderness (areas above 9,500 feet elevation) were closed to grazing and were removed from inclusion in any allotment with the approval of the 1987 Plan (1987 Plan, page 110). Alternatives B (modified), C, and D identified these areas as unsuitable for grazing in Chapter 4 of the revised plan (see table 12, Areas unsuitable for grazing on Coconino NF). Removing grazing also protects habitat from grazing-related surface disturbance and possible grazing of individual plants, promoting the survival and reproduction of the species.

The San Francisco Peaks Research Natural Area is common to all alternatives. The existing San Francisco Peaks Research Natural Area was established in 1931, and is an example of a bristlecone pine/tundra/old-growth spruce-fir community. It currently covers 1,010 acres, but would be expanded in alternatives B (modified), C, and D to include an additional 141 acres of alpine tundra habitat to the existing research natural area. Both the existing and expansion portions of the research natural area contain known occurrences of San Francisco Peaks ragwort. Research natural areas are part of a national network of ecological areas designated in perpetuity for research and education and/or to maintain biological diversity on National Forest System lands. Research natural areas are managed to protect and maintain their uniqueness and ecological condition (1987 Plan, page 195; SA-RNABotGeo-DC-1, 2, 4).

The research natural area and all known occurrences and habitat for San Francisco Peaks ragwort are completely within the Kachina Peaks Wilderness Area, so the more restrictive laws, regulations, and policies that apply to wilderness would be common to all alternatives (1987 Plan, pages 101, 108; SA-Wild-DC-1 to 11, SA-Wild-S-3, 5). Alternatives B (modified), C, and D expressly include desired conditions for wilderness to contribute to the preservation of San Francisco Peaks ragwort and its habitat by preserving the primitive integrity of wilderness while sustaining the ecosystems and ecological resources and addresses the natural processes and functions in the wilderness (SA-Wild-DC 1, 2)

These restrictive management components reduce the risk of damage to habitat and individual plants by off trail activities.

Alternative A

Prior consultations under the Endangered Species Act

A Biological Assessment for the continued implementation of forest LRMPs across the region was prepared in 2004 (USDA Forest Service 2004d). The determination of effect for San Francisco Peaks ragwort stated that the continued implementation of the LRMP was “may affect not likely to adversely affect” the San Francisco Peaks ragwort. This finding was based on the assumption that the population of San Francisco Peaks ragwort is stable, the integration of the Alpine Tundra Management Plan (1984), the area closure prohibiting off-trail hiking in the alpine tundra, and no livestock grazing in the habitat. The Biological Assessment stated that continuing to implement the LRMPs was not likely to adversely affect critical habitat for the San Francisco Peaks ragwort. The Biological Assessment supported this conclusion by citing the presence of wilderness, which provides an added layer of protection, as well as the area closure prohibiting off-trail hiking in the alpine tundra and no livestock grazing in the habitat. An additional protective measure, the expansion of the San Francisco Peaks Research Natural Area, was cited as a beneficial action for critical habitat, but the expansion was never completed.

The Fish and Wildlife Service concurred with this finding in their Biological Opinion (USDI Fish and Wildlife Service 2005a). Their findings were based on the conservation measures for the San Francisco Peaks ragwort, the area closure prohibiting off-trail hiking in the alpine tundra, and no livestock grazing in the habitat. The Fish and Wildlife Service agreed with the determination that the LRMP will not destroy or adversely modify critical habitat of the San Francisco Peaks ragwort based on guidance that protects critical habitat, the area closure for hiking, and the closure of the alpine tundra and upper mixed conifer slopes to grazing and removal of these areas from any grazing allotment.

The Southwestern Region prepared another biological assessment for the continued implementation of the forest LRMPs across the region in 2011. The BA contained “may affect not likely to adversely affect” findings for the species and critical habitat. There have been no significant changes in LRMP or significant scientific information to warrant a change in the finding (USDA Forest Service 2011f). The 2012 Biological Opinion concurred with the finding (USDI Fish and Wildlife Service 2012d).

Since 2011, there have been two amendments to the current plan; one addressing cultural resources and one incorporating the direction of the Travel Management Rule decision into the current plan. Neither of these apply to San Francisco Peaks ragwort.

Since 2012, there have been no significant changes in LMRP or significant scientific information to warrant a change in the finding.

Table 73 shows that under alternative A, Alpine Tundra ERU would remain in good condition, but would trend away from desired conditions primarily due to climate change. Spruce-Fir ERU would remain in fair condition and trend toward desired conditions. Talus slopes would remain in good condition with a static trend.

As shown in table 73, the likelihood that habitat on the forest would be a limiting factor for the San Francisco Peaks ragwort is moderate to very high depending on the habitat. These likelihoods were derived by combining San Francisco Peaks ragwort’s F Rank of F1 with the likelihood of habitat limitation variables for each ERU: Alpine Tundra (moderate), Spruce-Fir (high), and talus

slopes (low) (table 9). Low to moderate ratings are considered to be within the natural range of fluctuations for the habitat.

The management effect row shows the relative expected outcome of plan language in terms of minimizing species viability risk. The management effect is classified as a 2 for Alpine Tundra. This means that plan components in alternative A maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area. Although there are no specific components addressing alpine tundra in alternative A, provisions closing the area to off-trail hiking and grazing (1987 Plan, pages 108, 110) and providing wilderness and watershed protection for the area.

The management effect is classified as a 4 for Spruce-Fir, which means there is a decline in habitat quality as a result of management or lack of management that result from plan components. Plan components may not exist or may be few. Alternative A lacks plan components specific to spruce-fir and existing plan components make it difficult to implement fire treatments in wilderness which overlaps the majority of spruce-fir vegetation on the forest. However, because plan components related to wilderness are generally protective, the fire return interval is only moderately departed, insect and disease activity is mainly within the historic range of variability, and few management activities have occurred, the spruce-fir portion of the habitat is still functional, See the section on Vegetation and Fire in volume 1 of the FEIS for detailed information.

The management effect is classified as a 3 for talus slopes, which means that plan components in alternative A maintain or improve protection and management for some habitat occurrences in the plan area, and thus, contribute less to the viability of this species than the other alternatives. This is primarily because alternative A closes the area above tree line to hiking during snow-free periods, minimizing the effects of foot traffic. This in turn reduces the threat of soil displacement and rock movement on the steep slopes, protecting the critical habitat of San Francisco Peaks ragwort.

Alternative A provides overarching plan direction for federally listed species to inventory, evaluate, and prepare recovery schedules for proposed, threatened, endangered, and sensitive plant species and provide appropriate law enforcement to protect habitat for listed species (1987 Plan, page 64, 65). This species and its habitat are located entirely in the Kachina Peaks Wilderness. Alternative A includes direction to implement corrective measures such as wilderness permit system if overuse causes unacceptable resource damage (1987 Plan, page 107). Under this alternative, the San Francisco Peaks ragwort is to be managed by the direction present in its management plan and in accordance with the San Francisco Peaks Tundra Management Plan, which is incorporated into alternative A and into the Recovery Plan (1987 Plan, page 65). Management under these components would protect the species and its critical habitat.

Alternative B (modified)

A Biological Assessment for the revision of the Coconino NF Land Management Plan was prepared in 2017 (USDA Forest Service 2017c). The determination of effect for San Francisco Peaks ragwort “may affect, not likely to adversely affect” for the species and critical habitat. The Fish and Wildlife Service concurred with this finding in their draft Biological and Conference Opinion received on August 8, 2017 (USDI Fish and Wildlife Service 2017b).

Table 73 shows that the condition and trend for the associated habitats would be the same under alternative B (modified) as alternative A. The Alpine Tundra ERU would remain in good condition and trend away from desired conditions. The Spruce-Fir ERU would remain in fair condition with a trend toward desired conditions, and talus slopes would remain in good condition with a static trend.

As shown in table 73, the likelihood that habitat on the forest would be a limiting factor for the San Francisco Peaks ragwort is moderate to very high depending on the habitat. These likelihoods were derived by combining San Francisco Peaks ragwort's F Rank of F1 with the likelihood of habitat limitation variables for each ERU: Alpine Tundra (moderate), Spruce-Fir (high), and talus slopes (low) (table 9). Low to moderate ratings are considered to be within the natural range of fluctuations for the habitat.

The management effect row shows the relative expected outcome of plan language in terms of minimizing species viability risk. The management effect is classified as a 2 for Alpine Tundra, Spruce-Fir, and talus slopes. This means that plan components in alternative B (modified) maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area. For Alpine Tundra, the management effect of 2 is the same as alternative A because plan components in both alternatives address the off-trail hiking (SA-Wild-S-3), camping (SA-Wild-S-4), and recreational livestock use (MA-Peaks-S-1, 3, MA-InBSN-S-1, SA-Wild-S-4) that can cause ground disturbance and accelerated soil erosion in this small rare ERU and degrade the habitat for the San Francisco Peaks ragwort.

For Spruce-Fir, this management effect rating is because this alternative has plan components specific to spruce-fir and the plan components in alternative A that made it difficult to implement fire treatments in wilderness have been removed. The majority of spruce-fir vegetation occurs within the Kachina Peaks Wilderness.

For talus slopes, the management effect rating of 2 is primarily because alternative B (modified) has plan components specifically for the unique ecosystem and structure associated with talus slopes, whereas there are few in alternative A. Plan components promote talus slopes that are generally undisturbed by human activities and that maintain specialized habitats for plants such as the San Francisco Peaks ragwort. In addition, a guideline states that projects and uses should maintain the integrity and function of talus slopes (FW-BioPhys-Geo-DC-1, 7, FW-BioPhys-Geo-G-1). These plan components would maintain and protect this component of ragwort habitat and promote the reproduction and survival of the species.

Alternative B (modified) would maintain the persistence and contribute to the viability of San Francisco Peaks ragwort in a variety of ways. In addition to prohibiting off-trail hiking (SA-Wild-S-3), use of horse, pack, and recreational stock (MA-InBsn-S-1, MA-Peaks-S-1, 3, SA-Wild-S-4), and overnight camping (SA-Wild-S-4), this alternative would direct new route construction and other recreation activities to avoid San Francisco Peaks ragwort habitat and to minimize disturbance to it (SA-Wild-S-5).

Talus slopes are part of the critical habitat and the primary constituent elements. Alternative B (modified) acknowledges the importance of talus slopes for the specialized habitats afforded by them (FW-BioPhys-Geo-DC-7) while providing direction to keep these and other biophysical features generally undisturbed by human activities (FW-BioPhys-Geo-DC-1). These desired

conditions add support to the Recovery Plan. The soils occupied by San Francisco Peak ragwort consist of loose volcanic soils on steep slopes. Alternative B (modified) provides forestwide guidance for the crucial habitat elements for San Francisco Peaks ragwort. The forestwide desired conditions for soil (FW-Soil-DC-1, 2) provide guidance for maintaining proper soil function and productivity within the capability of the site while providing nutrient cycling and water infiltration.

Alternative B (modified) would expand the existing San Francisco Peaks RNA into the Alpine Tundra habitat, which would include a portion of the populations and designated critical habitat. This would offer additional protections to the plant and habitat because research natural areas are permanently protected and maintained in natural condition, so they may serve as experimental research controls and monitoring sites, and be used for education. Associated plan components would result in little disturbance or evidence of human activities (SA-RNABotGeo-DC-1, SA-RNABotGeo-S-1, 2, SA-RNABotGeo-G-1, 2).

The Alpine Tundra ERU contains most of the known occurrences and habitat for San Francisco Peaks ragwort. Desired conditions that preserve the integrity of this ERU benefit those species that live within them. One of the desired conditions for this ERU addresses the attributes and processes that support ecological diversity and resiliency in the ERU (FW-TerrERU-AT-DC-1). Resiliency to disturbance will allow San Francisco Peaks ragwort to persist in its tundra habitat.

Another desired condition for the Alpine Tundra ERU addresses the importance of providing for the unique high-elevation ecosystem present in the Alpine Tundra including the native species and narrow endemics that are present in the diverse habitats present in the tundra including the boulder fields, talus slopes, and high-elevation meadows that form specialized habitats in this harsh environment (FW-TerrERU-AT-DC-2). It especially addresses the presence of San Francisco Peaks ragwort, stating that Alpine Tundra should provide habitat for the San Francisco Peaks ragwort, a federally listed species. This desired condition will reinforce other plan direction and the Recovery Plan for the species.

An Alpine Tundra ERU guideline addresses recreational activities, stating that these activities should be managed to maintain or improve ecological, attributes, processes and habitat for native biota (FW-TerrERU-AT-G-1). This guidance will strengthen the closure of the tundra area to cross-country hiking as well as providing guidance for activities such as trail maintenance in the Alpine Tundra ERU. Maintenance of existing trails is important. Well defined and maintained trails encourage people to remain on trails, while poorly maintained trails may contribute to more off-trail use and user created trails. Alternative B (modified) includes a desired condition for a system of well-marked and well-maintained sustainable trails (FW-Rec-Trails-DC-1). Three standards associated with Designated Wilderness regulate recreational uses in the Kachina Peaks Wilderness, specifically in the Alpine Tundra by limiting recreational activities to designated trails during snow-free periods (SA-Wild-S-3); prohibiting camping and livestock use above tree line (SA-Wild-S-4); and avoiding designated critical habitat, occupied habitat, and high density of plants during new route construction. (SA-Wild-S-5).

Unlike alternative A, alternative B (modified) has a standard that would affect the Arizona Snowbowl permit area and ragwort habitat. The standard applies to unauthorized areas under special use permit that are impacted by authorized activities (in this case, avalanche abatement). The standard requires the permittee to rehabilitate the impacted area (FW-SpecUse-S-2). As mentioned previously, the special use permit for this area issued under a separate NEPA process.

This could be beneficial for the species because it would restore habitat that was damaged by avalanche abatement activities.

San Francisco Peaks ragwort plants occurring in Spruce-Fir habitat are in atypical habitat, occurring in small openings in the forest as compared to the open talus slope habitat occupied by plants in the Alpine Tundra ERU. The Spruce-Fir ERU can be subdivided into lower elevation (Spruce-Fir Mix) and higher elevation (Subalpine Spruce-Fir), each with differing fire regimes and subdominant species composition. The higher elevation subtype is bounded by Alpine Tundra ERU above about 11,500 feet. San Francisco Peaks ragwort occur on the higher elevation Spruce-Fir Forest. The area containing San Francisco Peaks ragwort is along the upper edge of the ERU where it meets the Alpine Tundra ERU. In the higher elevation subtype, high-severity fires occur very infrequently (Fire Regimes IV and V). Approximately 72 acres of the higher elevation Spruce-Fir ERU are occupied by San Francisco Peaks ragwort.

The frequent small disturbances within the Spruce Fir ERU that result in small patches provide the openings for San Francisco Peaks ragwort where it occurs in the upper elevations of its habitat. A Spruce-Fir desired condition benefits San Francisco Peaks ragwort by acknowledging the varying occurrences of groups and patches of habitat depending on disturbance, elevation, soil type, aspect, and site productivity (FW-TerrERU-SF-DC-6). Another desired condition for Spruce-Fir ERU acknowledges that grasses, forbs (including San Francisco Peaks ragwort) and shrubs may comprise up to 100 percent of the vegetation in openings in the Spruce-Fir forest (FW-TerrERU-SF-DC-9). The Spruce-Fir ERU also contains a desired condition that focuses on fine scale features less than 10 acres and acknowledges the importance of small openings that are created by disturbances (FW-TerrERU-SF-DC-11). These areas provide habitat for San Francisco Peaks ragwort and other forbs, grasses and shrubs. In these areas more nutrients and sunlight would be available to the herbaceous vegetation, including San Francisco Peaks ragwort, as compared to heavily treed areas where resources might be limited.

Climate change has been identified as a risk to the high-elevation habitat occupied by San Francisco Peaks ragwort. If the habitat becomes unsuitable for San Francisco Peaks ragwort due to climate change, the species could possibly go extinct (Fowler and Sieg 2010). Plan components that promote resiliency to uncharacteristic disturbances will help to mitigate the risk. Desired conditions for all ecosystems (FW-Eco-DC-1) and all terrestrial ERUs (FW-TerrERU-All-DC-2) provide direction for proper functioning ecosystems and resiliency to San Francisco Peaks ragwort habitat while reducing the threat of uncharacteristic disturbances. A forestwide soil desired condition recognizes the importance of ecosystem processes, such as nutrient cycling and water infiltration (FW-Soil-DC-2), would maintain the harsh soils that support San Francisco Peaks ragwort, which will aid in sustaining resiliency.

Alternative C

Alternative C has the same effects as alternative B (modified).

Alternative D

Alternative D has the same effects as alternative B (modified).

Findings

San Francisco Peaks ragwort is very rare on the forest in its habitat and occupies a small portion of its habitat. It is vulnerable to perturbations in the environment because of its small population size, rarity, and because it known from only one location. Alpine Tundra ERU is similar to

reference conditions, but is trending away from reference conditions primarily due to climate change, which is causing an increase in alpine meadow conditions.

Warmer and drier weather resulting from climate change and impacts from the exotic spruce aphid may increase stress levels on the major tree species within Spruce-Fir ERU leading to higher levels of tree mortality and dramatic shifts in the structure and function and possible disappearance of the ERU on the forest. Under the scenario of warming and drying conditions, the vegetation in this high-elevation ERU cannot migrate upward to higher elevations to escape climate change. If this occurs, portions of the ERU containing San Francisco Peaks ragwort may substantially degrade and be unsuitable for this species.

All alternatives contribute to the viability and persistence of the San Francisco Peaks ragwort and contain a series of desired conditions to assure that the habitat of San Francisco Peaks ragwort is resilient to human impacts and natural disturbance.

All alternatives maintain the talus slopes that form the primary constituent elements of critical habitat for San Francisco Peaks ragwort by reducing recreation impacts through restricting off-trail use in the fragile tundra environment, but the guidance in alternatives B (modified), C, and D provide more complete and integrated direction in areas such as biophysical features and soil.

Given prohibitions in off-trail hiking in the San Francisco Peaks ragwort's habitat, as well as other measures that reduce recreation impacts, trampling of plants, and increased soil instability from off-trail hiking would be addressed in all alternatives, but the guidance in alternatives B (modified), C, and D is more complete and integrated into program areas.

Under all alternatives, avalanche abatement would be limited by special-use permit. However, unlike alternative A, under alternatives B (modified), C, and D if unauthorized areas are impacted, the permittee would be required to rehabilitate the impacted area (FW-SpecUse-S-2).

Threatened and Endangered: Reptiles

Narrow-headed Gartersnake

Affected Environment

The narrow-headed gartersnake was listed as threatened in 2014 (USDI Fish and Wildlife Service 2014) with proposed critical habitat defined in 2013 (USDI Fish and Wildlife Service 2013), but not yet designated. No recovery or conservation plan had been published yet.

Distribution

Narrow-headed gartersnakes are found broadly across the forest, but in densities not thought to be viable in many watersheds. This species occurs in perennial stream habitats up to 8,500 feet in elevation across the Mogollon Rim in Arizona and New Mexico. This species' distribution and abundance have declined significantly, with densities in some extant populations thought to be too low to be viable (USDI Fish and Wildlife Service 2014). It had previously been documented throughout the sub-basins of the Gila watershed, including the Salt, Verde, and Gila Rivers. As of 2011, the species was only found reliably in Oak Creek Canyon and less reliably, likely due to low densities, in other creeks within the Verde watershed on the forest (USDI Fish and Wildlife Service 2014).

Habitat

These animals are associated with clear, rocky streams using pool and riffle habitats that include cobbles and boulders for hiding as it is an ambush predator (USDI Fish and Wildlife Service 2014, AZGFD 2012). Streamside, shrub-sized vegetation is important to this species for basking and to facilitate quick escape from predators (USDI Fish and Wildlife Service 2014). This species requires connected aquatic habitats that allow for migration and that are free from invasive competitors and predators.

Critical habitat is proposed in upper Verde River watershed, including the Verde River, Oak, and West Fork Oak Creeks (AZGFD 2012). The Primary Constituent Elements are stream habitat, terrestrial space, viable prey species of native fishes, and absence of non-native or invasive species.

Risk Factors

Threats to narrow-headed gartersnakes include loss or degradation of habitat through changes or loss of streamflow and connected aquatic habitats, loss of riparian vegetation and increased sedimentation through both grazing and increased recreational use of riparian areas. This species is also threatened by introduced or invasive predators, such as bullfrogs, crayfish and predatory fishes (AZGFD 2012, USDI Fish and Wildlife Service 2014).

Environmental Consequences

The scope of this analysis includes Cottonwood Willow and Mixed Broadleaf Deciduous Riparian Forest Types, including adjacent mesquite bosques, and proposed critical habitat for the narrow-headed gartersnake. The analysis below focuses on those risk factors and program areas that would be most consequential in terms of maintaining viability for narrow-headed gartersnake.

Table 74 summarizes the viability analysis for narrow-headed gartersnake. This table was developed using the analysis process described under the Species Viability section above. It includes information on the status, F Rank, habitat, habitat condition and trend, likelihood that this species is limited by its habitat, and the projected management effect, by alternative. Management effect categorizes the relative expected outcome of plan language in each alternative in terms of minimizing species viability risk and are the result of plan decisions, including plan objectives. Management effect category values are 1, 2, 3, and 4. The lower the management effects rating for a species' associated habitat, the more effective the alternative is for that species viability. These topics and the effects of the alternatives are explained in greater detail in the discussions on the alternatives that follow.

Table 74. Analysis summary for the narrow-headed gartersnake

		Alternative A		Alternatives B (modified), C, and D	
Species and status	**Habitat**	**Habitat condition and trend relative to desired conditions**	**Likelihood species is limited**	**Habitat condition and trend relative to desired conditions**	**Likelihood species is limited**
Narrow-headed gartersnake (Threatened,	CWRF	Fair, slowly toward	VH	Good, slowly toward	H
	MBDRF	Good, static to slowly toward	H	Good, slowly toward	H

Species and status	Habitat	Alternative A		Alternatives B (modified), C, and D	
		Habitat condition and trend relative to desired conditions	Likelihood species is limited	Habitat condition and trend relative to desired conditions	Likelihood species is limited
Endemic)	MWRF	Good, static to slowly toward	H	Good, slowly toward	H
F Rank = F1*	Perennial streams	Poor, static	VH	Poor, toward	VH
Management effect		CWRF, MBDRF, and MWRF = 3: Plan components maintain or improve protection and management for some habitat occurrences in the plan area. Quality of habitat or habitat elements is maintained or improved by providing protection, maintenance, and restoration to some occurrences. Perennial streams = 4: Decline in habitat quality as a result of management or lack of management that result from plan components. Plan components may not exist or may be few.		All habitats = 2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.	

* F1: Very rare on the forest within its habitat – occupies a very small portion of its habitat.

Common to All Alternatives

Plan components in all alternatives contribute to species viability by managing for sustainable populations of native species and improving and protecting habitat for threatened, endangered, and sensitive species (1987 Plan, pages 22-1, 23, 64, 64-1, 66, 95, 108-2, 180, 187, 206-9, 206-11, 206-12, 206-13, 206-23, 206-30, 206-32, 206-66, 206-67, 206-71, 206-72, 206-79, 206-87, 206-89, 206-98, 206-103, 206-105, 206-108, 206-109, 206-114; FW-WFP-DC-1, 2, 3, 4, 5, 6, 8, and FW-Eco-DC-1). See At-risk Species in the Wildlife and Plant Issues and Topics section above for more information.

Disease, competition, and predation through introductions of non-native species are the greatest fine filter threats to Narrow-headed gartersnakes and their native fish prey. There is language under all alternatives that prioritizes habitat improvement and protections for projects for threatened and endangered species (1987 Plan, pages 23, 59, 64-6, 87; FW-LndAdj-G-1, FW-Minerals-G-3, FW-RdsFac-G-7, Alternatives B (modified) C, D). Additionally, management applications under alternatives B (modified), C, and D provide recommendations to managers regarding approaches for successful implementation of plan components, such as prioritization of work to benefit threatened and endangered species (FW-RdsFac-MgtApp, FW-Rip-All-MgtApp, FW-Rip-Strm-MgtApp, FW-Water-MgtApp). Finally, all alternatives contain plan components provide for some guidance to manage introductions of non-native species (see Non-native or Invasive Species in the Wildlife and Plant Issues and Topics section); however, viability of native

species is threatened on the forest when the focus is limited solely to introductions because most of the aquatic habitat on the forest already has undesirable non-native species.

The existing Munds Mountain and Red Rock-Secret Mountain Wilderness Areas protect parts of potential critical habitat for this species and habitat for native fish prey species in the Oak Creek watershed from sedimentation due to roads and accessibility.

Alternative A

Because it was listed as Threatened in 2014, the narrow-headed gartersnake was not analyzed in previous LRMP or plan amendment Biological Assessments and Biological Opinions.

The Aquatics Specialist’s Report for the forest Plan Revision FEIS (USDA Forest Service 2016d) determined “the continued implementation of alternative A may affect and is likely to adversely affect the narrow-headed gartersnake and its proposed critical habitat.” Factors leading to this finding include relatively inadequate guidance related to management of introduced species; threatened and endangered species conservation strategies; integration of riparian, water, and aquatic species management strategies; improvement in watershed conditions, riparian, and stream habitats; language to support habitat connectivity; and strategies to address climate change. In particular, alternative A does not adequately protect habitat conditions of native fish communities that the gartersnake relies upon.

<u>Viability</u>

Table 74 shows that under alternative A, Cottonwood Willow Riparian Forest would remain in fair condition and have a slow trend toward desired conditions. In Cottonwood Willow, some portions of the Verde River, Dry Beaver Creek, and Spring Creek, would be static due to high recreation or private land, such as the area around Childs, Spring Creek, Dry Beaver Creek, and private lands.

Mixed Broadleaf Deciduous Riparian Forest would remain in good condition. Static trends would be associated with the Oak Creek 5th code and West Clear Creek 5th code HUCs. The trend would be static or moving slowly toward desired conditions except in the Beaver Creek, West Clear Creek and Oak Creek 5th code HUCs and portions of Fossil Creek where recreation impacts are high. Areas of private land would remain static as well.

Montane Willow Riparian Forest would remain in good conditions with a majority of the habitat either static or trending slowly toward desired conditions, except the Upper Clear Creek 5th code HUC is trending toward desired conditions.

Perennial streams would remain in poor condition with a static trend in relation to desired conditions. This condition is generally due to most streams having invasive and non-native animal species that are outside of their historic variability.

As shown in table 74, the likelihood that habitat on the forest would be a limiting factor for narrow-headed gartersnake is high to very high for depending on the habitat. These likelihoods were derived by combining the narrow-headed gartersnake’s F Rank of F1 with the likelihood of habitat limitation variables for each ERU: Cottonwood Willow Riparian Forest (high), Mixed Broadleaf Deciduous Riparian Forest (moderate), Montane Willow Riparian Forest (moderate, except the Fern Mountain Botanical Area and Upper Clear Creek 5th code HUC are high), and

perennial streams (high) (table 9). Low to moderate ratings are considered to be within the natural range of fluctuations for the habitat.

The management effect row shows the relative expected outcome of plan language in terms of minimizing species viability risk. The management effect is classified as a 3 for Cottonwood Willow, Mixed Broadleaf, and Montane Willow Riparian Forests, which means that plan components in alternative A maintain or improve protection and management for some habitat occurrences in the plan area and thus contribute less to the viability of this species than the other alternatives. Alternative A would maintain or improve riparian forests and streamcourses because it has a focus on improving riparian areas in any condition, preventing damage to riparian vegetation, stream banks, and channels, and restoring degraded riparian areas to good condition as soon as possible (1987 Plan, pages 65-2, 65-8, 172, and 206-8). Other protective language includes the following: Only beneficial new special uses are allowed in riparian areas and exceptions such as utility line or roads crossing stream courses are designed to minimize the extent and magnitude of impact to riparian areas (1987 Plan, page 177). Aggressive fire suppression may be used to prevent resource damage utilizing methods that minimize long-term adverse impacts to riparian habitats (1987 Plan, page 177). In addition, acquisition of riparian areas through land exchange is a high priority (1987 Plan, pages 177 and 185). The plan would manage commercial uses, and recreation in some areas, to protect riparian values (1987 Plan, pages 206-10, 22, 26, and 39). This alternative has less potential for improvement to riparian condition compared to the other alternatives because plan language for specific riparian forest types is lacking and there is not a focus on functioning-at-risk and non-functional riparian areas (USDA Forest Service 2016b).

The management effect is classified as a 4 for perennial streams, which means there is a decline in habitat quality as a result of management or lack of management that result from plan components. Plan components may not exist or may be few. As described in the Coarse Filter: Habitat section, the threat of dispersed recreation to riparian resources is not addressed forestwide in alternative A. Special areas such as the Verde Wild and Scenic River and wilderness, and the management areas within Flagstaff/Lake Mary Ecosystem Area and the Sedona-Oak Creek Planning Area most specifically address the conflicts and strategies to resolve resource damage in riparian areas. This direction mainly addresses dispersed recreations impact to specific riparian areas where there have been past conflicts and resource damage, but it provides very limited direction when areas that previously received low use are “discovered” and see unexpected increases in recreation, such as Fossil Creek. As a result, alternative A addresses this threat sporadically compared with alternatives B (modified), C, and D, but it does mitigate some of the areas where the conflict is most pronounced.

Alternative A provides some guidance to reduce introductions of non-native species (primarily focused on plant species, 1987 Plan, page 206-72), but this language is insufficient in scope to maintain viability of narrow-headed gartersnake and their native fish prey on the forest. Currently, some wilderness protections are afforded by the implementation of broad standards, such as complying with Arizona water quality standards that would minimize affects to the habitat of narrow-headed gartersnake (1987 Plan, pages 23 and 74). Management concerns not currently well addressed in the 1987 plan include language to address management of introduced or invasive species; threatened and endangered species conservation strategies; integration of riparian, water, and aquatic species management strategies; language to support habitat connectivity; and strategies to address climate change. Additionally, recreational use suitability from less to more motorized access in the Oak Creek proposed to accommodate the increasing

human community needs does not provide for protection of narrow-headed gartersnake habitat nor that of their prey base, and alternative A retains the most acreage for motorized access and roads. Trends in watershed conditions are likely to remain static, with declining flows in perennial streams due to climate change and continued water development off-forest lands that impact groundwater and stream volume on the forest. Viable populations of this species are very limited within its habitat on the forest, and it is sensitive to habitat disturbances that alter riparian vegetation, accessible terrestrial space adjacent to streams, debris and boulders for cover and stream habitat conditions that support native fish prey including natural hydrograph, connectivity, macroinvertebrate and macrophyte communities, and introduced or invasive predators and competitors.

Alternative B (modified)

Consultation under the Endangered Species Act

A Biological Assessment for the revision of Coconino NF Land Management Plan was prepared in 2017 (USDA Forest Service 2017c). The determination of effect for narrow-headed gartersnake and its critical habitat was “may affect, likely to adversely affect” primarily due to the potential for adverse effects of activities such as livestock grazing and thinning or prescribed burning in watersheds containing narrow-headed gartersnakes. The Fish and Wildlife Service determined that “implementation of the Coconino NF’s revised LRMP will not jeopardize the continued existence of the narrow-headed gartersnake and northern Mexican gartersnake, and will not destroy or adversely modify their proposed critical habitat” in their draft Biological and Conference Opinion received on August 8, 2017 (USDI Fish and Wildlife Service 2017b). No incidental take was assigned. The Fish and Wildlife Service provided six discretionary conservation recommendations intended to minimize or avoid adverse effects, help implement recovery plans, or develop information.

Viability

Table 74 shows that under alternative B (modified), Cottonwood Willow Riparian Forest would improve to good condition and trend slowly toward desired conditions except portions of the Verde River, Towel Creek, Spring Creek and Dry Beaver Creek would improve faster (i.e., have a trend toward desired conditions).

Mixed Broadleaf Deciduous Riparian Forest would remain in good condition and slowly move toward desired conditions except portions of Fossil Creek and Wet Beaver Creek would remain static in areas of high recreation use. It would improve faster than alternative A in the Beaver Creek, Oak Creek, West Clear Creek, and Fossil Creek 5th code HUCs.

Montane Willow Riparian Forest would remain in good condition and slowly move toward desired conditions. In the Upper Clear Creek 5th code HUC, Montane Willow would move toward desired condition at a faster rate than alternative A.

Perennial streams would remain in poor condition, but the trend would be toward desired conditions because of updated plan components (see management effect discussion below).

As shown in table 74, the likelihood that habitat on the forest would be a limiting factor for narrow-headed gartersnake is high to very high depending on the habitat. These likelihoods were derived by combining narrow-headed gartersnake’s F Rank of F1 with the likelihood of habitat limitation variables for each ERU: Cottonwood Willow Riparian Forest (moderate), Mixed

Broadleaf Deciduous Riparian Forest (moderate), Montane Willow Riparian Forest (moderate), and perennial streams (high) (table 9). Low to moderate ratings are considered to be within the natural range of fluctuations for the habitat.

The management effect row shows the relative expected outcome of plan language in terms of minimizing species viability risk. The management effect is classified as a 2 for all the coarse filter habitats associated with the narrow-headed gartersnake. This means that plan components in alternatives B (modified), C, and D maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area. For Cottonwood Willow, Mixed Broadleaf Deciduous, and Montane Willow riparian forest types, this rating is primarily because there are updated desired conditions and guidelines that distinguish between the riparian forest types and that support their respective composition, structure, and function (FW-Rip-RipType-DC-1 to 6 FW-Rip-RipType-G-1 to 4). In addition, riparian functional condition would improve faster than alternative A, especially along the Verde River, Towel Creek, Spring Creek, and Dry Beaver Creek, which is habitat for bald eagles, beavers, common black hawks, and western red bats. The desired conditions manage for vegetation diversity and riparian function including in priority watersheds (FW-Rip-RipType-DC-1 and 2; FW-Water-G-2; FW-Rip-RipType-O-1). More site-specific aquatic management zone guidelines protect riparian function and water quality (FW-Rip-All-G-3; Fw-Rip-Strm-G-2) (USDA Forest Service 2016b). Plan components in the Wildlife, Fish, and Plant section also contribute to the viability of species associated with riparian areas by promoting properly functioning ecosystems that have the necessary physical and biological components to meet the needs of associated native species (FW-WFP-DC-1 and 3).

For perennial streams, this management effect rating is based on language regarding mitigating the effects of roads and promoting connectivity within drainages and between streamcourses and upland habitats, (see FW-RdsFac-G-2, 5, 7 and 9 and the Connectivity topic in the Wildlife and Plants Topics and Issues section). Although there are three recommended wildernesses, only the Davey’s recommended wilderness area connects to perennial water, Fossil Creek. Guidelines for recommended wilderness would lessen the effects of roads by restricting motorized use except for limited permitted and administrative use and promoting trails for mechanized and non-motorized use (SA-RWild-G-3, 5). This is beneficial for connected waters and habitat for these species because roads can alter natural water flow patterns and natural sediment levels.

Restoration activities in alternative B (modified) (i.e., installation of non-native species barriers, vegetation treatments that reduce uncharacteristic fires within watersheds, vegetation plantings and riparian restoration and channel stabilization projects) may have short-term negative impacts, but they will have long-term benefits to the species. The greatest threat to narrow-headed gartersnake populations is lack of water during drought conditions and predation, competition, and effects on the native fish prey base from non-native fish, bullfrogs, and crayfish. Cooperative actions with Arizona Game and Fish and the Fish and Wildlife Service under the Wildlife/Fish/Plants program may help decrease the threats from non-native species (FW-Invas-DC-1; FW-Invas-G-1). Guidance under alternative B (modified) will likely move perennial stream habitats more rapidly toward desired conditions (USDA Forest Service 2016j), possibly adding and connecting more suitable stream habitats to be available for narrow-headed gartersnakes and their prey (also see Connectivity). This species has no recovery plan but has proposed critical habitat on the forest, some of which is accessible to grazing and recreational impacts. Plan language for Alternative B (modified) includes guidance for incorporating the recovery actions and conservation strategies for federally listed or candidate species including

their critical habitats (FW-WFP-G-1, 2). The implementation of plan components are expected to have minimal effects to narrow-headed gartersnake population in the West Fork of Oak Creek. Most of the West Fork of Oak Creek watershed is designated as either wilderness or resource natural area so vegetation treatments are unlikely to occur.

Alternative C

Implementation of plan components under alternative C would have similar effects to alternative B (modified) with a few meaningful exceptions. Alternative C would have more recommended wilderness areas. Under alternative C, the Deadwood Draw Recommended Wilderness Area increases the protected areas in Beaver Creek, and within the Oak and Beaver Creek 5th code HUCs to 17 percent from 15 percent protected under alternatives A, B (modified), and D. Wilderness areas and inventories roadless areas provide protections to reduce or eliminate the impacts of road and motorized vehicle access. Roads and dispersed recreational use can damage riparian vegetation, compact soils, and lead to increases in sedimentation and embeddedness that adversely impact the narrow-headed gartersnake and its habitats. In addition, motorized access adjacent to Oak and Beaver Creeks may continue to cause adverse impacts, but these areas are reduced under alternative C to the greatest extent of the four alternatives.

Alternative D

Alternative D is similar to alternative B (modified) in most aspects. However, alternative D does not recommend new wilderness areas. The effects associated with managing those areas as recommended wilderness would not occur. These areas would still be managed by the other forestwide, management area, and special area direction in alternative B (modified) with the corresponding effects discussed above in the alternative B (modified) section.

Alternative D would designate the Cottonwood Basin Geological Area (which contain no springs and smaller acreage than the area that would be designated as the Cottonwood Basin Geological and Botanical Area under alternative B (modified) and C).

These small changes will not change the conditions and trends in aquatic habitats from those provided by alternatives B (modified) and C for this species.

Findings

Implementation of alternative B (modified) would contribute more to the viability of the narrow-headed gartersnake than alternative A because of updated plan components for management of the different riparian forests, invasive animal species management, updated language for water quality, and language that addresses endemic species. Although alternative C would have the same effects as alternative B (modified), it would contribute slightly more to the viability of these species due to the additional protection provided in recommended wilderness in the watersheds for this species. Continued management under alternative A would contribute to the viability of this species, but less so than the other alternatives. Although it has language to maintain the viability of wildlife species, much of the plan language is outdated. For example, it lacks sufficient guidance for invasive animal species or disease; does not distinguish between the different riparian forest types; and lacks language that would protect endemic species or those with restricted distributions.

Northern Mexican Gartersnake

The northern Mexican gartersnake (*Thamnophis eques megalops*) was listed as threatened in 2014 (USDI Fish and Wildlife Service 2014) with proposed critical habitat defined in 2013 (USDI Fish and Wildlife Service 2013), but not yet designated. No recovery or conservation plan had been published yet.

Affected Environment

Distribution

The species' current distribution in Arizona has been reduced to less than 10 percent of its former range along mainstem rivers. It remains in fragmented populations within the middle/upper Verde River drainage, and within the forest boundary on State of Arizona lands at Bubbling Ponds and Page Springs fish hatcheries (AZGFD 2012). This species is found in Cottonwood Willow and Mixed Broadleaf Deciduous Riparian Forests and prefers slower moving waters with substantial amphibian prey. Critical habitat is proposed on the forest within the Verde River watershed in the upper Verde River, Oak Creek, and Spring Creek.

Habitat

Northern Mexican gartersnakes occupy or have critical habitat designated along the upper Verde River within Oak and Spring Creeks in Cottonwood Willow and Mixed Broadleaf Deciduous Riparian Forests, but it will use available wetlands, cienegas, and springs. It is most abundant in densely vegetative habitat and avoids steep mountain canyon stream habitats (AZGFD 2012). The gartersnakes forage along streambanks, primarily feeding upon native fish and native frogs and tadpoles. Their diet is also supplemented with earthworms and vertebrates such as small rodents, lizards, salamanders, and other native and non-native frog species (AZGFD 2012).

Critical Habitat: The primary constituent elements are stream-side habitat, terrestrial space, viable prey species, and absence of non-native or invasive species.

Risk Factors

Threats include destruction and modification of habitat, predation and competition from non-native species such as bullfrogs, crayfish, and non-native fishes, and loss of population viability due to fragmentation of populations (AZGFD 2012).

Environmental Consequences

Table 75 summarizes the viability analysis for northern Mexican gartersnake. This table was developed using the analysis process described under the Species Viability section above. It includes information on the status, F Rank, habitat, habitat condition and trend, likelihood that this species is limited by its habitat, and the projected management effect, by alternative. Management effect categorizes the relative expected outcome of plan language in each alternative in terms of minimizing species viability risk and are the result of plan decisions, including plan objectives. Management effect category values are 1, 2, 3, and 4. The lower the management effects rating for a species' associated habitat, the more effective the alternative is for that species viability. These topics and the effects of the alternatives are explained in greater detail in the discussions on the alternatives that follow.

Table 75. Analysis summary for northern Mexican gartersnake

		Alternative A		Alternatives B (modified), C, and D	
Species and status	**Habitat**	**Condition and habitat trend relative to desired conditions**	**Likelihood species is limited**	**Condition and habitat trend relative to desired conditions**	**Likelihood species is limited**
Northern Mexican gartersnake (Threatened, Endemic) F Rank = F1*	CWRF	Fair, slowly toward	VH	Good, slowly toward	H
	MBDRF	Good, static to slowly toward	H	Good, slowly toward	H
	Wetlands	Good, toward**	H	Good, toward	H
	Perennial streams	Poor, static	VH	Poor, toward	VH
	Ephemeral Intermittent Streams	Poor, static	Accessible: VH Inaccessible: H	Poor, slowly toward	VH
Management effect		CWRF, MBDRF, wetlands, and ephemeral and intermittent streamcourses = 3: Plan components maintain or improve protection and management for some habitat occurrences in the plan area. Quality of habitat or habitat elements is maintained or improved by providing protection, maintenance, and restoration to some occurrences. Perennial streams = 4: Decline in habitat quality as a result of management or lack of management that result from plan components. Plan components may not exist or may be few.		All habitats = 2: Plan components maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.	

*F1 = Very rare on the forest within its habitat – occupies a very small portion of its habitat.

** For analysis, wetland condition and trend are based on total acres of wetlands, which has the effect of giving greater weight to larger wetlands. The condition and trend is fair and slowly toward desired conditions when of individual wetlands is considered, instead of total wetland acres.

Common to All Alternatives

Plan components in all alternatives contribute to species viability by managing for sustainable populations of native species and improving and protecting habitat for threatened, endangered, and sensitive species (1987 Plan, pages 22-1, 23, 64, 64-1, 66, 95, 108-2, 180, 187, 206-9, 206-11, 206-12, 206-13, 206-23, 206-30, 206-32, 206-66, 206-67, 206-71, 206-72, 206-79, 206-87, 206-89, 206-98, 206-103, 206-105, 206-108, 206-109, 206-114; FW-WFP-DC-1, 2, 3, 4, 5, 6, 8, and FW-Eco-DC-1). See At-risk Species in the Wildlife and Plant Issues and Topics section above for more information.

Disease, competition, and predation through introductions of non-native species the greatest fine filter threats to northern Mexican gartersnakes and their prey. There is language under all alternatives that prioritizes habitat improvement and protections for projects for threatened and

endangered species (1987 Plan, pages 23, 59, 64-6, and 87; FW-LndAdj-G-1; FW-Minerals-G-3; FW-RdsFac-G-7). Additionally, management applications under alternatives B (modified), C, and D provide recommendations to managers regarding approaches for successful implementation of plan components, such as prioritization of work to benefit threatened and endangered species (Management Approaches for Roads and Facilities, All Riparian Areas, Stream Ecosystems, and Watersheds and Water). Finally, all alternatives contain plan components that provide for some guidance to manage introductions of non-native species (see Non-native or Invasive Species in the Wildlife and Plant Issues and Topics section); however, viability of native species is threatened on the forest when the focus is limited solely to introductions because most of the aquatic habitat on the forest already has undesirable non-native species.

The existing Munds Mountain and Red Rock-Secret Mountain Wilderness Areas protect parts of potential critical habitat for this species and habitat for native fish prey species in the Oak Creek watershed from sedimentation due to roads and accessibility.

Alternative A

Prior consultations under the Endangered Species Act

Because they were listed as threatened in 2014, the environmental consequences for the northern Mexican gartersnake were not analyzed in previous LRMP Biological Assessments and Biological Opinions.

The Biological Assessment and the amendment to the Biological Assessment of the Travel Management Rule (USDA Forest Service 2010d, 2011m) determined the effect for actions in the proposed plan amendment “may affect but is not likely to adversely affect the northern Mexican garter snake.” The U.S. Fish and Wildlife Service concurred with the finding (USDI Fish and Wildlife Service 2011e, 2011f).

The Aquatics Specialist’s Report for the forest Plan Revision FEIS (USDA Forest Service 2016d) determined “the continued implementation of alternative A may affect and is likely to adversely affect the northern Mexican gartersnake and its proposed critical habitat.” Factors leading to this finding include relatively inadequate guidance related to management of introduced species, threatened and endangered species conservation strategies, integration of riparian, water, and aquatic species management strategies, recreation management, habitat protection for the snake’s amphibian prey base, improvement in watershed, riparian, and stream habitats, language to support habitat connectivity, and strategies to address climate change.

Viability

Table 75 shows that under alternative A, Cottonwood Willow Riparian Forest would remain in fair condition and have a slow trend toward desired conditions. In Cottonwood Willow, some portions of the Verde River, Dry Beaver Creek, and Spring Creek, would be static due to high recreation or private land, such as the area around Childs, Spring Creek, Dry Beaver Creek, and private lands.

Mixed Broadleaf Deciduous Riparian Forest would remain in good condition. Static trends would be associated with the Oak Creek 5th code and West Clear Creek 5th code HUCs. The trend would be static or moving slowly toward desired conditions except in the Beaver Creek, West Clear Creek and Oak Creek 5th code HUCs and portions of Fossil Creek where recreation impacts are high. Areas of private land would remain static as well.

Wetlands would remain in good condition and slowly trend toward desired condition based on total acres of wetlands. The condition would be fair and slowly trend toward desired conditions if the evaluation is based on the number of wetlands.

Perennial streams would remain in poor condition with a static trend in relation to desired conditions. This condition is generally due to most streams having invasive and non-native animal species that are outside of their historic variability.

Ephemeral and intermittent streamcourses that are intersected by roads and are accessible would remain in poor condition with a static trend. Ephemeral and intermittent streamcourses that are inaccessible would remain in fair condition with a static trend.

As shown in table 75, the likelihood that habitat on the forest would be a limiting factor for northern Mexican gartersnake is high to very high depending on the habitat. These likelihoods were derived by combining the northern Mexican gartersnake's F Rank of F1 with the likelihood of habitat limitation variables for each ERU: Cottonwood Willow Riparian Forest (high), Mixed Broadleaf Deciduous Riparian Forest (moderate), wetlands (moderate, by acres), perennial streamcourses (high), and ephemeral and intermittent streamcourses (high if accessible, moderate if inaccessible) (table 9). Low to moderate ratings are considered to be within the natural range of fluctuations for the habitat.

The management effect row shows the relative expected outcome of plan language in terms of minimizing species viability risk. The management effect is classified as a 3 for Cottonwood Willow Riparian Forest, Mixed Broadleaf Deciduous Riparian Forest, wetlands, and ephemeral and intermittent streamcourses, which means that plan components in alternative A maintain or improve protection and management for some habitat occurrences in the plan area, and thus, contribute less to the viability of this species than the other alternatives. Alternative A would maintain or improve riparian forests, wetlands, and ephemeral and intermittent streamcourses because it has a focus on improving riparian areas in any condition, preventing damage to riparian vegetation, stream banks, and channels, and restoring degraded riparian areas to good condition as soon as possible (1987 Plan, pages 65-2, 65-8, 172, and 206-8). Other protective language includes the following: Only beneficial new special uses are allowed in riparian areas and exceptions such as utility line or roads crossing stream courses are designed to minimize the extent and magnitude of impact to riparian areas (1987 Plan, page 177). Aggressive fire suppression may be used to prevent resource damage utilizing methods that minimize long-term adverse impacts to riparian habitats (1987 Plan, page 177). In addition, acquisition of riparian areas through land exchange is a high priority (1987 Plan, pages 177 and 185). The plan would manage commercial uses, and recreation in some areas, to protect riparian values (1987 Plan, pages 206-10, 206-22, 206-26, and 206-39).

This alternative has the least potential for improvement to riparian condition compared to the other alternatives because desired conditions for specific riparian forest types are lacking and there is no focus on functioning-at-risk and non-functional riparian areas (USDA Forest Service 2016b).

The management effect is classified as a 4 for perennial streams, which means there is a decline in habitat quality as a result of management or lack of management that result from plan components. Plan components may not exist or may be few. Alternative A largely lacks language for invasive and non-native aquatic species that were not present historically. These species can

alter the composition, structure, and processes of stream ecosystems. As described in the Coarse Filter: Habitat section, the threat of dispersed recreation to riparian resources is not addressed forestwide in alternative A. Special areas, such as the Verde Wild and Scenic River and wilderness, and the management areas within Flagstaff/Lake Mary Ecosystem Area and the Sedona-Oak Creek Planning Area most specifically address the conflicts and strategies to resolve resource damage in riparian areas. This direction mainly addresses dispersed recreations impact to specific riparian areas where there have been past conflicts and resource damage, but it provides very limited direction when areas that previously received low use are "discovered" and see unexpected increases in recreation, such as Fossil Creek. As a result, alternative A addresses this threat sporadically compared with alternatives B (modified), C, and D, but it does mitigate some of the areas where the conflict is most pronounced.

Alternative A provides some guidance to reduce introductions of non-native species (primarily focused on plant species, 1987 Plan, page 206-72), but this language is insufficient in scope to maintain viability of Mexican gartersnake on the forest. Currently, some wilderness protections are afforded by the implementation of broad standards, such as complying with Arizona water quality standards that would minimize affects to gartersnake habitats (1987 Plan, pages 23 and 74). However, several key management concerns are not currently addressed. These include language to address management of introduced or invasive species; threatened and endangered species conservation strategies; integration of riparian, water, and aquatic species management strategies; language to support habitat connectivity; and strategies to address climate change. Additionally, trends in watershed conditions are likely to remain static, with declining flows in perennial streams due to climate change and continued water development off forest lands that impact groundwater and stream volume on the forest. Viable populations of this species are very limited within its habitat on the forest, and it is sensitive to habitat disturbances that alter riparian vegetation, accessible terrestrial space adjacent to streams, debris and boulders for cover and stream habitat conditions that support native fish prey including natural hydrograph, connectivity, macroinvertebrate and macrophyte communities, and introduced or invasive predators and competitors.

Alternative B (modified)

Consultation under the Endangered Species Act

A Biological Assessment for the revision of Coconino NF Land Management Plan was prepared in 2017 (USDA Forest Service 2017c). The determination of effect for northern Mexican gartersnake and its critical habitat was "may affect, likely to adversely affect" due primarily to potential for adverse effects of activities such as livestock grazing, road construction, and thinning or prescribed burning in watersheds containing northern Mexican gartersnakes. The Fish and Wildlife Service determined that "implementation of the Coconino NF's revised LRMP will not jeopardize the continued existence of the narrow-headed gartersnake and northern Mexican gartersnake, and will not destroy or adversely modify their proposed critical habitat" in their draft Biological and Conference Opinion received on August 8, 2017 (USDI Fish and Wildlife Service 2017b). No incidental take was assigned. The Fish and Wildlife Service provided six discretionary conservation recommendations intended to minimize or avoid adverse effects, help implement recovery plans, or develop information.

Viability

Table 75 shows that under alternative B (modified), Cottonwood Willow Riparian Forest would improve to good condition and trend slowly toward desired conditions except portions of the

Verde River, Towel Creek, Spring Creek and Dry Beaver Creek would improve faster (i.e., have a trend toward desired conditions).

Mixed Broadleaf Deciduous Riparian Forest would remain in good condition and slowly move toward desired conditions except portions of Fossil Creek and Wet Beaver Creek would remain static in areas of high recreation use. It would improve faster than alternative A in the Beaver Creek, Oak Creek, West Clear Creek, and Fossil Creek 5th code HUCs.

Wetlands would remain in good condition, the trend would improve to toward desired condition regardless of whether the wetlands are evaluated based on the total acres of wetlands or the number of wetlands.

Perennial streams would remain in poor condition, but the trend would be toward desired conditions because of updated plan components (see management effect discussion below). Ephemeral and intermittent streamcourses that are intersected by roads and are accessible would remain in poor condition, but the trend would improve to slowly toward desired conditions. Ephemeral and intermittent streamcourses that are inaccessible would remain in fair condition, but the trend would improve to slowly toward desired conditions.

As shown in table 75, the likelihood that habitat on the forest would be a limiting factor for northern Mexican gartersnake is high to very high depending on the habitat. These likelihoods were derived by combining the northern Mexican gartersnake's F Rank of F1 with the likelihood of habitat limitation variables for each ERU: Cottonwood Willow Riparian Forest (moderate), Mixed Broadleaf Deciduous Riparian Forest (moderate), wetlands (moderate, by acres), perennial streamcourses (high), and ephemeral and intermittent streamcourses (high if accessible, moderate if inaccessible) (table 9). Low to moderate ratings are considered to be within the natural range of fluctuations for the habitat.

The management effect row shows the relative expected outcome of plan language in terms of minimizing species viability risk. The management effect is classified as a 2 for all the coarse filter habitats associated with northern Mexican gartersnake. This means that plan components in alternative B (modified) maintain or improve habitat quality by maintaining or improving protection and management for most habitat and habitat element occurrences in the plan area.

For Cottonwood Willow and Mixed Broadleaf Deciduous Riparian Forests, this rating is primarily because there are updated desired conditions and guidelines that support the composition, structure, and function of riparian forest types (FW-Rip-RipType-DC-1 to 6, FW-Rip-RipType-G-1 to 4). In addition, riparian functional condition would improve faster than alternative A, especially along the Verde River, Towel Creek, Spring Creek, and Dry Beaver Creek. Plan components manage for vegetation diversity and riparian function (FW-Rip-RipType-DC-1 and 2; FW-Water-G-2; FW-Rip-RipType-O-1). Plan components in the Wildlife, Fish, and Plants section also contribute to the viability of species associated with riparian areas by promoting properly functioning ecosystems that have the necessary physical and biological components to meet the needs of associated native species (FW-WFP-DC-1, 3).

For wetlands, this rating is primarily because there are updated desired conditions and guidelines that support wetland composition, structure, and function, connectivity between uplands and aquatic and riparian areas, and the maintenance of habitat for species (FW-Rip-Wtlnds-DC-1, 2, FW-Rip-All-DC-1, 3, 5 and G-2, 3, FW-WFP-DC-6). In addition, riparian functional condition would improve faster than alternative A. The desired conditions manage for vegetation diversity

and riparian function including in priority watersheds (FW-Rip-RipType-DC-1, 2, FW-Water-G-2, FW-Rip-RipType-O-1). More site-specific aquatic management zone guidelines protect riparian function and water quality (FW-Rip-All-G-3, Fw-Rip-Strm-G-2) (USDA Forest Service 2016b). Plan components in the Wildlife, Fish, and Plant section also contribute to the viability of species associated with riparian areas by promoting properly functioning ecosystems that have the necessary physical and biological components to meet the needs of associated native species (FW-WFP-DC-1, 3).

For perennial, ephemeral, and intermittent streamcourses, this rating is based on language regarding mitigating the effects of roads, connectivity of drainages, connectivity between streamcourses and upland habitats, and earthen stock tank locations (to minimize impacts to sensitive resources) (see FW-ConstWat-G-1 and 2, FW-RdsFac-G-2, 5, 7 and 9). Alternative B (modified) would apply aquatic management zones or best management practices to perennial, intermittent, or ephemeral drainages to maintain the chemical, physical, and biological conditions of connected or downstream caves, karst, and lava tubes (FW-BioPhys-Geo-G-8). The water quantity or baseflows of intermittent and perennial streams would be sustained to mimic seasonal flow regimes and riparian ecosystems and corridors would promote the natural role of water, natural hydrogeomorphic processes, sediment movement and capture, woody debris recruitment and retention, and root masses, and maintain water tables (FW-Water-DC-5, FW-Rip-All-DC-1). Other updated desired conditions promote streamcourses having access to their floodplains and natural sinuosity so flood energy can be dissipated without causing damage to the channel streambanks; promote natural disturbances in streamcourses; and provide more detailed desired conditions on the functioning of perennial and intermittent streamcourses and their floodplains (FW-Rip-Strm-DC-1, 2, 3).

Unlike alternative A, alternative B (modified) has a desired condition that promotes ephemeral and intermittent streamcourses as habitat and movement corridor for species (FW-WFP-DC-4 and 6). A management approach in Stream Ecosystems reminds managers that ephemeral streamcourses may be protected at the project level depending on downstream water quality issues. Another management approach in the same section encourages coordination with local, State, private, and other Federal agencies to ensure that natural streamcourses are maintained and not fragmented by development that would maintain their function as movement corridors.

Alternative B (modified) proposes three recommended wildernesses, all of which contain ephemeral streamcourses. Plan components for recommended wilderness would be beneficial for riparian habitat and connected drainages because recommended wilderness would be managed to maintain or enhance primitive and undeveloped characteristics; to preserve native species and unique features; to reduce evidence of modern human control and manipulations; and motor vehicle uses should only occur for limited administrative and permitted activities to be consistent with wilderness character (FW- RWild-DC-1 to 3; FW-RWild-G-1 and 3).

Restoration activities in alternative B (modified) (i.e., installation of non-native species barriers, vegetation treatments that reduce uncharacteristic fires within watersheds, vegetation plantings and riparian restoration and channel stabilization projects) may have short-term negative impacts, but they will have long-term benefits to the species. A high percentage of the watersheds that potentially contain northern Mexican gartersnakes and their proposed critical habitat also contain Ponderosa Pine and Mixed Conifer ERU types which are prioritized for treatment with fire and mechanical restoration, thereby having short-term adverse effects to riparian forests and potentially increasing stream sedimentation. Desired conditions and guidelines should minimize

effects and therefore the implementation of plan components are expected to have minimal effects to northern Mexican gartersnake population in the Verde River. There are long-term benefits expected for the species related to the desired conditions in Watersheds and Water, Riparian, Soils, and Wildlife, Fish, and Plants programs. The greatest threat to northern Mexican gartersnake populations is lack of water during drought conditions and predation, competition, and effects on the native fish and amphibian prey base from non-native fish, bullfrogs, and crayfish. Cooperative actions with the Arizona Game and Fish Department and the Fish and Wildlife Service under the Wildlife, Fish, and Plants program may help decrease the threats from non-native species.

Livestock grazing may cause significant disturbance to riparian vegetation, alteration of stream morphology due to trampling and removal of riparian vegetation, and negative impacts to water quality from sedimentation, due to lack of ground cover and bank trampling, and livestock urine and feces. Livestock access to Verde River, Oak Creek, West Fork of Oak Creek, and Spring Creek is limited to crossing areas and water gaps. The exclosure fence precludes access to river from livestock, but there is livestock access in shedding and hibernating habitat. If guidelines are followed, negative effects should be minimized. Roads and Facilities and Forest Products programs may have short-term adverse effects to the species, but implementation of guidelines would provide for a trend toward maintaining or improving habitat for northern Mexican gartersnake.

Alternative C

Implementation of plan components under alternative C would have similar effects to alternative B (modified). Motorized access adjacent to Oak Creek and Beaver Creeks may continue to cause adverse impacts, but these areas are reduced under alternative C to the greatest extent of the four alternatives.

Alternative D

Implementation of alternative D would have similar effects to Alternative B (modified) except that alternative D would designate the Cottonwood Basin Geological Area (which contain no springs and smaller acreage than the Cottonwood Basin Geological and Botanical Area designated under alternatives B (modified) and C).

Alternative D recommends no new wilderness areas. The effects associated with managing the recommended areas under alternatives B (modified) and C as recommended wilderness would not occur. These areas would still be managed by the other forestwide, management area, and special area direction in alternative B (modified) with the corresponding effects discussed above in the alternative B (modified) section. Implementation would be the same as alternative A with regard to maintenance of existing wilderness. These small changes would not change the conditions and trends in aquatic habitats from those provided by alternatives B (modified) and C for this species.

Findings

Implementation of alternative B (modified) would contribute more to the viability of northern Mexican gartersnake than alternative A because of updated plan components for management of the different riparian forests, invasive animal species management, updated language for water quality, and language that addresses endemic species. Although alternative C would have the same effects as alternative B (modified), it would contribute slightly more to the viability of these species due to the additional protection provided in recommended wilderness in the watersheds

for this species. Continued management under alternative A would contribute to the viability of this species, but less so than the other alternatives. Although it has language to maintain the viability of wildlife species, much of the plan language is outdated. For example, it lacks sufficient guidance for invasive animal species or disease; does not distinguish between the different riparian forests; and lacks language that would protect endemic species or those with restricted distributions.