

Fossil Creek Wild & Scenic River Comprehensive River Management Plan

Wildlife, Plants, and Vegetation Report

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for:

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Coconino National Forest

Payson Ranger District
Tonto National Forest

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Introduction

This report summarizes the affected environment and environmental consequences of the actions described in the Environmental Impact Statement for the Fossil Comprehensive River Management Plan (CRMP) on threatened, endangered, candidate and proposed species; Bald and Golden Eagle Act species; Regional Forester's sensitive species; Forest Service locally important species (LIS), Management Indicator Species (MIS); neotropical migratory birds and vegetation.

Two species listed as LIS are included in this analysis based on direction from a number of sources:

1. The Coconino National Forest's revised plan supports their analysis in these ways:
 - a. Both species were identified in the revision process as 2 of the 56 species whose viability may be at risk. See EIS Vol 2a, pg. 14
 - b. Additionally, there are many plan components that support management of wildlife populations. A few key ones are:
 - c. Desired conditions to have sustainable populations of native plant and animal species (FW-WFP-DC-1)
 - d. DC to manage habitat conditions to preclude the need for listing (FW-WFP-DC-2)
 - e. Objective to restore or enhance terrestrial wildlife habitat (includes other than special status species) (FW-WFP-O-3)
 - f. Guideline to protect and provide for narrow endemic species (FW-WFP-G-10)
 - g. Protect raptor nests with 300 foot buffer (FW-WFP-G-11)
2. Both the Arizona toad and Common Black-hawk are Species of Greatest Conservation Need (SGCN) and are listed in The State Wildlife Action Plan Species of Greatest Conservation Need.
3. The Master MOU between the AGFD and R3 states that the FS agrees..."To recognize and give full consideration to conservation of the State's fish and wildlife species of concern and their habitats, including Species of Greatest Conservation Need..."
4. The Common Black-hawk is on the Fish and Wildlife Service's (FWS) Bird of Conservation Concern list for BCR 34.
5. The FWS issued a positive 90-day finding on a petition to list the Arizona toad.
6. Forest Service Manual 2600 – numerous policy statements. E.g. 2603.1 – "Serve the American people by maintaining diverse and productive wildlife...This includes...maintenance of viable populations of all vertebrates..."
7. In addition, current literature exists that provides best available science as a reason for concern for both of these species

This specialist report presents the results of an analysis of the direct, indirect, and cumulative environmental consequences of the proposed action, other alternatives considered, as well as no action. This report includes all but fish and macroinvertebrates which are covered in a separate specialist's report.

The Biological Outstandingly Remarkable Value (ORV) in Fossil is comprised of both habitat and populations of fish, aquatic invertebrates, and wildlife, including birds, mammals, reptiles, and amphibians. Fossil Creek is at a crossroads of several regional geographic elements and floristic provinces, which support a high diversity of indigenous flora and fauna species.

Due to its length, continuous and abundant flow, elevational gradient, unfragmented nature, and presence of travertine, Fossil Creek provides outstanding habitat for a high diversity of fish and wildlife species and is the

only pure warm water native fishery in Arizona. Fossil Creek is the only uninterrupted system between the Verde River and the Mogollon Rim, spanning and connecting a number of biotic communities from upper Sonoran desert scrub up through ponderosa pine forests. The elevational gradient and length of the Fossil corridor is significant compared to other perennial systems in Arizona, especially in terms of protection during climate change. Since wildlife species will experience environmental stressors as a result of climate change, large areas with unfragmented habitat will be even more important for long-term population survival and growth. This unfragmented system not only provides contiguous habitat for species that can only survive in aquatic and riparian habitat, it also provides a contiguous corridor for wildlife species moving through during dispersal or migration and will be important in the face of climate change for species' long-term population survival and growth. It is one of only a few major north/south riparian corridors in Arizona which is important for many mammalian and avian species. In the travertine-dominated reaches, the deposition of travertine and creation of travertine dams has resulted in the impoundment of sediments and the formation of terraces that support a variety of submergent, floating, emergent, herbaceous, and shrubby habitat components. The floristic diversity of aquatic and riparian vegetation provides a variety of physical structures, which in turn supports a wider diversity of wildlife species. In addition to the floristic diversity, the presence of travertine has greatly increased the diversity of pools, riffles, glides, runs and backwaters, all of which provide a diverse array of habitat for numerous wildlife species. The diversity of this unique habitat demonstrates the outstandingly remarkable fish and wildlife habitat of Fossil Creek.

Special status wildlife and plant species that are known to occur, or have existing or potential habitat, include: 6 federally-listed species; 14 Forest Service sensitive species; 2 locally important species ; 19 Forest Service management indicator species (MIS); 19 federal and state designated neotropical migratory birds (NTMB), and Bald and Golden Eagle Act species.

Refer to Table 1 for a list of all special status species included in this analysis. Note that species lists are updated and over time, new special status species may be added or removed, and species may be re-introduced into the Fossil W&SR corridor for recovery purposes.

Table 1: Special Status Species Included in This Analysis

Common Name	Scientific Name	Status	Critical Habitat
Birds			
Mexican Spotted Owl	<i>Strix occidentalis lucida</i>	Threatened	Yes
Southwestern Willow Flycatcher	<i>Empidonax traillii extimus</i>	Endangered	Yes
Western Yellow-billed Cuckoo	<i>Coccyzus americanus occidentalis</i>	Threatened	Proposed
Common Black-hawk	<i>Buteogallus anthracinus</i>	LIS, MIS, NTMB	N/A
Bald Eagle	<i>Haliaeetus leucocephalus</i>	Sensitive, MIS, and Eagle Act	N/A
American Peregrine Falcon	<i>Falco peregrinus anatum</i>	Sensitive	N/A
Northern Goshawk	<i>Accipiter gentiles</i>	Sensitive, MIS	N/A
Golden Eagle	<i>Aquila chrysaetos</i>	Eagle Act	N/A
Juniper Titmouse	<i>Baeolophus ridgwayi</i>	MIS	N/A
Ash-throated Flycatcher	<i>Myiarchus cinerascens</i>	MIS	N/A
Gray Vireo	<i>Vireo vicinior</i>	MIS, NTMB	N/A
Townsend's Solitaire	<i>Myadestes townsendi</i>	MIS	N/A
Northern Flicker	<i>Colaptes auratus</i>	MIS	N/A
Spotted Towhee	<i>Pipilo maculatus</i>	MIS	N/A
Black-chinned Sparrow	<i>Spizella atrogularis</i>	MIS, NTMB	N/A
Savannah Sparrow	<i>Passerculus sandwichensis</i>	MIS, NTMB	N/A
Horned Lark	<i>Ermophila alpestris</i>	MIS	N/A
Black-throated Sparrow	<i>Amphispiza bilineata</i>	MIS	N/A
Canyon Towhee	<i>Melospiza fusca</i>	MIS	N/A
Lucy's Warbler	<i>Oreothlypis luciae</i>	NTMB	N/A
Bell's Vireo	<i>Vireo bellii</i>	MIS, NTMB	N/A
Summer Tanager	<i>Piranga rubra</i>	MIS	N/A
Hooded Oriole	<i>Icterus cucullatus</i>	MIS	N/A
Bendire's Thrasher	<i>Toxostoma bendirei</i>	NTMB	N/A

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Common Name	Scientific Name	Status	Critical Habitat
Black-throated Gray Warbler	<i>Setophaga nigrescens</i>	NTMB	N/A
Chestnut-collared Longspur	<i>Calcarius ornatus</i>	NTMB	N/A
Common Nighthawk	<i>Chordeiles minor</i>	NTMB	N/A
Elf Owl	<i>Micrathene whitneyi</i>	NTMB	N/A
Ferruginous Hawk	<i>Buteo regalis</i>	NTMB	N/A
Flammulated Owl	<i>Otus flammeolus</i>	NTMB	N/A
Grace's Warbler	<i>Setophaga graciae</i>	NTMB	N/A
Lark Bunting	<i>Calamospiza melanocorys</i>	NTMB	N/A
Phainopepla	<i>Phainopepla nitens</i>	NTMB	N/A
Virginia's Warbler	<i>Oreothlypis virginiae</i>	NTMB	N/A
Wood Duck	<i>Aix sponsa</i>	NTMB	N/A
Yellow Warbler	<i>Setophaga petechia</i>	NTMB	N/A
Amphibians			
Chiricahua Leopard Frog	<i>Rana chiricauiensis</i>	Threatened	Yes
Lowland Leopard Frog	<i>Rana yavapaiensis</i>	Sensitive	N/A
Arizona Toad*	<i>Bufo microscaphus microscaphus</i>	LIS	N/A
Reptiles			
Northern Mexican Gartersnake	<i>Thamnophis eques</i>	Threatened	Proposed
Narrow-headed Gartersnake	<i>Thamnophis rufipunctatus</i>	Threatened	Proposed
Mammals			
Western Red Bat	<i>Lasiurus blossevillei</i>	Sensitive	N/A
Allen's Lappet-browed Bat	<i>Idionycteris phyllotis</i>	Sensitive	N/A
Pale Townsend's Big-eared Bat	<i>Corynorhinus townsendii pallescens</i>	Sensitive	N/A
Spotted Bat	<i>Euderma maculatum</i>	Sensitive	N/A
Pronghorn	<i>Antilocapra americana</i>	MIS	N/A
Arizona Gray Squirrel	<i>Sciurus arizonensis</i>	MIS	N/A
Snails			
Fossil Springsnail	<i>Pyrgulopsis simplex</i>	Sensitive	N/A
Plants			
Arizona Phlox	<i>Phlox amabilis</i>	Sensitive	N/A
Cochise Sedge	<i>Carex ultra</i>	Sensitive	N/A
Metcalf's Tick-trefoil	<i>Desmodium metcalfei</i>	Sensitive	N/A
Mt. Dellenbaugh Sandwort	<i>Eremogone aberrans</i> formerly <i>Arenaria aberrans</i>	Sensitive	N/A
Eastwood Alumroot	<i>Heuchera eastwoodii</i>	Sensitive	N/A

*Common black-hawk and Arizona toad were on the Regional Forester's Sensitive Species list up until 2013. These species continue to be analyzed as locally important species.

In addition to special status species, there are hundreds of additional species of mammals, birds, reptiles, amphibians, and invertebrates in the Fossil Creek Wild and Scenic River Corridor (FC WSR corridor, corridor). Based on actual observations during limited wildlife surveys, Fossil Creek and its associated riparian habitat support roughly 200 known bird, mammal, reptile, and amphibian species. There is potential for an additional 300 species of mammals, birds, reptiles, and amphibians to be present along Fossil Creek based on the diverse habitat available.

The vegetative diversity of the Fossil corridor is represented by seven biotic communities: riparian, semi-desert grassland, pinyon/juniper woodland, juniper/grassland transition, alligator/Utah juniper savanna, ponderosa pine forest, and mixed conifer forest. Riparian is comprised of mixed deciduous and cottonwood/willow low elevation streams, springs, and wetlands. Non-native invasive plant species do exist in the Fossil corridor. The main species include giant reed, tamarisk, Himalayan blackberry, and tall fescue.

This analysis will focus on the following components: management direction in the CRMP, ground-disturbing activities associated with each of the alternatives (including mitigation measures, design features, and best management practices), the monitoring plan, adaptive management, amendments to both the Coconino and Tonto forest plans, and other past, present, and reasonably foreseeable actions in the area.

Appendices that follow this specialist report include:

Appendix A – Tonto and Coconino Forest Plan direction pertinent to wildlife and vegetation.

Appendix B - Resource protection measures specific to vegetation (particularly invasive species) and special status species (pollinators and bat species).

Appendix C – Taxa-specific reports from the Fossil Corridor Wildlife and Plant Database.

Appendix D – Result of 2003 invasive weed survey and species targeted for treatment.

Appendix E – a list of special status species; both those that occur in the analysis area (or those for which suitable habitat occurs in the analysis area) and those that do not and are therefore excluded from this analysis.

Appendix F –Fossil Creek Comprehensive Management Plan – management direction.

Forest Plan Consistency, and Relevant Laws, Regulations, and Policy

Land and Resource Management Plan

Plan Consistency

A forest plan consistency check has occurred for wildlife and plant related direction in both the Coconino and Tonto National Forest plans. All the pertinent plan language is in Appendix A. Based on a review of the two forest plans, the Fossil Comprehensive River Management Plan is consistent with both the Coconino and Tonto forest plans. The Fossil Comprehensive Management Plan is found in Appendix F.

Plan amendments

There is a need to amend the forest plans for the Coconino and Tonto national forests to finalize the management boundary for the Fossil Creek Wild and Scenic River and incorporate the management direction provided by the CRMP to ensure protection and enhancement of river values. Additionally, there is a need to recommend modifications to the Fossil Springs Botanical Area in order to better encompass the riparian community this area was designated to protect. The following programmatic forest plan amendments, which would be completed pursuant to the 2012 Planning Rule at 36 CFR 219.13, are proposed.

The Land and Resource Management Plan (LRMP) for the Coconino National Forest (USDA FS 2018) would be amended to:

- Decrease the area of the Fossil Creek Designated Wild and Scenic River Special Area by four acres at T21N, R7E, E 1/2 Section 21 in order to comply with the requirements of Section 3(b) of the Wild and Scenic Rivers Act, which states, “boundaries shall include an average of not more than 320 acres of land per mile....”
- Include the management direction provided in Chapter 3 of the Fossil Creek CRMP. This management direction would apply to the 2,892 acres within the Fossil Creek Designated Wild and Scenic River Special Area on the Coconino National Forest.
- Recommend an 11.6-acre addition to the Designated Fossil Springs Botanical Area in order to better incorporate the diverse vegetation community in the vicinity of Fossil Springs.

The LRMP for the Tonto National Forest (USDA FS 1985) would be amended to:

- Establish Management Area 4G, Payson Ranger District Fossil Creek Wild and Scenic River Management Area. This area would encompass approximately 2,170 acres and consist of the Wild and Scenic River Corridor established by Congress and modified by the CRMP to include a spring in the vicinity of Forest Road 708. Establishing this new Management Area would reduce the area of Management Area 4A (Mazatzal Wilderness) by approximately 1,509 acres, Management Area 4E (Proposed Fossil Springs

Natural Area) by approximately 132 acres, and Management Area 4F (Payson Ranger District General Management Area) by approximately 529 acres.

- Incorporate (by reference) the management direction provided in Chapter 3 of the Fossil Creek CRMP. This management direction would apply to the Fossil Creek Wild and Scenic River Management Area mentioned above.
- Recommend designation of 9.4 acres of the Fossil Springs Botanical Area adjacent to and part of the Fossil Springs Botanical Area on the Coconino National Forest within the Fossil Creek Wild and Scenic River corridor. This recommended botanical area and associated plan direction would be incorporated into Management Area 4E and the new Management Area 4G (Fossil Creek Wild and Scenic River Management Area).

Key assumptions include:

- The CRMP will provide Fossil Creek-specific management direction. If there is a conflict between CRMP management direction and Forest Plan components, the CRMP management direction will supersede the Forest Plan components.
- If the CRMP is silent on management direction for a particular resource or use that occurs in the wild & scenic river corridor, the Forest Plan management direction will apply.
- Management direction in the Verde WSR CRMP supersedes management direction in the Fossil Creek CRMP for the overlapping portion of the two river corridors.
- The revised COF and current TNF plans will be amended to incorporate the management direction provided for the Fossil Creek WSR, and the management direction in the CRMP will carry the same weight as the forest plan components.

Federal Law

The Forest Service is legally required to comply with a number of federal laws as described here.

Migratory Bird Treaty Act

Enacted in 1916 to make it unlawful to pursue, hunt, take, capture, kill, or sell migratory birds. The statute does not discriminate between live or dead birds and also grants full protection to any bird parts including feathers, eggs, and nests.

Wild and Scenic Rivers Act

The Wild and Scenic Rivers Act (WSRA) of 1968 (PL 90-542; 16 USC 1271-1278) establishes a system of rivers that “shall be preserved in free-flowing condition, and ... their immediate environments shall be protected for the benefit and enjoyment of present and future generations” (16 USC. 1271).

Section 7

Section 7 directs federal agencies to protect the values of designated rivers from adverse effects of “water resources projects” within the bed and banks of the river. Section 7 requires a rigorous process to ensure that proposed water resources projects, implemented or assisted by federal agencies within the bed and banks of designated rivers, do not have a “direct and adverse effect” on the values for which the river was designated. The effects to wildlife and habitat are described in the Section 7 portion of this specialist report towards the end of the Environmental Consequences section.

Section 10

Section 10 of WSRA sets forth the management direction for designated river segments and includes the following:

- WSRA shall be administered to *protect and enhance* a river's ORVs. Insofar as possible, uses that are consistent with this and do not substantially interfere with public enjoyment and use of these values should not be limited (Section 10[a]; 16 USC 1281[a]).
- In administration of a Wild and Scenic River, "primary emphasis shall be given to protecting its aesthetic, scenic, historic, archeologic, and scientific features. Management plans may establish varying degrees of intensity for its protection and development, based on the special attributes of the area" (Section 10[a]; 16 USC 1281[a]).
- Wild and Scenic River segments inside congressionally designated wilderness are subject to both WSRA and the Wilderness Act. Where the two conflict, the more restrictive (i.e., protective of resources) regulation will apply (Section 10[b]; 16 USC 1281[b]).
- The Secretary of Agriculture, in his or her administration of any component of the national wild and scenic rivers system area, may utilize the general statutory authorities relating to the national forests in such a manner as he or she deems appropriate to carry out the purposes of WSRA (Section 10[d]; 16 USC 1281[d]).
- Section 10(e) enables administering federal agencies to enter into cooperative agreements with state and local governments to allow them to participate in the planning and administration of components of the Wild and Scenic Rivers System that include or adjoin state- or county-owned lands.

Endangered Species Act

The Endangered Species Act (ESA, PL 93-205), Forest Service Manuals (FSM) 2670.11, 2670.21 and 2670.31 , the Coconino and Tonto National Forest Plan standards all require that National Forest System lands are not only managed for endangered, threatened and proposed (TEP) species, but also to recover TEP species. The ESA states that all Federal departments and agencies shall seek to conserve TEP species. FSM 2670 directs Forests to manage National Forest System habitats to achieve recovery of TEP species and to avoid the need to implement special protection measures under the ESA.

Section 2 of the Endangered Species Act of 1973, as amended in 1978, 1979, 1982, and 1988 (16 U.S.C. 1531 et seq.) declares that "...all Federal departments and agencies shall seek to conserve endangered species and threatened species and shall utilize their authorities in furtherance of the purposes of this Act." Section 7 directs Federal agencies to ensure that actions authorized, funded, or carried out by them are not likely to jeopardize the continued existence of any threatened or endangered species or result in the destruction or adverse modification of their critical habitats (16 U.S.C. 1536 et seq.). Federal agencies also must consult with U.S. Fish and Wildlife Service whenever an action authorized by the agency is likely to affect a species listed as threatened or endangered or to affect its critical habitat. The Act mandates conference with the Secretary of the Interior whenever an action is likely to jeopardize the continued existence of any species proposed for listing as threatened or endangered, or whenever an action might result in destruction or adverse modification of critical habitat proposed for listing (16 U.S.C. 1536(a)4).

Bald and Golden Eagle Protection Act (Eagle Act)

The Eagle Act, originally passed in 1940, prohibits the take, possession, sale, purchase, barter, offer to sell, purchase, or barter, transport, export, or import, of any bald or golden eagle, alive or dead, including any part, nest, or egg, unless allowed by permit (16U.S.C 668(a);50CFR 22). "Take" is defined as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb" a bald or golden eagle. The term "disturb" under the Eagle Act was further defined via a final rule published in the Federal Register on June 5, 2007 (72 Fed. Reg. 31332). "Disturb" means to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior.

National Forest Management Act

The National Forest Management Act of 1976, required the Secretary of Agriculture to develop guidelines for land management planning with the individual forest being the planning unit or area. The Act states that “Fish and wildlife habitat shall be managed to maintain viable populations of existing native and desired non-native vertebrate species in the planning area.” (36 C.F.R. § 219.19). A viable population is defined as “[a population] which has the estimated numbers and distribution of reproductive individuals to insure its continued existence is well distributed in the planning area.” (§ 219.19). Therefore, management of viable populations is intended to be accomplished at the individual National Forest level (planning area).

National Environmental Policy Act of 1969 (NEPA)

NEPA established procedures for decision making, disclosure of effects, and public involvement on all major federal actions. Forest Service Manual 1950.2 requires a consideration of the impacts of Forest Service proposed actions on the physical, biological, social, and economic aspects of the human environment (40 CFR § 1508.14).

Fish and Wildlife Coordination Act

Fish and Wildlife Coordination Act of 1934, as amended (FWCA) - The FWCA provides a procedural framework for the consideration of fish and wildlife conservation measures in Federal water resource development projects. Coordination with the FWS and State wildlife management agencies are required on all Federal water development projects.

The amendments enacted in 1946 require consultation with the Fish and Wildlife Service and the fish and wildlife agencies of States where the "waters of any stream or other body of water are proposed or authorized, permitted or licensed to be impounded, diverted . . . or otherwise controlled or modified" by any agency under a Federal permit or license. Consultation is to be undertaken for the purpose of "preventing loss of and damage to wildlife resources."

As part of this analysis, existing gabions that are failing will be repaired. The effects of this work will be analyzed in this specialist report and consultation with FWS will occur.

Regulation

Invasive Species

The authority to manage for invasive species on National Forest System lands and other lands under Forest Service control is delegated from the Secretary of Agriculture to the Under Secretary for Natural Resources and Environment at Title 7, Code of Federal Regulations (CFR), section 2.20 (7 CFR 2.20). This authority has been delegated in turn from the Under Secretary for Natural Resources and Environment to the Chief of the Forest Service at Title 7, Code of Federal Regulations, section 2.60 (7 CFR 2.60). Title 36, Code of Federal Regulations (including Parts 221, 222, 228, 241, 251, 261, 290, 292, 293, 296, and 297) provides additional authorities to manage and regulate invasive species across the National Forest System, including establishing requirements and prohibitions to prevent and control aquatic and terrestrial invasive

Policy

Forest Service Manuals

Forest Service Manuals (FSM) 2670.11, 2670.21 and 2670.31, require that National Forest System lands are not only managed for endangered, threatened and proposed (TEP) species, but also to recover TEP species. FSM 2670 directs Forests to manage National Forest System habitats to achieve recovery of TEP species and to avoid the need to implement special protection measures under the ESA.

Forest Service Sensitive Species

Forest Service Manual 2621.2 directs managers to display findings under the various management alternatives considered for individual projects. This assessment is based on the current geographic range of sensitive species on the Coconino National Forest and the area affected by the project. This assessment considers, as appropriate for the species and area, factors that may affect the current trend for the species population.

Sensitive species are defined as "those plant and animal species identified by a Regional Forester for which population viability is a concern, as evidenced by:

- a. significant current or predicted downward trends in population numbers or density, or
- b. significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution [FSM 2670.5(19)]".

It is the policy of the Forest Service regarding sensitive species to

1. assist States in achieving their goals for conservation of endemic species,
2. as part of the National Environmental Policy Act process, review programs and activities, through a biological evaluation, to determine their potential effect on sensitive species,
3. avoid or minimize impacts to species whose viability has been identified as a concern,
4. if impacts cannot be avoided, analyze the significance of potential adverse effects on the population or its habitat within the area of concern and on the species as a whole (the Line Officer, with project approval authority, makes the decision to allow or disallow impacts, but the decision must not result in loss of species viability or create significant trends toward Federal listing), and
5. Establish management objectives in cooperation with the State when projects on National Forest system lands may have a significant effect on sensitive species population numbers or distributions.

Invasive Species

Forest Service regulations at 36 CFR 222.8 acknowledge the Agency's obligation to work cooperatively in identifying invasive species (including noxious weeds) problems and initiating control programs in aquatic and terrestrial areas of the National Forest System.

Departmental Regulation 9500-4. USDA policy on wildlife, fish, and plant habitat management on National Forest System lands and waters. This regulation provides that the Department will promote the concept and use of integrated pest management practices in carrying out its responsibilities for pest control, and will seek to alleviate damage by plant and animal pests to farm crops, livestock, poultry, forage, forest and urban trees, wildlife, and their habitats. Departmental agencies, through management and research programs, will develop or assist in developing new techniques and methodologies for the prevention of damage to agricultural or forestry production. The agencies also will strive to reduce potential depredation through improved management of USDA programs. Pest control techniques and considerations will be incorporated into appropriate management and education programs.

Native Plant Materials Policy (FSM 2070). Forest Service manual direction on the use of native plant materials in re-vegetation, rehabilitation, and restoration of both aquatic and terrestrial ecosystems across the National Forest System.

Pesticide Use Management and Coordination Policy (FSM 2150). Provides agency policy and guidance on the use of pesticides as part of an integrated pest management approach. Additional guidance provided in the Pesticide Use Management Handbook (FSH 2109).

Executive Orders

Invasive Species, EO 13112 of February 3, 1999

Directs Federal agencies to: (1) identify actions that may affect status of an invasive species; (2)(a) prevent introduction of such species; (b) detect and control such species; (c) monitor population of such species; (d) provide for restoration of native species; (e) conduct research on invasive species and develop technologies to prevent introduction of such species; (f) promote public education of such species; and (3) not authorize, fund, or carry out actions likely to cause the introduction or spread of invasive species in the United States or elsewhere unless the benefits of the action clearly outweigh the harm and the agencies take steps to minimize the harm.

Migratory Birds, EO 13186 of January 10, 2001

On January 10, 2001, President Clinton signed Executive Order 13186 for the “Responsibilities of Federal Agencies to Protect Migratory Birds” which directed the federal agencies to develop an MOU with the US Fish and Wildlife Service to promote conservation of migratory birds. Agencies shall identify potential impacts to migratory birds and their habitats, avoid or minimize adverse impacts, restore and enhance habitats, and evaluate the effects of actions on migratory birds. The MOU between the Forest Service and the U.S. Fish and Wildlife Service was signed in 2008, and was extended through 2017 by mutual agreement between the agencies. In March 2018, the Southwestern Region issued project-level implementation guidance for disclosing impacts to migratory birds.

Other Guidance or Recommendations

Pollinators

On June 20, 2014, the White House released a “Presidential Memorandum—Creating a Federal Strategy to Promote the Health of Honey Bees and Other Pollinators” (PDF, 52 KB). The memo’s introduction states the following:

“Over the past few decades, there has been a significant loss of pollinators, including honey bees, native bees, birds, bats, and butterflies, from the environment. The problem is serious and requires immediate attention to ensure the sustainability of our food production systems, avoid additional economic impact on the agricultural sector, and protect the health of the environment.” “Given the breadth, severity, and persistence of pollinator losses, it is critical to expand Federal efforts and take new steps to reverse pollinator losses and help restore populations to healthy levels.”

With this direction, U.S. Department of Agriculture and U.S. Department of Interior, issue this timely and critically needed document, Pollinator-Friendly Best Management Practices For Federal Lands, May 11, 2015 (PDF, 5.1 MBs). This document will guide federal land managers to effectively and efficiently use available resources and engage public and private partnerships in taking action for the conservation and management of pollinators and pollinator habitat on federal lands. BMPs cover these categories:

- determining the quality of foraging habitat;
- identifying important pollinator reproduction sites;
- determining important nesting and overwintering sites;
- identifying pollinators of sensitive or at-risk plant species on Federal, State, local, or nongovernmental organization (NGO) (e.g., NatureServe) lists as outlined in the National Academy of Sciences report Status of Pollinators in North America.
- identifying and removing invasive species to improve pollinator habitat;
- identifying, collecting, and using local, genetically appropriate native seeds;
- implementing adaptive management; and

- engaging and informing the public.

On May 19, 2015, the Secretary of the Department of Agriculture and the Administrator, U.S. Environmental Protection Agency, on the behalf of the Pollinator Health Task Force, transmitted the National Strategy to Promote the Health of Honey Bees and Other Pollinators (Strategy). This strategy outlines a comprehensive approach to tackling and reducing the impact of multiple stressors on pollinator health, including pests and pathogens, reduced habitat, lack of nutritional resources, and exposure to pesticides.

Topics and Issues Addressed in This Analysis

Purpose and Need

Purpose and need

The purpose of this project is to prepare a comprehensive river management plan for the Fossil Creek Wild and Scenic River to meet the requirements of Section 3(d)(1) of the Wild and Scenic Rivers Act. To meet these requirements, there is a need to develop management direction to provide for the protection or enhancement of Fossil Creek's river values (water quality, free-flowing condition and its outstandingly remarkable values or ORVs) for the benefit and enjoyment of present and future generations. In accordance with WSRA Section 3(d), "the plan shall address resource protection, development of lands and facilities, user capacities, and other management practices necessary or desirable to achieve the purposes of this Act." There is a need to amend the Land and Resource Management Plan for the Coconino National Forest (USDA FS 2018) and the Land and Resource Management Plan for the Tonto National Forest (USDA FS 1985, as amended and under revision) to incorporate the management direction provided by the CRMP. Currently, neither plan has sufficient guidance that would protect river values.

Following the lowering of the historic Fossil Springs dam and restoration of full water flows to Fossil Creek in 2005, public use of the river corridor has increased substantially. Recreational use during the summer season grew from an estimated 20,000 visitors in 2006 (Rotert 2013) to approximately 86,000 visitors in 2015 (DeSutter 2015). That same year, over 43,000 additional visitors were turned away because of lack of space in the corridor. This recreational use has essentially been unconstrained, as amenities present in Fossil Creek are limited in their ability to accommodate recreational demands and protect river values. Impacts to water quality, vegetation, wildlife, and cultural resources have been observed in recent years as a result of this unconstrained recreation. An interim management reservation/permit system was implemented in 2016, which limited the number of vehicles accessing the corridor per day. There is a need for a long-term management plan and site-specific actions that protect river values and other biological, physical and social resources while managing recreational access, use, and amenities at levels that strive to meet demand but are consistent with the protection of river values.

Issues

Key issues were raised in regards to: recreation use and visitor capacities; recreation management; infrastructure development; motorized access; and economic and commercial opportunities. Specifically for wildlife the following issues were raised:

1. Recreational use in Fossil Creek may disturb wildlife and fish, damage streamside vegetation, impact travertine deposition and existing travertine structures, increase soil erosion, reduce water quality, damage archeological sites, and compromise contemporary tribal values.
2. Allowing camping may increase impacts to natural and cultural resources and result in additional trash in the Fossil Creek corridor.
3. Motorized use in the vicinity of Fossil Creek may increase noise, crowding, trash, invasive species, pollutants, erosion, and siltation into the creek.

These issues are addressed in the analyses for wildlife, plants, and vegetation for each alternative.

Analysis Questions

Analysis questions for the Fossil Creek Wild and Scenic River corridor are connected both to programmatic direction the CRMP will provide for future management of the corridor and to specific actions proposed under the action alternatives.

- How do management actions protect and enhance indicators of the biological ORV?
- Which activities affect wildlife, plants, and their habitat and how?
- How do management actions protect other biological values that are not river ORVs?
- How do management actions promote and move towards sustainable recreation and resource management?

Methodology

The Biological ORV analyzed in this report is comprised of wildlife habitat and representative species for which there is sufficient data to understand where they occur in the corridor and how management and recreational activities affect them (springsnail, black-hawk, lowland leopard frog, and invasive species). It is these species for which WSRA-specific analysis is conducted (indicators, measures, adverse effect thresholds, degradation thresholds, enhancement thresholds, monitoring). Also, for these species baseline condition is required as per WSRA. Baseline is defined as the state of species population at the time of designation which was 2009. Not all of the species had survey data in 2009, so the next best available information was used.

The effects analysis, however, covers all special status species. The effects analysis discusses the different components of management activities (programmatic management direction, design features, monitoring, adaptive management and amendments to both forest plans), the acres of habitat that could be lost due to construction of infrastructure within recreation development areas, the amount of habitat that can be impacted within recreation dispersal areas, the amount of habitat affected by roads and trails, the amount of acres that will be restored, and the overall amount of refugia (particularly riparian habitat) protected. Definitions for these various categories are described next.

Measures that quantitatively describe alternative effects include acres of disturbed habitat by specific vegetation type, acres of refugia habitat, acres of restored habitat, acres of full potential habitat (refugia plus restored), number of dispersed recreation sites with creek access, stream lengths with recreation access, percentage of stream length with recreation access, PAOTs, and feet of stream per person within recreation sites.

Key Assumptions

The project area includes the FCWSR corridor plus additional areas along FR 708 where maintenance may occur, the area south of FR 708 on the Strawberry side where rock scaling would be required before opening the closed portion of the road, and the Fossil Springs and proposed Bear trailhead areas.

The analysis area includes four 6th code watersheds (Upper Fossil Creek, Lower Fossil Creek, Hardscrabble Creek, and Mud Tanks Draw).

In general, the analysis of effects will cover the programmatic management direction (incorporated by amendment in to the Coconino and Tonto national forest plans), management actions, the monitoring plan, and adaptive management. The analysis assumes all necessary mitigation measures, design features, best management practices, and monitoring will be implemented along with management actions. Connected to the management actions, there are five categories where management activities differs:

- 1) The areas associated with each of the **developed recreation footprints** and the **construction footprints** (gabion, new FR 708 bridge, and entrance stations) will be analyzed as if the entire area could be

disturbed from either machinery, the building of infrastructure, the presence of vehicles, and use by visitors.

- 2) In the areas associated with the **recreation dispersal footprints**, the effects of visitors (ground disturbance, noise disturbance, trash, etc.) will be analyzed but the assumption is that no major machinery or infrastructure will be used or built in these areas. Minor allowed infrastructure or actions could include signage, hardened trails and armored creek access, and restoration activities.
- 3) In areas slated for **restoration** and roads slated for closure, a variety of methods can be used spanning from soft closures with natural revegetation occurring to hard closures involving ripping and seeding and temporary barriers.
- 4) On **designated roads and trails**, ground-disturbing activities and use of equipment may occur. On designated roads, maintenance (including new drainage improvements) and hazard mitigation activities (e.g. rock scaling) may be necessary outside of the road prism. In designated wilderness areas, no motorized equipment or mechanized transport will occur.
- 5) In **refugia areas**, which are upland and riparian areas outside of the above categories, the assumption is that effects from visitors will be so minor as to be negligible and that there will be no use of heavy machinery or development of infrastructure except for designated trails in upland areas.

Definitions for Consistency

Middle Fossil: The segment of Fossil Creek between the Mazatzal recreation site upstream to ¼ mile above the waterfall at the end of Lewis Trail.

Recreation site: the combined area of both the recreation construction footprint and the recreation dispersal area.

Assumptions specific to the wildlife analysis include:

- 1) The project analysis area is the Fossil Wild and Scenic River (FWSR) corridor.
- 2) Effects analyses are based on the amount of disturbed habitat, amount of habitat to be restored, riparian habitat disturbed versus restored, total potential refugia, and the differences in implementation strategies.
- 3) The cumulative effects analysis area is the following 6th code watersheds: Lower Fossil Creek, Upper Fossil Creek, Hardscrabble Creek, and Mud Tanks Draw. Because only a few acres occur in the Gap Creek 6th code down by the Verde confluence and this area is managed under the Verde River CRMP, it is not included in this analysis.

Information Sources

Species occurrence information was obtained by:

- Compiling past Forest survey results into an Access database.
- Compiling survey results from agency, academia, and citizen science efforts.
- Inventory and monitoring species and their habitat following established protocols.
- Querying the District Biologist's database for all species observations in Fossil Creek

Affects analysis is accomplished utilizing the following:

- The Forest Service's past recreation use numbers
- The Forest Service's bare soil inventory data

- Soils and Watershed specialist report
- GIS queries of acreages in various categories

Incomplete and Unavailable Information

Although surveys for some species have occurred, surveys have not been conducted throughout the entire corridor due to inaccessibility of the lower Fossil Creek reach. Also, thorough inventories of most species and some major taxa groups has not been completed. For example, in certain years, fairly thorough surveys have been conducted for plants, southwestern willow flycatcher, western yellow-billed cuckoo, lowland leopard frogs, black-hawks, and bats. But for Fossil springsnails, only certain springs have been surveyed and other springs and seeps still need to be investigated. The most under-inventoried taxa are the terrestrial invertebrates, followed by upland birds, upland mammals, and upland reptiles.

Spatial and Temporal Context for Effects Analysis

Direct/Indirect Effects Boundaries

The spatial boundaries for analyzing the direct and indirect effects to wildlife are generally the FC WSR corridor, because most recreation impact and construction of and maintenance of existing infrastructure occurs within the corridor. However, because the Mail trail connects the corridor to Hwy 260 and through Chiricahua leopard frog habitat, that species has a different analysis boundary. Likewise, visitors canyoneering in the upper part of the corridor will likely continue into Sandrocks and Calf Pen canyons. Therefore the analysis area for the Mexican spotted owl will include Sandrocks and Calf Pen canyons.

The temporal boundaries for analyzing the direct and indirect effects are until new information becomes available. While the effects will continue as long as recreation is allowed in the corridor, the effects analysis should be adequate for a decade or more. Monitoring will indicate need for changes in management. Should new information regarding these species become available, adaptive management changes or even additional analysis may be warranted. If new species are added to various special status species list, new or additional analysis may be warranted. For example, if a species becomes listed, consultation may be required upon listing.

Cumulative Effects Boundaries

The spatial boundaries for analyzing the cumulative effects to wildlife and plants are the four 6th code watersheds (Upper and Lower Fossil, Hardscrabble, and Mud Tanks) because there may be downstream indirect effects such as sedimentation and movement of non-native species. In addition, canyoneering, cross country travel, and use of the Mail Trail connect activities in the uplands outside of the corridor to the Fossil Creek corridor. The future temporal boundaries for analyzing the cumulative effects are 10 years because we anticipate we will have implemented the selected alternative elements within 10 years.

Summary of the Biological Outstandingly Remarkable Value

Analysis Indicators and Measures

The biological ORV is comprised of both habitat and populations of fish, aquatic invertebrates, and wildlife, including birds, mammals, reptiles, and amphibians. This specialist report covers all but fish and macroinvertebrates, which are covered in a separate report. The biological indicators used to analyze the effects of the programmatic management direction and specific management actions proposed under the CRMP include wildlife habitat, springsnail habitat, black-hawk habitat, black-hawk population, lowland leopard frog, and invasive species. These species are, by proxy, indicators for suites of wildlife; their ability to thrive in Fossil Creek are indicators that conditions are acceptable for other species. Refer to Table 2 for the measures associated with each of the biological indicators.

Table 2. Wildlife indicators and measures for assessing future effects

Resource Element	Resource Indicator	Measure	Used to address: P/N, or key issue?	Source
Wildlife Habitat	Hydrologically connected unplanned bare soil	Miles of unauthorized trails or area (acres) of bare soil from dispersed recreation	Y	Biological/Habitat
Invasive plant species	Presence of Class A and E non-native invasive plant species.	Acres occupied by class A and E non-native plant species	Y	Biological ORV/Habitat
Springsnail Habitat	Habitat condition assessment rating on occupied springs	Numeric habitat condition ratings for various habitat parameters	Y	Biological ORV/Habitat
Black-hawk Habitat	Understory vegetation remains intact	Human-caused ground disturbance within proximity of occupied nest and number of sites abandoned.	Y	Biological ORV/Habitat
Springsnail Population	Viable population as indicated by relative abundance	Number of individual snails counted (catch per unit effort) during timed count surveys.	Y	Biological ORV/Wildlife
Black-hawk Population	Number of active black-hawk nests from Fossil Springs down through Mazatzal site.	Number of black-hawk pairs or fledged young	Y	Biological ORV/Wildlife

Adverse Impact Thresholds

The wildlife population component of the biological ORV would be adversely impacted if public use, development, or administrative use negatively impact the size, structure, or requirements of wildlife species populations in the Fossil Creek corridor in a way that reduces population numbers but not to the level that affects population viability.

The wildlife population portion of the Biological ORV is based on special status species for which there was enough concern regarding their status in the Fossil corridor that resources were allocated for inventory and monitoring efforts. The following explanation of thresholds by species are based on the monitoring plan which is subject to change if new information indicates a need for changing threshold levels.

The common black-hawks in Fossil Creek are an important species to monitor because they are an early indicator of disturbance within this watershed for the following reasons: 1) they are susceptible to disturbance (as expected from restoration activities as well as recreational use of the corridor), 2) they were a Forest Service Sensitive species prior to 2013, 3) they are a Tonto National Forest Management Indicator Species with a declining population trend; 4) in Fossil Creek, abundant native prey (fish) is available to black-hawks unlike all other perennial system in the Verde Valley (Etzel et al. 2013), 5) they are a top level predator that thrives on native prey, 6) they are a good indicator for other canopy nesting, riparian obligate bird species (e.g. Summer Tanager, Warbling Vireo, Brown-crested Flycatcher); and 6) the Fossil population represents reference condition (for

comparison to other southwest populations) since nesting and food availability along Fossil reflect historic conditions.

Lowland leopard frogs have been monitored in Fossil Creek and are of concern because 1) they are a Forest Service sensitive species, 2) Fossil Creek supports the single remaining viable population of lowland leopard frogs on the Coconino National Forest and a significant population on the Tonto, and 3) decommissioning activities were closely managed in order to prevent the loss of the Fossil Creek population. Lowland leopard frogs on the Coconino have otherwise been extirpated or occur in such low numbers that population are inviable outside of Fossil Creek.

Fossil Springsnails are a species of interest in Fossil Creek because 1) they are a Forest Service sensitive species, 2) they are only known to occur in the Fossil Creek corridor (they are endemic to Fossil Creek), 3) there are only a few small populations isolated to specialized ecological niches within a narrow geographic range so Fossil springsnails are vulnerable to population die-offs and risk of extinction; 4) and they can be indicators of spring health.

The wildlife habitat portion of the Biological ORV is based on the vigorous deciduous riparian community as well as the complexity of structural aquatic habitat created by travertine formations within the channel. Impacts from recreation (such as trampling vegetation, compacting soil, erosion and sedimentation) are some of the stressors to Fossil riparian habitat.

Invasive plant species are another threat because when established, invasive species often convert diverse pockets of native vegetation to monocultures of non-native species, reducing habitat suitability for a variety of wildlife species.

Adverse effect thresholds to wildlife habitat and select species (with monitoring data) in the population portion of the Biological ORV are described in Table 3. Monitoring will determine if/when thresholds are exceeded.

Table 3. Adverse impact thresholds for the biological ORV

Resource Element	Adverse Effect would be indicated when:
Wildlife Habitat	New unauthorized trails or other areas of bare soil caused by visitor use are detected in refugia areas..
Invasive plant species	Existing class A and E non-native invasive plant populations increase in size or new populations become established.
Springsnail Habitat	Habitat rating of occupied springs is trending downward as a result of visitor use
Black-hawk Habitat	New unauthorized trails or other areas of bare soil caused by visitor use are detected in refugia areas within 400 meters of a black-hawk nest.
Springsnail Population	Monitoring shows a 25-50% reduction of the mean cumulative catch per unit effort estimates.
Black-hawk Population	...if in two consecutive years, seven black-hawk territories active nest sites are present between Fossil Springs and 0.5 miles below Mazatzal and there is evidence of increased bare soil caused by visitor use within 400 meters of nest sites.

Degradation Thresholds

The wildlife population component of the biological ORV would be degraded if public use, development, or administrative use impact the size, structure, or requirements of wildlife populations to the extent that viability of populations in the Fossil Creek corridor is threatened.

The indicators for degradation for the various wildlife habitat and population components, based on the monitoring plan which is subject to change, are included in Table 4:

Table 4. Degradation thresholds for the biological ORV

Resource Element	Degradation would be indicated when:
Wildlife Habitat	Unuauthorized trails or other areas of bare soil in refugia areas caused by visitor use are expanding despite implementation of adaptive management actions associated with soft thresholds or if recreation sites at the segment-wide scale are connected by unauthorized trails.
Invasive plant species	... on-native invasive plant species pose a risk to ecosystem function, including displacing or diminishing native plant and animal species.
Springsnail Habitat	Visitor use interferes with occupied springs' ability to attain and maintain high or moderate habitat condition in the long term.
Black-hawk Habitat	Unauthorized trails or other areas of bare soil in refugia areas within 400 meters of black-hawk nests caused by visitor use are expanding despite implementation of adaptive management actions associated with the soft threshold or recreation sites at the segment-wide scale are connected by unauthorized trails..
Springsnail Population	Monitoring shows >50% reduction of the mean cumulative catch per unit effort estimates.
Black-hawk Population	If two consecutive years, six or fewer active black-hawk territories and/or nests are detected between Fossil Springs and 0.5 miles below Mazatzal and there is evidence of increased bare soil caused by visitor use within 400 meters of a site.

Enhancement Thresholds

The wildlife population component of the biological ORV is protected if the size and structure of wildlife populations support long-term species viability in the Fossil Creek corridor. Opportunities for enhancement include expanding interpretation and educational programming related to wildlife intended to reduce human impacts to these species' populations; actions that would enhance water quantity and quality, riparian function, travertine formations, and prey bases; the Fossil Creek corridor contributing to down-listing or delisting of federally listed species that occur or have potential to occur in the corridor; and supporting inventories and research intended to improve the understanding of wildlife populations.

The indicators for enhancement for the various wildlife habitat and population components, based on the monitoring plan which is subject to change are included in Table 5:

Table 5. Enhancement opportunities for the biological ORV

Resource Element	Enhancement would be indicated when:
Wildlife Habitat	...Bare soil in refugia areas that can be attributed to visitor use is absent or decreases year-to-year.
Invasive plant species	...class A and E non-native, invasive plant species populations are reduced and spread is controlled.
Springsnail Habitat	...springs maintain high habitat condition ratings.
Black-hawk Habitat	... Bare soil in refugia areas within 400 meters of black-hawk nest areas that can be attributed to visitor use is absent or decreases year-to-year.
Springsnail Population	Viable populations of Fossil springsnails are maintained in the Fossil Creek Corridor.
Black-hawk Population	...More than seven pairs of black-hawks are maintained from Fossil Springs downstream to 0.5 below Mazatzal.

Summary of Alternatives

This summary highlights the general purpose of each alternative considered in detail for the Fossil Creek CRMP and how implementation of the alternatives would occur. By considering different visitor capacities, recreation facilities, and transportation infrastructure, the alternatives would provide differing visitor experiences in Fossil Creek. The different scenarios reflected in each alternative are responsive to issues raised during the extensive scoping conducted throughout the planning process. Refer to Chapter 2 of the EIS for the full narrative description of the components of the alternatives.

While each alternative would present a different visitor experience, many components would be common to all of the action alternatives. These common components result from requirements of the Wild and Scenic Rivers Act to protect and enhance river values and other Forest Service law, regulation and policy. Common components include management direction to define management goals and support progress toward those goals; monitoring and adaptive management; restoration of impacted areas to improve watershed and ecosystem function; interpretation and education to facilitate effective management and enhance visitor understanding and stewardship of wild and scenic rivers and the unique Fossil Creek environment, history, and culture; and opportunities for research. Additionally, in all alternatives, areas outside of recreation sites¹ and away from trails and roads would serve as refugia for wildlife, fish, and plants.

Alternative A (No Action): As the “no action” alternative, Alternative A serves as the basis of comparison for analyzing the environmental impacts of implementing the action alternatives. Alternative A represents a continuation of current management of the Fossil Creek and the surrounding area. No CRMP would be developed; thus, management of Fossil Creek would not comply with the Wild and Scenic Rivers Act. Interim management such as capacity control and restoration activities would continue as needed, but would not be guided by plan direction specific to the Fossil Creek area.

Alternative B (Enhanced Protections): Alternative B would provide a more primitive visitor experience in Fossil Creek and emphasize protection of natural and cultural resources with minimal development of new facilities and infrastructure and a lower visitor capacity. Existing recreation sites, roads, and trails would be retained but not expanded, and a minimal amount facility and infrastructure improvement would support the sustainability of the recreation sites and transportation infrastructure.

Alternative C (Non-Motorized Experience): Alternative C would emphasize non-motorized recreation in Middle Fossil² by limiting motor vehicle use in portions of the river corridor during the busiest times and developing additional trails for hiking, bicycling, and equestrian use. A lower visitor capacity would support a quieter recreation experience. Trail access to the historic dam and Fossil Springs would be eliminated to minimize the effects of human presence in this area. Additional parking and visitor facilities would be developed at Cactus Flat and Homestead to serve as the primary entry point into the river corridor; from there visitors would access the corridor by foot, bicycle, or horseback during the high-use season. During the low-use season, visitors would be able to drive past Homestead to park at a reduced number of parking spaces in existing parking lots. A moderate amount facility and infrastructure improvement would support the sustainability of recreation sites and transportation infrastructure in the corridor.

Alternative D (Motorized Use and Refugia): Alternative D would expand motorized access to Middle Fossil by increasing road connectivity and providing for scenic driving. Once hazard mitigations and repairs are completed, the currently closed portion of Forest Road (FR) 708 would be reopened to all motor vehicles. Recreational use would be focused at fewer sites in the river corridor. Some recreation sites would be closed and trail access to Fossil Springs and the Waterfall would be eliminated in order to maximize relatively undisturbed habitat (refugia) areas. New facility and infrastructure development would be focused on facilitating motorized access and supporting increased use at and sustainability of recreation sites. Increases in visitor capacity could be phased in over time.

Alternative E, Proposed Action (Enhanced Recreation Opportunities with Phased Implementation): Alternative E would emphasize providing a variety of recreation opportunities throughout the Fossil Creek

¹ The term “**recreation sites**” includes both developed recreation footprints and recreation dispersal footprints. **Developed recreation footprints** are areas within the Fossil Creek WSR corridor in which disturbance from machinery, the building of infrastructure, the presence of vehicles, and use by visitors may occur. **Recreation dispersal footprints** are areas within the Fossil Creek WSR corridor where effects from visitor use may occur, but no major machinery or infrastructure will be used or built in these areas. Minor allowed infrastructure or actions could include signage, hardened trails and armored creek access, and restoration activities. These areas differ by alternative.

² “Middle Fossil” includes the segment of Fossil Creek between the Mazatzal recreation site upstream to ¼ mile above the waterfall at the end of the Lewis Trail.

corridor. Phased development of additional parking and visitor facilities could occur at Cactus Flat, Heinrich, and Irving to support increased visitor capacity, and improvements at other recreation sites would be focused on supporting increased use at and sustainability of those sites. New trails for hiking, bicycling, and equestrian use would be constructed. Once hazard mitigations and repairs are completed, the currently closed portion of FR 708 would be reopened to motor vehicles less than 62 inches wide.

Alternative F (Demand-based Access): Alternative F would meet anticipated demand for recreational use in Fossil Creek through 2030 in order to prevent the need for a reservation system. This would be accomplished by establishing a large parking area at Cactus Flat, with additional parking at Homestead and several other recreation sites. New trails for hiking, bicycling, and equestrian use would be constructed. New facility and infrastructure development would support increased use at and sustainability of recreation sites. Cactus Flat and Homestead would serve as the primary entry point into the river corridor; private motor vehicle access to the remaining upstream recreation sites in Middle Fossil would be restricted during the high-use season. During the low-use season, visitors would be able to drive past Homestead to park in existing parking lots.

Alternative Selection and Implementation

The decision on this project will select which alternative is carried forward into the CRMP. A combination of components of alternatives in the decision is possible, so long as the effects of the combination are within bounds of effects disclosed in this EIS. An implementation plan would be developed for the selected alternative along with the final decision. If **alternatives B or C** are selected, the number of parking spaces at recreation sites would be reduced in the year following finalization of the CRMP to bring visitor use at recreation sites to levels consistent with capacities.

If **alternatives D, E, or F** are selected, increasing visitor capacity would occur incrementally and be contingent on funding availability and establishing facilities and infrastructure that are able to support higher amounts of use. Development of new facilities and infrastructure and corresponding increases in visitor capacity would require determination that river values would continue to be protected with additional visitor use. This determination would be based on assessment of monitoring data and management observations. Alternative F would strive to meet recreation demand relatively quickly while holding to these conditions in order to achieve the goal of eliminating the need for a reservation system efficiently.

Programmatic Management Direction

Definitions Specific to Programmatic Management Direction

The CRMP provides “plan components” (plan decisions) and “other content” for the Fossil Creek Wild and Scenic River Management Area described by the land and resource management plans for the Coconino and Tonto national forests. Plan components include desired conditions, objectives, standards, and guidelines. Other content, in the form of management approaches, is meant to provide information and assist in understanding the larger management context, but is not mandatory direction (i.e., not a plan decision). Incorporation of the plan components and other content into the Coconino and Tonto forest plans will be done through programmatic plan amendments. The next 15 or so pages include management direction specific to vegetation and wildlife. The management direction contained in the Fossil Creek Comprehensive River Management Plan is included in its entirety in Appendix F.

Plan Components Specific to Vegetation and Wildlife

General Management Direction

Desired Conditions

The character and integrity of Fossil Creek and the 1/4-mile management buffer associated with the Wild and Scenic Rivers Act designation are maintained, with special emphasis on the protection and enhancement of Fossil Creek’s river values (free flow, water quality, and outstandingly remarkable values).

Other uses³ within and around the Fossil Creek WSR corridor do not adversely impact the river values and are consistent with river segment classifications.

The portion of the **recreational segment** between 1/4-mile upstream of the waterfall to 1/4-mile downstream of the historic dam protects travertine formations, riparian and aquatic habitat, and soil productivity.

Standards

River values at the segment scale shall not be degraded.

Forest orders shall be issued as necessary to protect and enhance river values and other river-related resources and protect public health and safety.

Guidelines

Resource protection measures should be applied where appropriate to minimize adverse effects of management activities to river values and other Fossil Creek WSR resources.

Management Approaches

Monitoring is used to determine management impacts on river values and to inform adaptive management actions.

Develop collaborative relationships with partners and local communities that create opportunities for volunteers and partners to work with the Forest Service to assist in recreation management, implementing projects, providing conservation education programs, and conducting research and monitoring.

Free Flow, Water Quality, and Water Quantity

Desired Conditions for Free Flow, Water Quality, and Water Quantity

Fossil Creek exists in a free-flowing condition with a natural range of flows that provide optimum conditions for native fish and wildlife, travertine formation and maintenance, riparian vegetation recruitment and maintenance, and human enjoyment.

Volumes or rates of spring recharge and/or discharge remain robust. Stream flows, including peak flows and flood events, occur within the range of natural variability and are minimally affected by human disturbances. Groundwater flow paths are within their natural range of variability and continue to contribute to base surface flows.

Fossil Creek's water quality maintains Arizona Department of Environmental Quality (ADEQ) standards. Water quality is maintained or enhanced to conform to the creek's classification as an Outstanding Arizona Water and to protect and enhance its outstandingly remarkable values.

Standards for Free Flow, Water Quality, and Water Quantity

A federal reserved water right for stream flows needed to protect Fossil Creek's outstandingly remarkable values shall be secured.

All proposals for water resources projects shall be subject to a Wild and Scenic Rivers Act Section 7 review process to analyze the potential impact to free-flow and other river values prior to installation.⁴

³ The Interagency Wild and Scenic Rivers Coordinating Council defines "other use" as "use within a WSR corridor other than public use, such as federally authorized mining, forestry, grazing, subsistence hunting and fishing, road use and management, administrative use for other than WSR purposes, and use on non-federal lands in a WSR corridor that have a potential to affect river values. Other use also includes any use on federal or non-federal lands that border upon or are adjacent to a WSR corridor that may substantially interfere with public use and enjoyment of river values" (IWSRCC 2018).

⁴ More guidance on the Section 7 determination process can be found in the Interagency Wild and Scenic Rivers Coordinating Council technical report *Wild & Scenic Rivers Act: Section 7* (IWSRCC 2004).

Water quality shall be managed for non-degradation of ADEQ standards and to support Fossil Creek's designation as an Outstanding Arizona Water.

Guidelines for Free Flow, Water Quality, and Water Quantity

Maintenance or modification of existing structures (e.g. the permanent fish barrier, gabion, and abutments of the Fossil Creek Bridge) should preserve or improve their integrity and function to protect river values. Temporary impediments to free flow, such as temporary fish barriers, should remain within the ordinary high water mark for as short a time as possible to minimize impacts to free-flow of the river.

Sanitary and trash facilities should be provided or other strategies should be used, where needed, to minimize impacts from human waste and trash and to protect Fossil Creek's water quality.

Objectives for Free Flow, Water Quality, and Water Quantity

Quantify stream flows needed to protect Fossil Creek's outstandingly remarkable values and claim a federally reserved water right to protect these flows within five years of plan approval.

Block and rehabilitate trails leading to Switchback Spring within five years of plan approval.

Management Approaches for Free Flow and Water Quality

Continue to measure and record Fossil Creek's stream flow.

Claim water rights on springs within the Fossil Creek corridor, with priority given to springs that support populations of Fossil springsnails and other sensitive wildlife species.

Seek opportunities to restore the structure and function of springs and seeps that support populations of Fossil springsnails and other sensitive wildlife species as needed.

Coordinate with ADEQ to assess, monitor, and adjust (as needed) management actions in order to meet state water quality standards.

Develop working relationships with local and state agencies with jurisdiction related to zoning of private property and/or use of groundwater and surface water.

Provide input to local and/or state planning processes that may impact water quantity in the Fossil Creek corridor.

Protect stream access by developing recreation sites and a sustainable trail system using appropriate best management practices (BMPs); in particular, designate armored stream access points (bedrock or extremely rocky surfaces).

Increase vegetation canopy and soil litter by rehabilitating disturbed or denuded areas where recreational infrastructure, including unauthorized trails, campsites, parking lots, day use areas, and forest and spur roads, are not needed. Allow denuded areas located in stream floodplains or with sensitive resource concerns that could be negatively affected by rehabilitation activities to recover naturally.

Riparian Function

Desired Conditions for Riparian Function

Riparian areas and associated stream courses, wetlands, and springs in the Fossil Creek corridor are functioning properly or making improvements toward proper function and are resilient to natural disturbances and changing climate conditions.

Stream bank stability and sedimentation levels fluctuate within natural range of variability and unplanned impacts from human use are rehabilitated.

Stream channel and bank stability are supported by native herbaceous species cover within the site's capability.

Road and trail crossings and other recreation impacts are minimized in springs, seeps, and wetlands. Where the existence of trails and roads over these areas is unavoidable, springs, seeps, and wetlands and their surrounding soil and vegetation are protected and function naturally.

Standards for Riparian Function

An aquatic management zone (AMZ) is established 100 feet from either edge of the perennial portion of Fossil Creek.

An AMZ is established for intermittent stream reaches (including the intermittent portion of Fossil Creek and Sally May and Boulder washes) to include the entire riparian area width⁵ or 50 feet on each side of intermittent streams, whichever is wider.

Guidelines for Riparian Function

To minimize short-term effects to riparian function, management practices within the AMZ should be planned and implemented in a manner that protects water quality, aquatic wildlife, and terrestrial and aquatic habitats.

Erosion and impaired conditions (loss of vegetation, reduced plant vigor, and impaired soils) should be reduced by eliminating trails on wetted soils and reducing trailing on fine, erosive soils.

Management Approaches for Riparian Function

Management activities and educational efforts should minimize human-caused damage to riparian trees, shrubs, herbaceous cover, and protective soil litter that may occur through trampling, rope swing construction, shelter construction, and "dead and down" and live wood collection.

Determine riparian function using the best available technique to assure the measureable indicators of riparian function are maintaining or making progress toward desired conditions.

Through coordination with other disciplines, restore or maintain riparian vegetation along Fossil Creek for moderating water temperature and protecting bank stability. Where necessary, investigate and implement cost effective biological remediation measures to control channel erosion.

Vegetation

Desired Conditions for Vegetation

A broad diversity of native plants representing all plant groups (bryophytes, ferns and their allies, and seed plants, including grasses and other monocots, forbs, vines, shrubs, and trees) is present within site capability. Native vegetation is able to naturally reproduce. Special status species, endemic species, and species of interest persist where suitable habitat occurs, and are not negatively impacted by human activities.

The composition of native vegetation species reflects potential as defined by the Terrestrial Ecological Unit Inventory or best available science. The density and vertical and horizontal canopy cover of native woody riparian tree species increases where not already at potential capability.

⁵ Criteria that may aid in delineating the riparian zone include, but are not limited to, (1) using existing site-specific riparian vegetation delineations (e.g. RMAP, riparian ecological response units, TEUI map units); (2) Soil and vegetation indicators, e.g. soil potential to support distinctive facultative or wetland-obligate vegetation; (3) fluvial geomorphic indicators; or (4) agency-supported guidance for delineating site-specific riparian areas such as the *National Riparian Vegetation monitoring Technical Guide*.

Riparian vegetation is at reference conditions for structure and species composition. Outside of recreation sites or stream access areas, vegetation is untrampled and human impacts to seedling and sapling riparian woody species are minimal.

Upland and riparian vegetation prevents accelerated soil erosion and sedimentation into downstream aquatic habitat. Vegetation within the AMZ serves as a natural filter to keep sediment out of the stream, reduce soil erosion, and buffer the stream from damage.

Mesquite bosque stands support productive and diverse understory conditions and remain intact and undeveloped.

Evergreen or live oaks (species known to be present are Emory oak, *Quercus emoryi*; Palmer oak, *Quercus palmeri*; and Netleaf oak, *Quercus rugosa*) occur in shrub or tree forms where conditions allow and are sustainable across the landscape. Large live oak trees provide food, roosts, and hibernation sites for wildlife and contribute to culturally important settings.

Invasive plants rarely occur in the Fossil Creek corridor, and where they exist their populations are declining or limited to regularly disturbed areas.

Guidelines for Vegetation

Stream vegetative cover should be managed toward potential natural vegetation outside of recreation sites, as defined by the Terrestrial Ecological Unit Inventory.

Existing invasive plant species targeted for removal should include, but are not limited to, tamarisk (*Tamarix chinensis*), giant reed (*Arundo donax*), and Himalayan blackberry (*Rubus discolor*).

Tree savers⁶ should be encouraged for hammock use.

Objectives for Vegetation

Obtain baseline inventory of plant species in Fossil Creek within 10 years of plan approval. When possible, obtain vouchers (or duplicates) through collection efforts and ensure they are curated in Forest Service Herbariums (either Tonto Herbarium or Coconino Herbarium).

Management Approach for Vegetation

Increase collaboration between agency botanists/biologists/ecologists experienced in Arizona/Southwest floristics, rare and invasive plants, and plant systematics in order to better document the flora within the corridor; population status of the special status species, endemic species, and species of interest, including possible new, previously unknown cryptic species that may emerge from further investigation; and to better understand plants and their role in the ecology of Fossil Creek.

Soil Condition

Desired Conditions for Soil Condition

Soil conditions in the Fossil Creek corridor support ecological function. Human-created bare areas outside of recreation sites are minimal, particularly in the AMZ and on connected upper stream terraces.

Guidelines for Soil Condition

Erosion, sedimentation into Fossil Creek, impacts to soil productivity, or other unacceptable adverse resource impacts originating in recreation sites, roads, or trails should be mitigated through the use of BMPs, site re-design, or restoration.

⁶ Tree savers are straps that go around trees to minimize damage to the tree bark and cambium that could result from hammock use.

If denuded or compacted areas are detected outside of recreation sites, designated trails, or roads, these areas should be evaluated for restoration, with priority given to areas that are hydrologically connected to Fossil Creek.

Geology

Desired Conditions for Geology

Formation of travertine dams and other natural travertine features occurs at varying rates, patterns, and locations consistent with Fossil Creek's natural free flow, water quality, and water quantity.

In the travertine-dominated reaches of Fossil Creek, the deposition of travertine impounds sediments and forms terraces or dams that support a variety of submergent, floating, emergent, herbaceous, and shrubby habitat components. The presence of travertine increases the diversity of pools, riffles, glides, runs and backwaters, all of which provide an array of habitats for numerous plant, wildlife and fish species.

Travertine formations in areas with creek access recover during the lower visitor use periods if impacts to these formations have occurred.

Guidelines for Geology

Management activities and recreational use should limit disturbance to the relict and contemporary travertine deposits in the corridor. Recreation sites and armored creek access points should be located to limit physical disturbance of travertine and sediment inputs that affect travertine deposition rates.

Management Approach for Geology

Develop collaborative relationships with recreational user groups, particularly boaters, for stewardship, protection, user community learning, and site design planning in order to protect travertine formations and deposition.

Determine interest in research, including long-term studies of travertine dam formation and recreation management, to provide a basis for determining whether human disturbances are influencing travertine deposition.

Wildlife, Fish and Aquatic Species

Desired Conditions for All Wildlife, Fish, and Aquatic Species

Wildlife, fish, and aquatic species are diverse and abundant, and populations are viable where suitable habitat exists. Native wildlife, particularly special status species, demonstrate high reproductive success rates.

Refugia from human-caused disturbance are abundant and accessible to wildlife, fish, and aquatic species.

Diminishing populations of native species remain stable or increase over time to ensure population viability.

Habitat conditions contribute to the survival and recovery of listed species, allow for repatriation of extirpated species, contribute to the delisting of species under the Endangered Species Act, and contribute to keeping common native species common.

The status of special status species is improving, contributing to recovery of these species. Special-status species populations are not adversely affected by land use and land management activities.

In Middle Fossil, stretches of relatively undisturbed habitat exist outside of recreation sites. These less-disturbed areas provide aquatic and riparian obligatory terrestrial species refugia from human disturbance. Unauthorized trails and other denuded areas do not become established between recreation sites.

Information about the consequences of introduction and spread of non-natives (plants, fish, crayfish, mussels, and diseases) is available to visitors and visitors take measures to inspect, remove, and clean equipment before

entering Fossil Creek to prevent spread of exotic species. New invasive exotic species are prevented from being introduced or established in the Fossil Creek corridor through public education, signage, and law enforcement. Known invasive species are contained, their spread is controlled, and populations are declining. Species that are the most invasive and pose the greatest threat to biological diversity, forest health, and watershed condition are eradicated. Natural population dynamics and predator-prey relationships previously damaged by non-native species are re-established, such as between native leopard frogs, garter snakes, and fish.

Desired Conditions for Wildlife

A diverse assemblage of bats is present in healthy populations, and a diversity of roosting structure is present. Disturbance of bat roosts within the river corridor is minimal.

Baseline conditions for major wildlife taxa (reptiles, amphibians, mammals, birds, and terrestrial invertebrates) are known.

Pollinators are diverse in Fossil Creek and food plants, larval host plants, nesting sites, and over-wintering sites are available throughout the river corridor. Fossil Creek serves as a nectar corridor connecting the Verde River corridor to the Mogollon Rim.

Human activities do not result in black-hawk nest site abandonment. No detections of nesting mortalities or nest failures attributed to human influences occur. Black-hawks continue to have high nesting success. Native prey constitutes the majority of black-hawks' diets.

Lowland leopard frogs colonize suitable habitat,⁷ and population numbers reflect site potential. Non-native species or human activities do not contribute to population declines.

Populations of predators (jays, ravens, grackles, skunks, ringtails), nest parasites (cowbirds), and nuisance wildlife (skunks, rodents, squirrels, and ants) do not increase as a result of garbage and food left unsecured or improperly disposed of.

Desired Conditions for Fish and Aquatic Invertebrates

Fossil Creek supports a diverse assemblage of native fish and aquatic invertebrates. Species and population abundances reflect the diversity, quantity, quality, and capability of habitats in the Fossil Creek corridor.

In the **recreational segment**, stretches of relatively undisturbed aquatic habitat (refugia) exist between recreation sites. These refugia represent all types of habitat present in Fossil Creek and support the ability of native fish to successfully survive and reproduce.

Baseline conditions for fish taxa, especially imperiled taxa, are known.

New and existing instream water rights are procured or maintained in the Fossil Creek corridor to ensure enough water is available to provide for habitat needs of special status aquatic species.

Human-caused sources of sediment input to Fossil Creek are minimized. Sediment and ash delivery to Fossil Creek resulting from wildfire is rare.

Re-introduced populations of native fish species are self-sustaining and future re-introductions of native fish and other native species support population viability.

Non-native fish remain absent in Fossil Creek above the permanent fish barrier.

⁷ From Irving to the permanent fish barrier, crayfish are present and likely contribute to lowland leopard frogs not colonizing that section. From the permanent fish barrier downstream to the confluence with the Verde River, it is unlikely lowland leopard frogs will become established and persist due to the presence of non-native fish and crayfish.

Fossil Creek supports an abundant and diverse aquatic macroinvertebrate community and rare species are present within the ecosystem's capability.

Standards for Wildlife, Fish, and Aquatic Species

When invasive non-native fish are detected upstream of the permanent fish barrier, efforts shall occur to contain and treat to eliminate the non-native fish.

To prevent the introduction and spread of terrestrial or aquatic pathogens or invasive plants and animals, approved methods shall be followed to decontaminate equipment (such as machinery, monitoring equipment, or footwear) that will come into contact with water or wetted soils in the Fossil Creek corridor.

Guidelines for Wildlife, Fish, and Aquatic Species

To minimize noise and disturbance which may result in nest abandonment or reproductive success, road maintenance and other non-emergency construction and maintenance activities such as power or transmission line vegetation maintenance involving loud heavy machinery or other loud activities (such as blasting) should occur only between September 1 and March 14 to avoid the breeding season for special status nesting bird species. Refer to **Appendix X** for sound levels for equipment and activities. Activities in the high, very high, and extremely high range should not occur during the breeding season (March 15 through August 31).

To minimize abandonment of occupied black-hawk nests sites, a 200-meter buffer around occupied nests should be largely free from visual and aural disturbance during the breeding season (March 15-August 30).

Seasonal closures, such as of trails, roads, or portions of Fossil Creek, should be implemented as needed in order to protect rare wildlife species during critical seasons.

To limit effects to springsnail populations, known Fossil springsnail sites should be protected from human-caused disturbance.

To maintain or augment springsnail populations, springs interrupted by man-made features such as roads should be restored to the furthest extent possible and should be made compatible with Fossil springsnail survival, if springsnails are found to be present at the location of such features.

Visitation to cliff dwellings, caves, and tunnels should be discouraged to reduce disturbance to roosting bats.

To limit and eradicate invasive species populations, treatment of known populations of highly invasive non-native terrestrial and aquatic species in the Fossil Creek corridor should continue.

The existing fish barrier should be inspected at least once annually (preferably in the fall) to ensure proper function at both base and elevated flows.

Recreation sites and new facilities within mesquite bosques should be limited to prevent habitat fragmentation for Bell's vireo, yellow-billed cuckoo, and other bosque-dependent species.

To promote refugia between recreation sites, human use outside of recreation sites, roads, and trails within the riparian area should be discouraged through natural barriers, revegetation, signage, or other actions anticipated to be effective.

Species recovery actions should be implemented for species with approved recovery plans or conservation strategies.

To augment or establish populations of native species where suitable habitat exists, re-introductions of extirpated native species should occur when scientifically supported and re-introductions are likely to be successful.

Objectives for Wildlife, Fish, and Aquatic Species

Obtain baseline inventory of the major wildlife taxa (reptiles, amphibians, mammals, birds, and terrestrial invertebrates) in Fossil Creek within 10 years of plan approval.

Obtain baseline inventory of aquatic invertebrate taxa (including IBI or a similar measure) with at least three surveys within 10 years of plan approval.

Management Approach for Wildlife, Fish, and Aquatic Species

Cooperatively manage the native fishery through existing policy and agreements between the Forest Service and Arizona Game and Fish Department.

If invasive non-native fish are discovered in the stream above the fish barrier, collaborate with AGFD, FWS, BOR and other agencies to remove the non-native fish using timely means appropriate to the situation. This may include a rapid response using mechanical methods for isolated, small non-native populations up to a temporary barrier with piscicide treatments for larger populations of non-native fish.

Continue cooperation with entities such as U.S. Fish and Wildlife Service, Arizona Game and Fish Department, Bureau of Reclamation, and academia to monitor species populations and habitat, identify threats, and propose adaptive management actions necessary to alleviate threats.

Coordinate with search and rescue agencies to record the frequency and location of emergency helicopter landings in the Fossil Creek corridor. Compare landing locations to black-hawk nest sites in order to track whether emergency landings result in changes to black-hawk occupancy and/or nest success.

Through collaborative efforts with Arizona Game and Fish Department and the U.S. Fish and Wildlife Service, track re-routed flows at Irving spring, conduct surveys for Fossil springsnails in wetted areas, and evaluate opportunities to restore or create habitat for springsnails.

State fishing rules and regulations are enforced in Fossil Creek.

Construct temporary fish barriers as needed to contain non-native fish. Treatment may include various methods such as use of piscicides or mechanical removal.

Restore denuded areas such as unauthorized roads, trails, campsites, and pullouts that have been created outside of recreation sites. Prioritize areas in the AMZ, especially denuded areas that have hydrologic connectivity with Fossil Creek. Obliterate unauthorized trails to cliff dwellings, caves, and tunnels in order to reduce disturbance to roosting bats (and archeological sites).

Traditional Cultural Practices

Desired Conditions for Traditional Cultural Practices

Overstory vegetation grows in a natural state (mesquite trees are not heavily trimmed, for instance).

To avoid cultural resource impacts, recreation use is limited to established recreation sites, system trails, and armored areas to access the creek

The river corridor upstream and downstream of Middle Fossil appear in a natural, unmodified condition without evidence of non-system trails, human-caused denuded areas, or other evidence of recreational use.

Guidelines for Traditional Cultural Practices

Recreational access to cliffs and caves in the uplands should be restricted if necessary to protect heritage resources.

Recreation

Desired Conditions for Recreation

Diverse visitors of all abilities and interests have opportunities to engage in a variety of wild and scenic river-dependent recreation activities. Abundant opportunities exist to view, learn about and appreciate the cultural and natural river values of Fossil Creek. A mixture of unstructured and managed recreation opportunities exists that is compatible with protection of river values.

The spatial and temporal distribution of visitors within the Fossil Creek corridor is consistent with capacity of recreation sites.

Hunting and fishing opportunities are available in coordination with Arizona Game and Fish Department, and do not conflict with Fossil Creek's resource protection and recreation management needs.

Wilderness character is preserved or enhanced in the two **wild segments**. These areas provide a high-quality wilderness recreational experience with outstanding opportunities for solitude, primitive and unconfined recreation, physical and mental challenge, and inspiration.

Interpretation and education support visitor understanding and appreciation of Fossil Creek's river values and to stewardship of the land.

Standards for Recreation

Capacities shall be established for visitor uses consistent with protection and enhancement of river values.

Group size in the **wild segments** is limited to 12 persons and/or stock animals (combined).

Toilets and developed camping shall be located outside of the 100-year floodplain and AMZ and away from Fossil springsnail habitat.

Dispersed campsites shall be located outside of the AMZ, except for backcountry camping where topography is limiting. Dispersed camping sites shall be located away from Fossil springsnail habitat.

Trails that parallel Fossil Creek and connect recreation sites shall not be constructed or adopted within the riparian area. The established Lewis (Waterfall) Trail is an exception.

No new trails shall be constructed to or across springs within the Fossil Creek corridor.

Roadside parking shall be prohibited throughout the river corridor, unless designated at specific locations.

Motorized vehicles and mechanized vehicles, such as mountain bikes, shall remain on designated roads and trails, where such uses are authorized.

Motorized watercraft shall be prohibited within the Fossil Creek corridor.

Discharging a firearm shall be prohibited within the Fossil Creek corridor unless conducted as part of a legal hunting activity.

Campfires and stove fires (with the exception of pressurized liquid or gas burners) shall be prohibited within the Fossil Creek corridor and Stehr Lake, except for tribal use.

Glass containers shall be prohibited within the Fossil Creek corridor.

Rope swings shall be prohibited within the Fossil Creek corridor.

Guidelines for Recreation

To manage for portions of the corridor that look, sound, and feel as natural and untrammelled as possible, social encounters and evidence of human use in the **wild segments** of the Fossil Creek corridor and the reach of Fossil Creek in the **recreational segment** between 1/4-mile upstream of the waterfall to 1/4-mile downstream of the historic dam should be more consistent with a primitive ROS setting.

Within refugia areas, recreational use should be dispersed and of low intensity so that the refugia characteristics are not significantly impacted.

Boating should be managed in a way that limits damage to travertine formations in the river corridor.

Recreation should be managed in a way that avoids known and potential Fossil springsnail sites.

Alternatives C, E, and F only: To allow recreational opportunities in the river corridor while limiting possible adverse impacts to river values, camping in Middle Fossil, trailheads, and other areas within the recreational segment should be allowed in designated areas only, except for special events authorized on a case-by-case basis (such as special use permits or educational events).

Alternative B only: To facilitate a more primitive visitor experience and emphasize protection of natural and cultural resources while providing recreational access and opportunities at existing facilities, camping in Middle Fossil and trailheads should be allowed in designated areas only, except for special events authorized on a case-by-case basis (such as special use permits or educational events). Limited dispersed camping in the Fossil Springs area should be allowed.

Alternative D only: To allow recreational opportunities in the river corridor while limiting possible adverse impacts to river values, camping should not be allowed in Middle Fossil, trailheads, and other areas within the recreational segment, except for special events authorized on a case-by-case basis (such as special use permits or educational events).

Alternative E only: To provide for unique recreational opportunities while minimizing potential effects to riparian vegetation, water quality, and other wildlife and botanical resources, camping in the Fossil Springs area should be allowed only at designated sites.

Alternative F only: To limit effects to water quality, riparian vegetation, and other wildlife and botanical resources, no camping should be allowed in the Fossil Springs area during the high-use season.

To provide for unique recreational opportunities in a more primitive setting, dispersed camping should be allowed in the **wild segments** beginning 1/4-mile upstream of the Bear Trail (previously Fossil Springs Trail) in the Fossil Springs wild segment and 1/4-mile downstream of the Mazatzal recreation site in the Mazatzal wild segment.

Instead of building new trails, existing trails should be considered for designation where compatible with river management objectives and sustainable trail design principles can be achieved. Designated trails should be stabilized using BMPs and/or constructing adequate drainage away from stream courses and into adjacent vegetation filter strips.

To minimize effects to soils and water quality, designated trails should be primarily located on soils with low erosion hazard, outside of the AMZ, and away from areas with special-status species concerns and heritage resources. Where they occur within the AMZ or terminate in the Fossil Creek floodplain, designated trails should be designed to terminate in armored areas and to incorporate stabilized tread or other appropriate features.

To minimize the establishment of unauthorized trails, creek access paths from parking areas and designated trails should be delineated and signed to direct visitors to armored areas along Fossil Creek.

To minimize effects to soils and water quality, unauthorized trails should be eliminated and rehabilitated, with priority placed on those that lead to denuded and compacted riparian areas or are hydrologically connected to Fossil Creek.

To minimize effects to water quality in springs and Fossil springsnails, no trails should be constructed or adopted that access upland springs.

To minimize noise and disturbance to wildlife and maintain a natural sounding and feeling environment for a unique recreational experience, no helicopter landings should occur in the corridor except for emergency and limited administrative purposes.

To minimize noise and disturbance to wildlife and maintain a natural sounding and feeling environment for a unique recreational experience, use of generators or other loud equipment should be discouraged within the river corridor except as needed for administrative purposes, particularly during the high-use season.

Management Approach for Recreation

Develop a recreation site plan that promotes consistent site design that is compatible with Fossil Creek's unique character, enhances visitor experience, and promotes protection of river values.

Use educational messaging, management presence, and the design and distribution of roads, trails, and recreation sites to enhance river value protection and the recreational experience.

Encourage visitors to take responsibility for their actions by picking up trash, using restrooms, and parking and recreating in established recreation sites.

If needed to manage visitor capacity, managed entry (such as a permit or reservation system) may be used to restrict visitor access to the Fossil Creek corridor. When used, the duration of (whether limited to a portion of the year or in place year-round) or locations subject to (whether in place corridor-wide or for specific sites) managed entry may be adjusted to accommodate changing resource protection or management needs.

Concentrate recreational use at designated recreation sites through site design, signage, and education.

Limit boating impacts to travertine features through education, partnerships, and collaborative site design planning.

Recreation/Lands Special Uses

Standards for Recreation/Lands Special Uses

To minimize impacts on visitors, commercial filming/photography using helicopters or unmanned aerial systems within the Fossil Creek corridor shall be prohibited year-round. Other commercial filming/photography within the Fossil Creek corridor shall be prohibited during the high-use season when the potential for user conflicts is high and shall be limited during other months.

Commercial filming/photography in the **wild segments** shall be consistent with Forest Service Wilderness filming policy.

Commercial recreation events within the **recreational segment** and Middle Fossil shall be prohibited during the high-use season and shall be limited during the remainder of the year. Commercial recreation events are prohibited in the **wild segments** outside of Middle Fossil year-round.

Authorizations for management of power lines and utilities shall comply with federal avian (raptor) protection guidelines.

Guidelines for Recreation/Lands Special Uses

Recreation special use permit holders and outfitters and guides should provide an educational component to their programs in Fossil Creek so clients understand the value of designated wild and scenic rivers and become familiar with the Fossil Creek's river values.

Commercial filming/photography within the corridor should have the primary objective of disseminating information about wild and scenic rivers, river values, or other features of scientific, educational, or historical/cultural value.

Research related to wild and scenic rivers, river values, and other unique aspects of Fossil Creek should be authorized where it can further scientific knowledge or information relevant to land management goals.

Management of utility corridors within the Fossil Creek corridor, such access and vegetation removal, should be performed in such a way that minimizes impacts to visitors, wildlife, and soils.

To limit effects to visitors, wildlife, scenery, and soils over the long-term, infrastructure and equipment resulting from research activities should be removed upon completion of data collection. Impacts from research activities should be fully restored to pre-research conditions once research is completed.

To limit effects to visitors, wildlife, scenery, and soils over the long-term while still facilitating for traditional cultural practices, removal of mineral materials from within the Fossil Creek corridor should be administratively unavailable, except free-use permits for collection of minor amounts of rock and mineral materials (less than 10 pounds) may be issued to American Indian tribal members for ceremonial purposes.

No new aerial utilities should be constructed in the Fossil Creek corridor.

Existing utility corridor rights-of-way should not be widened in the Fossil Creek corridor.

Objectives for Recreation/Lands Special Uses

Pursue locatable mineral withdrawal of the **recreational segment**⁸ of the Fossil Creek corridor within 10 years of plan approval.

Management Approach for Recreation/Lands Special Uses

Determine the suitability of future commercial services (outfitters, guides, and concessionaires) and complete an outfitter and guide needs assessment in a manner consistent with Wild and Scenic Rivers Act guidelines. Authorize future commercial services based on the need for services and the ability of such services to protect or enhance river values.

Use special use permits (such as for outfitters and guides) to facilitate resource protection, provide livery services to address parking issues, and improve public safety. Ensure permitted activities align with established capacity limits.

Support research and monitoring with citizen science projects and other efforts.

Work with the Bureau of Land Management to pursue mineral withdrawal of the recreational segment of the Fossil Creek WSR corridor.

⁸ The wild segments of the Fossil Creek WSR corridor are automatically withdrawn from mineral entry through designation under the Wild and Scenic Rivers Act.

Roads and Facilities

Desired Conditions for Roads and Facilities

The arrangement and amount of roads and facilities in the Fossil Creek corridor contribute to protection and enhancement of river values.

Roads and parking areas possess adequate drainage and/or water retention features so as not to deliver excessive sediment and water into connected stream courses.

Unauthorized roads are not present in the Fossil Creek corridor.

Standards for Roads and Facilities

Construction and maintenance activities in the Fossil Creek corridor shall implement BMPs and develop design features to minimize resource impacts.

All developed recreation sites shall be designed to meet accessibility requirements of the Forest Service Outdoor Recreation Accessibility Guidelines and Forest Service Trail Accessibility Guide, or similar current guidance, as possible given site-specific environmental constraints.

Guidelines for Roads and Facilities

No new system roads should be constructed in the Fossil Creek corridor unless needed to access recreation sites, for authorized special uses, or administrative needs to protect river values.

To maintain and improve water quality, unauthorized roads in the Fossil Creek corridor should be decommissioned, obliterated or closed, with priority given to roads that are hydrologically connected to streamcourses or springs.

To minimize effects to soils, vegetation, and scenery, parking lots should be designed with features to prevent overflow parking outside of designated spots.

All facilities and roads should minimize disturbance to springs and seeps.

To protect riparian vegetation and water quality, and promote public safety all facilities except signs, designated trails, and other minor improvements should be located outside of the AMZ.

Toilets should be provided to manage human waste in order to prevent water quality impacts.

To protect wildlife and minimize human-wildlife conflicts, trash receptacles should be located and designed to prevent attracting predators, nest parasites, and nuisance wildlife.

Recreation infrastructure, such as parking and campsites, should be located outside of areas with special-status species concerns or heritage resources to protect these resources.

Fossil Springs Botanical Area

The Fossil Springs Botanical Area includes a highly diverse riparian deciduous forest. The Botanical Area surrounds a large and complex spring system that is the headwaters for an unusual travertine system. Plan components in the vegetation section above apply to the Fossil Springs Botanical Area.

Desired Conditions for Fossil Springs Botanical Area

Visitors enjoy photography and plant and wildflower viewing in the Fossil Springs Botanical Area.

The integrity of native species and natural ecological processes is maintained in the Fossil Springs Botanical Area.

Vegetation communities and soil productivity in the Fossil Springs Botanical Area are largely free of impact from human activities.

Guidelines for Fossil Springs Botanical Area

Projects treating invasive plants in the Fossil Springs Botanical Area should be staggered in order to avoid excessive erosion and to allow for recovery of treated areas before additional areas are treated.

Horse camping should not be permitted within the Fossil Springs Botanical Area.

Interpretation and Education

Desired Conditions for Interpretation and Education

Environmental education and interpretation enhance public enjoyment of Fossil Creek, help visitors learn first-hand about the natural processes and cultural features that make Fossil Creek special, and support protection and enhancement of river values. Well-designed environmental messaging instills in visitors an active stewardship ethic, builds a connection between visitors and the natural world, and instills the importance of natural areas for present and future generations.

The Fossil Creek corridor provides a setting for tribal youth education related to culture, history, and land stewardship, and for the exchange of information between tribal elders and youth.

Interpretive information in multiple languages is available at recreation sites, with topics that may include:

- The native plants, wildlife, fish, and aquatic species and their habitats present in and around Fossil Creek, particularly special-status species such as black-hawks, lowland leopard frogs, native fish, and Fossil springsnail. This knowledge encourages visitors to minimize disturbance of native species.
- The impacts of disease and non-native plant, fish, and aquatic species on ecosystems and how to prevent their introduction and spread.
- The prehistory, history, and contemporary tribal values associated with Fossil Creek. Information about archaeological site etiquette is readily available, and visitors gain an understanding of the tribal cultural history of the area, learning about tribal values and the importance of the corridor to living tribes and the need to approach Fossil Creek with respect. Information is available about the development, use, and decommissioning of the Childs/Irving power system, including how the Apache/Yavapai people were part of, and affected by, the power system.
- Resource protection related to visitor behavior, such as wilderness self-reliance; minimizing unauthorized trails; tree protection; not feeding wildlife; Leave No Trace; Pack-It-In, Pack-It-Out; and proper disposal of trash, human waste, ant killer, food remains, soap, oil, and other cooking wastes.
- The Wild and Scenic Rivers Act and national wild and scenic rivers system.
- Other topics related to Fossil Creek's river values and regionally-unique features, such as the Fossil Springs Botanical Area, geology/travertine, water processes, night sky, nocturnal species, wilderness, wild and scenic rivers, and Fossil Creek's designation as an Outstanding Arizona Water.
- Restoration activities and their role in promoting ecosystem function.

Guidelines for Interpretation and Education

Any commercial uses (such as tours) of heritage-based sites should be limited to activities that are consistent with tribal interests, enhance the public's understanding of the resource, and protect or enhance the resource.

Management Approach for Interpretation and Education

Develop an interpretive plan for the Fossil Creek corridor as soon as possible after plan approval.

Use interpretative signage near the travertine dam formation reaches of Fossil Creek to describe the travertine dam depositional processes and explain how travertine dams have shaped the geomorphology and biology of Fossil Creek. Travertine interpretation is meant to protect and enhance travertine as a key component of the geology river value. Collaborative relationships for stewardship, protection, user community learning, and site design planning (such as for kayak put in/take out) can be used to protect and enhance travertine formations.

Environmental education activities related to biological resources may include snorkeling/snooping, wading, fishing, scenery viewing, hiking, wildlife viewing, bird watching, plant identification, and boating.

Provide interpretation related to Forest Service-supported and citizen science projects by youth and adults.

Outfitter and guide services may augment Forest Service and tribal public education efforts.

Management Actions

The areas in which alternatives differ from each other (for relevant management actions, implementation, and monitoring) are summarized here. It is these parameters upon which the effects analysis is based.

Differences Among the Action Alternatives

If **alternatives B or C** are selected, the number of parking spaces at recreation sites would be *reduced* in the year following finalization of the CRMP to bring visitor use to levels consistent with capacities specific to those alternatives.

If **alternatives D or E** are selected, increasing visitor capacity would occur *incrementally* and be contingent on 1) funding availability to construct facilities and infrastructure that are necessary to support higher amounts of use and 2) monitoring to determine that river values would continue to be protected with additional visitor use.

If **Alternative F** is selected, development of the majority of additional parking and other facilities and infrastructure in the corridor and increases in visitor capacity would occur. Monitoring would then occur to assess what effects higher capacities have on resources and ORVs.

Alternative B

Programmatic Actions Specific to Alternative B:

There is only one specific programmatic difference identified in the Fossil CRMP for Alternative B and that is a recreation guideline:

Camping in Middle Fossil and trailheads should be allowed in designated areas only, except for special events authorized on a case-by-case basis (such as special use permits or education events). Limited dispersed camping in the Fossil Springs area should be allowed.

While camping can increase disturbance to soil and vegetation and increase the amount of visual and aural disturbance to wildlife, designating camping, versus allowing dispersed camping, can reduce the amount of disturbance. Allowing limited dispersed camping in the Fossil Springs area can result in an increase in the direct and indirect effects to vegetation, wildlife, and their habitat.

Site Specific Actions:

This alternative *differs* from other alternatives in these ways (refer to effects analysis below for actions common to all action alternatives):

Recreation sites that would be open in Alternative B include:

Purple Mountain – 6 parking spaces, portable toilet.

Sally May – 10 parking spaces, portable toilet.

Junction – temporary parking, vault toilet, kiosk, visitor contact station.

Homestead – In upper loop, 20 parking spaces, vault toilet, kiosks, and picnic tables. Walk-in to lower loop. West loop prioritized for tribal use but vault toilet available for all use.

Heinrich – Welcome center with 15 parking spaces, indoor/outdoor interpretive trail and/or canopy walk, toilet, trash receptacles, and one-way loop. Host/administrative site with toilet. No river access.

Fossil Creek Bridge – 15 parking spaces, vault toilet, kiosk, trash receptacles, and bike racks.

Tonto Bench – 4 parking spaces, vault toilet, kiosk, trash receptacles, bike racks.

Irving – 15 parking spaces, vault toilet, kiosks, and trash receptacles on southwest side of creek. Pedestrian access to northwest side via existing low water crossing. Also Flume trail trailhead.

Lewis Trailhead – 5 parking spaces, vault toilet, kiosks, trash receptacles, bike racks, armored access points to the creek along trail, toilet could be built at end of trail.

Bear Trailhead – 15 parking spaces, plus 3 stock trail spaces with corrals, vault toilet, kiosks, trash receptacles.

Historic Fossil Springs dam and Fossil Springs area – accessible via foot trails and alternative toilet if needed.

Between all these sites, there are 112 parking spots.

Camping would be divided amongst Mazatzal, Purple Mountain, Sally May, Homestead, Tonto Bench, and/or Irving outside of the high use season. Dispersed camping would be available for up to three groups (each group 5 people). Dispersed camping would continue to be allowed in middle Fossil outside of the permit season downstream of the Fossil Creek Bridge until campsites are designated. Dispersed camping would continue to be available in the Fossil Springs area outside of the permit season but only until resources are adequate to manage year-round camping and until the permit system is updated to include camping permits.

There are no specific provisions for scenic driving or motorized trail use in Alternative B.

The 4.5 mile Flume trail would continue to be open to foot and equestrian travel from Irving to junction with Bear Trail (formerly Fossil Springs trail) at the historic Fossil Springs dam, providing access to Fossil Springs area and the botanical area. The four mile Bear trail would continue to be open to foot and equestrian travel from trailhead to junction with Flume Trail at historic Fossil Springs dam, providing access to the Fossil Springs area and the botanical area. The 0.9 mile Lewis trail (formerly Waterfall trail) would be open to foot travel and formally adopted as a system trail which will facilitate maintenance activities to ensure the trail sustainability and resource protection. A short interpretive trail and/or canopy walk would be provided at Heinrich. The portion of FR 708 from Strawberry and that is closed to motorized use could be used for foot traffic and therefore would be maintained to ensure proper water drainage.

The corridor-wide capacity is 640 PAOT (which includes 50 administrative PAOT and 30 walk-in PAOTs). If monitoring indicates recreation activities or conditions at recreation sites may be adversely impacting river values, a variety of actions may be taken including implementing resource protection measures (both also referred to as resource protection measures), modifying the type or arrangement of facilities provided within recreation sites, targeted restoration activities, increased management presence, education efforts targeted at addressing observed impacts, permit system changes to adjust use patterns, or temporary or long-term closures or prohibitions of specific recreation activities.

Alternative C

Programmatic Actions Specific to Alternative C:

There is one recreation guideline specific to Alternative C.

Camping in Middle Fossil, trailheads, and other areas within the recreation segment should be allowed in designated areas only, except for special events authorized on a case-by-case basis (such as special use permits or educational events).

While camping can increase the effects to soil and vegetation and increase the amount of visual and aural disturbance to wildlife, designating camping, versus allowing dispersed camping, can reduce the amount of disturbance.

Site Specific Actions:

This alternative *differs* from other alternatives in these ways (refer to section above for actions common to all action alternatives):

Recreation sites that would be open in Alternative C include:

Purple Mountain – No parking, site rehabilitated.

Sally May – No parking, site rehabilitated.

Junction – 5 parking spaces, temporary parking, vault toilet, kiosk, visitor contact station.

Cactus Flat – All new: welcome center with 47 parking spaces, plus 3 stock trailer spaces, indoor/outdoor interpretive displays; toilet, trash receptacles, picnic tables, and bike racks. New Creek View Trailhead just north on FR9D.

Homestead – Upper and lower loop is meant to serve as an extension of the Cactus Flat welcome center with 40 parking spaces, vault toilets, kiosks, trash receptacles, picnic tables, and bike racks. West loop prioritized for tribal use but vault toilet available for all use.

Heinrich – Host/administrative site with toilet. No public access.

Fossil Creek Bridge – walk-in only during high use season and approximately 10 parking spaces during low use season. Vault toilet, kiosk, trash receptacles, bike racks and picnic tables.

Tonto Bench – Walk-in only. No parking. Vault toilet, kiosk, trash receptacles, bike racks.

Irving – Walk-in only during high use season but approximately 18 parking spaces during low use season on southwest side of creek. Vault toilet, kiosks, trash receptacles, picnic tables, and bike racks on southwest side of creek. Pedestrian access to northwest side via existing low water crossing. Also Flume trail trailhead and Creek View trail connector.

Lewis Trailhead – Walk-in only. No parking. Vault toilet, kiosks, trash receptacles, bike racks, armored access points to the creek along trail, toilet could be built at end of trail.

Bear and New Rim Trailheads – Combined parking for new Rim Trailhead and existing Bear Trailhead. 30 parking spaces, plus 3 stock trail spaces with corrals, vault toilet, kiosks, trash receptacles, picnic tables, and bike racks.

Historic Fossil Springs dam and Fossil Springs area – no trail access.

Between all these sites, there are 132 parking spots.

The corridor-wide capacity is 720 PAOT (which includes 50 administrative PAOT and 10 walk-in PAOTs). This is the second lowest PAOT of all action alts and 90 PAOT less than current management.

Camping in middle Fossil could include up to 3 designated campsites at Cactus Flat year-round and up to 4 designated campsites provided at Rim Trailhead year-round. No camping would be allowed in Fossil Springs.

There are no specific provisions for scenic driving or motorized trail use in Alternative C.

A new 3 mile Creek View trail would be constructed from the trailhead near Cactus Flat parking area on FR9D to the Flume trail. Two connector trails totaling 1.3 miles would be constructed from the Creek View Trail – one to FR 708 between Heinrich and Bridge, and one to Irving. Creek View Trail and connector trails open to foot, equestrian, and bicycle use. The 3.25 mile Flume trail would be open to foot and equestrian travel from Irving to viewpoint, but not up to the Historic Fossil Springs dam. A 1.25 mile portion of the trail from the viewpoint to the dam is closed and decommissioned. The 0.9 mile Lewis trail (formerly Waterfall trail) would be open to foot travel and formally adopted as a system trail. A new toilet could be installed at the end of Lewis trail. New Rim trail loop would be constructed in the vicinity of the existing Bear Trailhead. Connector trail constructed from FR 708 to west side of loop. Total trail length including the connector is 1.4 miles. Rim trail and connector open to foot, equestrian, and bike. The 3.3 mile long Bear trail is open to foot and equestrian travel to the junction with the Mail trail but no longer continues to Fossil Springs, the botanical area, the historic Fossil Springs dam or the Flume trail. A 0.7 mile portion of trail is decommissioned. The portion of FR 708 from Strawberry and that is closed to motorized use could be used for foot traffic and therefore would be maintained to ensure proper water drainage.

Vehicle access into the corridor is via FR 708 from SR260. The 6.1 mile section of FR 708 between Homestead and the gate at the canyon rim (Strawberry side) closed to motor vehicles. Maintenance to improve proper water drainage and to reduce erosion and sedimentation would be completed since the road may be used by emergency personnel.

Alternative D

Programmatic Actions Specific to Alternative D:

There is only one recreation guideline specific to Alternative D.

Camping should not be allowed in Middle Fossil, trailheads, and other areas within the recreation segment, except for special events authorized on a case-by-case basis (such as special use permits or educational events).

By not allowing camping in Middle Fossil Creek under alternative D, there are no direct or indirect effects to vegetation, wildlife, and their habitat. Effects are wholly beneficial.

Site Specific Actions:

This alternative *differs* from other alternatives in these ways (refer to section above for actions common to all action alternatives):

Recreation sites that would be open in Alternative D include:

Purple Mountain – no parking; site rehabilitated.

Sally May – no parking; site rehabilitated.

Junction – temporary parking, vault toilet, kiosk, visitor contact station.

Homestead – In upper loop, 10 parking spaces, vault toilet, kiosks, picnic tables, and shelters. Walk-in to lower loop. West loop prioritized for tribal use but vault toilet available for all use.

Heinrich – Small welcome center with 10 parking spaces, short interpretive trail and/or canopy walk, toilet, trash receptacles. Host/administrative site with toilet. No river access.

Fossil Creek Bridge – 15 parking spaces, vault toilet, kiosk, trash receptacles, and bike racks.

Tonto Bench – No long-term parking. Site rehabilitated. Roadside vault toilet available with temporary parking.

Fossil Creek CRMP – Wildlife, Plants, and Vegetation Report

Irving – 60 parking spaces, vault toilet, kiosks, trash receptacles, picnic tables (including group sites), shade ramadas, and bike racks possible on both sides of the creek. New bridge across the creek. Boardwalk on the south side of the creek and Trail to wildlife blind. Also serves as Flume trail trailhead.

Lewis Trailhead – No long-term parking. Trailhead and trail rehabilitated. Roadside vault toilet available, with temporary parking.

Rim Trailhead – no Bear trail. 30 parking spaces; vault toilets, kiosks trash receptacles, picnic tables, and bike racks.

Historic Fossil Springs dam and Fossil Springs area – No trail access

Between all these sites, there are 129 parking spots.

The corridor-wide capacity is 1,080 PAOT (which includes a maximum of 235 administrative PAOT). This is the second highest PAOT of all action alts and 95 PAOT more than current management.

There would be no camping in Middle Fossil, the east side trailheads, nor the Fossil Springs and botanical area.

There would be access for scenic driving for up to 40 vehicles at one time with short-term parking at recreation sites. A special permit would be required during the permit season.

The 3.25 mile Flume trail would continue to be open to foot and equestrian travel from Irving to viewpoint but no access to the historic Fossil Springs dam, Fossil Springs, or botanical area. A 1.25 mile portion of the Flume trail would be closed and rehabilitated. The Lewis trail and trailhead is closed and decommissioned. A new one mile Rim Trail loop would be constructed in the vicinity of the existing Bear Trailhead. The four mile Bear trail would be closed and decommissioned. A new short boardwalk and trail to a wildlife blind would be constructed at Irving.

The currently closed portion of FR 708 from Strawberry would be opened to motorized travel pending repair of the 4.1 mile closed section.

Alternative E

Programmatic Actions Specific to Alternative E:

There are two recreation guideline pertinent to alternative C:

Camping in Middle Fossil, trailheads, and other areas within the recreation segment should be allowed in designated areas only, except for special events authorized on a case-by-case basis (such as special use permits or educational events).

Limited camping in the Fossil Springs area should be allowed at designated sites.

While camping can increase the effects to soil and vegetation and increase the amount of visual and aural disturbance to wildlife, designating camping, versus allowing dispersed camping, can reduce the amount of disturbance. Allowing limited dispersed camping in the Fossil Springs area can result in an increase in the direct and indirect effects to vegetation, wildlife, and their habitat.

Site Specific Actions:

This alternative *differs* from other alternatives in these ways (refer to section above for actions common to all action alternatives):

Recreation sites that would be open in Alternative E include:

Purple Mountain – 6 parking spaces and portable toilets.

Sally May – 10 parking spaces and portable toilets.

Junction – temporary parking, vault toilet, kiosk, visitor contact station.

Cactus Flat – new welcome center with 47 parking spaces, plus 3 stock trailer spaces, indoor/outdoor interpretive displays, toilet, trash receptacles, picnic tables and bike racks. A new Creek View Trailhead just north on FR9D would provide access to a new trail.

Homestead – 25 parking spaces, vault toilet, kiosks, picnic tables, and shelters would be available. Walk-in to lower loop. West loop prioritized for tribal use but vault toilet available for all use.

Heinrich – 25 parking spaces, short interpretive trail and/or canopy walk, toilet, trash receptacles. Host/administrative site with toilet. No river access.

Fossil Creek Bridge – 15 parking spaces, vault toilet, kiosk, trash receptacles, and bike racks.

Tonto Bench – 15 parking spaces, vault toilet, kiosk, trash receptacles, and bike racks.

Irving – 60 parking spaces, vault toilet, kiosks, trash receptacles, picnic tables (including group sites), shade ramadas, and bike racks possible on both sides of the creek. New bridge across the creek. Boardwalk on the south side of the creek and Trail to wildlife blind. Creek View Trail connector.

Lewis Trailhead – 21 parking spaces, vault toilet, kiosks, trash receptacles, bike racks, armored access points to the creek along trail, toilet could be built at the end of the trail.

Rim and Bear Trailhead – Bear Trailhead moved ¼ mile to east with 6 parking spaces. Rim trailhead would have 30 parking spaces plus 3 stock trailer spaces with corrals, vault toilet, kiosks, trash receptacles, picnic tables, and bike racks.

Historic Fossil Springs dam and Fossil Springs area – Accessible via trails. Alternative toilet if needed.

Between all these sites, there are 270 parking spots.

The corridor-wide capacity is 1,685 PAOT (which includes a maximum of 255 administrative PAOT). This is the highest PAOT of all action alts and 700 PAOT more than current management.

There would be up to 10 designated campsites divided amongst Mazatzal, Purple Mountain, Sally May, Homestead, Tonto Bench, and/or Irving, year-round. Up to 3 administrative campsites at Cactus Flat. Up to 4 designated campsites would be provided at Rim Trailhead year-round. There would be up to 3 designated campsites in the Fossil Springs area year-round.

There would be access for scenic driving for up to 40 vehicles at one time with short-term parking at recreation sites. A special permit would be required during the permit season.

A new three mile Creek View trail would be constructed from the trailhead near Cactus Flat. In addition, there would be 1.3 miles of two connector trails from Creek View Trail – one to 708 and one to Irving. The Flume trail would be open to the historic Fossil Springs dam. The 0.9 mile Lewis trail would be open and formally designated. A new Rim Trail loop would be constructed in the vicinity of the existing Bear Trailhead. This would include a connector trail from FR 708 to the west side of the loop for a total of 1.4 miles. The 3.7 mile Bear trail would be open but the trailhead moved to a new parking lot. A short interpretive trail and/or canopy walk would be provided at Heinrich. A short boardwalk and trail to a wildlife blind could be provided at Irving.

The currently closed portion of FR 708 from Strawberry would be opened to motorized travel less than 62 inches wide pending repair of the 4.1 mile closed section.

Alternative F

Programmatic Actions Specific to Alternative F:

There are several recreation guidelines pertinent to alternative F.

Camping in Middle Fossil, trailheads, and other areas within the recreation segment should be allowed in designated areas only, except for special events authorized on a case-by-case basis (such as special use permits or educational events).

No camping should be allowed in the Fossil Springs area during the high-use season.

While camping can increase the effects to soil and vegetation and increase the amount of visual and aural disturbance to wildlife, designating camping, versus allowing dispersed camping, can reduce the amount of disturbance. Not allowing camping in the Fossil Springs area will result in less direct and indirect effects to vegetation, wildlife, and their habitat, than alternatives where camping at the springs is allowed.

Site Specific Actions:

This alternative *differs* from other alternatives in these ways (refer to section above for actions common to all action alternatives):

Recreation sites that would be open in Alternative E include:

Purple Mountain – 6 parking spaces, trash receptacles, and portable toilets.

Sally May – 10 parking spaces, trash receptacles, and portable toilets.

Junction – temporary parking, vault toilet, kiosk, visitor contact station.

Cactus Flat – new welcome center with 367 parking spaces, plus horse trailer accommodations; potential for partial closure of parking lot during the low use season; indoor/outdoor interpretive displays; possible future visitor center; toilet, trash receptacles, picnic tables and bike racks. Potential for portion of area to be available for group use (e.g. camping for school groups). A new Creek View Trailhead just north on FR9D would provide access to a new trail.

Homestead Upper Loop – site meant to serve as an extension of the Cactus Flat welcome center. 75 parking spaces, vault toilet, kiosks, picnic tables, and shelters would be available. Walk-in to lower loop.

Homestead West Loop – walk-in for camping at designated sites; prioritized for tribal use but vault toilet available for all use. Trash receptacles. Potential for portion of area to be available for group use (e.g. camping for school groups).

Heinrich –Host/administrative site with toilet and wastewater holding tank, open-air cooking/dining space; trash receptacles, administrative campsites.

Fossil Creek Bridge –New Bridge. Walk-in only during high use season; approximately 10 parking spaces during low-use season, vault toilet, kiosk, trash receptacles, bike racks, and picnic tables.

Tonto Bench –Walk-in only during high-use season, approximately 15 parking spaces during low-use season, vault toilet, kiosk, bike racks; trash receptacles.

Irving – No vehicle access during high-use season; approximately 18 parking spaces during low use season on SW side of creek. In the long-term possible alternative toilets, kiosks, trash receptacles, picnic tables (including group sites), shade ramadas, and bike racks possible on both sides of the creek. Pedestrian access to NW side via low water crossing; Flume trailhead; Creek View Trail connector.

Lewis Trailhead – No vehicle access during high-use season; approximately 21 parking spaces during low-use season; vault toilet, kiosks, trash receptacles, bike racks, armored access points to the creek along trail.

Rim and Bear Trailhead – Combined parking for new Rim and existing Bear TH would have 30 parking spaces plus 3 stock trailer spaces with corrals, vault toilet, kiosks, trash receptacles, picnic tables, and bike racks.

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Historic Fossil Springs dam and Fossil Springs area – Accessible via Flume Trail only. Alternative toilet if needed.

Between all these sites, there are 310 parking spots.

The corridor-wide capacity is 2,580 PAOT (which includes 50 administrative PAOT, and 30 walk-in PAOTs). This is the highest PAOT of all action alts and 1770 PAOT more than current management.

There would be up to 10 designated walk-in campsites at Homestead middle loop and dispersed camping would be allowed downstream of Fossil Creek Bridge outside of the permit period.

A new three mile Creek View trail would be constructed from the trailhead near Cactus Flat. In addition, there would be 1.3 miles of two connector trails from Creek View Trail – one to 708 and one to Irving. The Flume trail would be open to the historic Fossil Springs dam and motorized emergency access would be permitted along the trail. The 0.9 mile Lewis trail would be open and formally designated. A new Rim Trail loop would be constructed in the vicinity of the existing Bear Trailhead. This would include a connector trail from FR 708 to the west side of the loop for a total of 1.4 miles. The 4 mile Bear trail would be open.

The currently closed portion of FR 708 from Strawberry would be remain closed to all motorized vehicles year-round. A section of 708 between Homestead and the Waterfall trailhead closed to public motorized travel during high use season but open during the low-use season

No Action Alternative

Programmatic Actions

In alternative A, the land and resource management plans for the Coconino and Tonto national forests would not be amended to include management direction specific to Fossil Creek or update the Fossil Springs Botanical Area boundary. No CRMP would be developed; thus, management of Fossil Creek would not comply with the Wild and Scenic Rivers Act. Interim management such as capacity control and restoration activities would continue as needed, but would not be guided by plan direction specific to the Fossil Creek area. There would be no formal monitoring plan.

Site Specific Actions:

This alternative *differs* from the other alternatives in these ways (refer to section above for actions common to all action alternatives):

Locatable mineral entry possible in the recreation segment.

There would be no federally reserved water right to protect stream flows.

Purple Mountain – 6 parking spaces, trash receptacles, and portable toilets.

Sally May – 10 parking spaces, trash receptacles, and portable toilets.

Junction – temporary parking, vault toilet, kiosk, visitor contact station with gate.

Cactus Flat – does not exist.

Homestead Upper Loop – ~25 parking spaces, vault toilet, kiosks, picnic tables,. Walk-in to lower loop. West loop prioritized for tribal use, vault toilet available for all. Potential for group use.

Heinrich –Site does not exist.

Fossil Creek Bridge –New Bridge. Approx. 10 parking spaces, vault toilet, kiosk.

Tonto Bench –approximately 21 parking spaces, vault toilet, kiosk.

Irving – Approx. 18 parking spaces, vault toilet, and kiosk on SW side of creek. Pedestrian access to NW side via low water crossing. Flume TH and kiosks on NE side of creek.

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Lewis Trailhead –approximately 21 parking spaces; vault toilet, kiosks.

Rim and Bear Trailhead –Bear TH only with 30 parking spaces plus 3 stock trailer spaces with corrals, vault toilet, kiosks, trash receptacles.

Historic Fossil Springs dam and Fossil Springs area – Accessible via foot trails.

Between all these sites, there are 148 parking spots.

The corridor-wide capacity is 810 PAOT (which includes 50 administrative PAOT, and 20 walk-in PAOTs).

Dispersed camping is allowed downstream of Fossil Creek Bridge outside of permit system. Dispersed camping is allowed upstream of historic Fossil Springs dam outside of the high-use season only. Dispersed backcountry camping allowed outside of permit area in wild segments.

The new Creek View, Rim, and interpretive trails do not exist. The Flume, Lewis and Mail trails would be open but not formally designated. The 4 mile Bear trail would remain open.

The currently closed portion of FR 708 from Strawberry would be remain closed to all motorized vehicles year-round.

Resource Protection Measures

Best management practices and mitigation measures are referred to as resource protection measures. Resource protection measures specific to vegetation (particularly invasive species) and special status species (pollinators and bat species) are numerous so are provided in full in Appendix B. Resource protection measures are common to all alternatives. Resource protection measures will be applied as needed to limit resource impacts based on anticipated effects of the action to be taken.

Monitoring and Adaptive Management

For a full description of the Fossil Creek monitoring and adaptive management plan, please see chapter 6 of the CRMP.

For all wildlife, fish, and habitat monitoring, the following situations may arise:

- New methodologies may be applied when these methodologies are proven to be effective at accomplishing monitoring objectives.
- If new species' issues come to light, additional inventory and monitoring may be warranted. Inventory and monitoring protocols, timing of surveys, and adaptive management recommendations would be decided at a future time.
- Should the status of any special status species be lowered, monitoring and adaptive management responses may be relaxed, but only if there is a scientific basis and with input from subject experts.

Following is a description of how the monitoring strategies differ between alternatives.

If any action alternatives are selected, monitoring would occur prior to any incremental increase in capacity. Once changes to capacity are made, further monitoring will be conducted to ensure there are no adverse effects to resources.

Biological – Wildlife Habitat Monitoring and Adaptive Management

Besides natural events (e.g. flooding, drought, insect outbreaks), the main causal changes to habitat in Fossil corridor is from recreational activities. Bare area monitoring is the most effective, efficient, and early detection methodology for measuring changes in vegetation and habitat. Because of its advantages, bare area is also used as an indicator for other ORV indicators (water quality, black-hawk habitat, and sensitive tribal areas). Riparian

condition and function will also be monitored as an indicator for riparian and aquatic habitat; refer to the water quality section regarding objectives, indicators, measures, frequency and thresholds.

Connectivity of bare areas to Fossil and impacts to riparian and aquatic habitat would be monitored. In monitoring habitat, bare area data collection will not only measure bare soil acres by activity, but will be further categorized by vegetation type (riparian, mesquite bosque, and upland). In addition to adaptive management measures listed in Table 6 below and in the master table, BMPs relating to watershed, water quality, and fisheries habitat are included in Appendix B. BMPs would be implemented to: reduce recreational impacts soil productivity; reduce erosion; and reduce sedimentation into Fossil Creek.

Table 6. Wildlife Habitat Monitoring and Adaptive Management as Indicated by Bare Soil

Objective	Minimize disturbance from visitor use in refugia areas outside of planned recreation sites, roads, and trails.
Indicator	Unauthorized trails or other bare soil resulting from visitor use outside of planned recreation sites, roads, and trails, classified by vegetation type, hydrological connectivity to Fossil Creek, and proximity to occupied common black-hawk nest sites.
Metric	Acres and/or miles and location of bare soil caused by visitor use, including distance from occupied common black-hawk nest sites.
Measurement Frequency	Baseline is collected for post-decision conditions, then annually.
Assessment Frequency	Annually.
Soft Threshold	New unauthorized trails or other areas of bare soil caused by visitor use are detected in refugia areas.
Adaptive Management Actions	One or more of the following adaptive management actions may be taken: - Investigate factors contributing to visitors recreating outside of recreation sites (such as by assessing management observations of visitor behavior or formal or informal visitor surveys) to determine what adaptive management actions are most likely to be effective at encouraging recreational use within planned recreation sites, roads, and trails. Accordingly, - Increase signage, education and outreach efforts, or ranger presence. - Improve amenities (such as toilets, picnic areas, and creek access points) within recreation sites to encourage use within these sites. - Better define the boundaries of recreation sites, roads, and trails through signage, barriers, or fencing. - Adjust the timing, location, or management (such as through permitting) of camping. - Improve road and trail maintenance. - Change permit terms for outfitters/guides or other special uses if the permitted activities are found to be increasing bare soil in refugia areas. - Restore unauthorized trails or other bare soil areas in refugia areas using passive or active techniques, with priority given to locations that are hydrologically connected to Fossil Creek or within 400 meters of common black-hawk nest sites. - If unauthorized trails or bare soil resulting from visitor use are detected within 400 meters of common black-hawk nests, conduct nest monitoring (see table 6-c) in the breeding season following implementation of adaptive management actions to assess changes in nesting status.
Hard Threshold	Unauthorized trails or other areas of bare soil in refugia areas caused by visitor use are expanding despite implementation of adaptive management actions associated with the soft threshold or recreation sites at the segment-wide scale (e.g. recreational segment) are connected by unauthorized trails.
Adaptive Management Actions	Adaptive management actions listed above may be taken if anticipated to be effective. Additionally, one or more of the following actions may be taken: - Actively restore unauthorized trails or other bare soil areas in refugia areas. - Change the locations, kinds, or amounts of visitor use in the Fossil Creek WSR corridor. Actions may include, but are not limited to, - Reallocate the number of permits among recreation sites (if permits are used).

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	- Establish permits for access to the WSR corridor (if not already in place), for access to specific locations within the corridor (such as the waterfall or Fossil Springs area), or for specific kinds of use. - Reduce the overall corridor-wide user capacity. - Relocate portions of roads or trails contributing to impacts. - Implement short- or long-term closures of specific location(s) or specific kinds of use (such as camping) within the WSR corridor.
Expected Outcomes	Unauthorized trails or other areas of bare soil caused by visitor use in refugia areas are detected and eliminated. Visitor use occurs within planned locations and does not result in new impacts to refugia areas.
Indicator of Success	Bare soil in refugia areas that can be attributed to visitor use is absent or decreases year-to-year.

Invasive Plant Species

Non-native invasive plants continue to be a concern in Fossil Creek because when established, invasive species often convert diverse pockets of native vegetation to monocultures of non-native species, reducing habitat suitability for a variety of wildlife species and affecting ecosystem function. Invasive species may be spread by visitor use and other management activities. The Forest Service places highest priority for prevention, eradication, and containment on Class A species and continuous control of Class E species. Class A species are defined as those that are newly established or have the potential to become established and pose unacceptable threat to watershed condition. Class E (for extreme) species have wide distribution within a particular area and pose an unacceptable, extreme hazard to watershed condition. While hydropower system decommissioning activities targeted and eradicated various upland species of invasive weeds, other species have since become a concern. Newly emerging species that are highly invasive but have not yet been added to the Class A list will be included in monitoring and eradication efforts. One example of such a plant is yellow bluestem.

Despite Forest Service treatments in 2010, 2012, 2013, 2014 and 2017, the reach of Fossil Creek from Fossil Springs downstream to the waterfall needs a formal inventory and the segment between the native fish barrier and two miles upstream from the Verde River has yet to be treated. In addition, treated areas need re-treatment. Treatments are rarely a one-time event. Many species will re-sprout after treatment and in between treatments seeds germinate into newly established plants and populations. Class A and E non-native invasive plant species such as salt cedar, giant reed, Russian olive, tree of heaven, and malta starthistle will be monitored and treated when approved treatment methods are available (table 6-a). Some methods, such as use of the Arundo wasp or treatment of weeds in water, may need separate clearance before they can be used. Employees will be trained to identify invasive plant species and will record and report observations to a weed coordinator, botanist, or biologist.

Table 6-a. Biological ORV monitoring and adaptive management – invasive plant species

Objective	Class A and E non-native, invasive plant species are limited in distribution, are targeted for eradication, and at a minimum are managed to reduce or control spread.
Indicator	Presence of class A or E non-native plant species.
Metric	Acres occupied by class A or E non-native plant species and the spatial distribution of these areas.
Measurement Frequency	Once weed inventories have been completed in the corridor, monitoring of 1/3 of the corridor will occur each year so that the entire corridor is fully monitored every three years.
Assessment Frequency	Following measurement.
Soft Threshold	Existing class A or E non-native invasive plant populations increase in size or new populations become established.
Adaptive Management Actions	One or more of the following adaptive management actions may be taken depending on what is anticipated to be effective:

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	• Increase signage and education and outreach efforts with the goal of preventing invasive species establishment and spread. • Treat invasive plant populations using approved mechanical, chemical, or biological methods. • Better define the boundaries of recreation sites, roads, and trails through signage, barriers, or fencing. • Restore unauthorized trails and other denuded areas before the following high-use season. • Pursue approval for use of new mechanical, biological, or chemical treatment methods.
Hard Threshold	Non-native invasive weed species pose a risk to ecosystem function, including displacing or diminishing native plant and animal species.
Adaptive Management Actions	Adaptive management actions listed above may be taken if anticipated to be effective. Additionally, one or more of the following actions may be taken: • Change the locations of visitor use in the Fossil Creek WSR corridor. Actions may include, but are not limited to, • Reallocate the number of permits among recreation sites (if permits are used). • Establish permits for access to the WSR corridor (if not already in place), for access to specific locations within the corridor (such as the waterfall or Fossil Springs area), or for specific kinds of use. • Implement short- or long-term closures of specific location(s) within the WSR corridor.
Expected Outcomes	Populations of class A and E non-native plant species are detected and treated. Visitor use does not contribute to the establishment or spread of class A and E non-native plant species.
Indicator of Success	Invasive plant populations are reduced and spread is controlled.

Biological Wildlife Population Monitoring and Adaptive Management

The biological ORV was designated for the diversity and abundance of terrestrial and aquatic species and their habitat. A native fish restoration effort that began in 2004 resulted in over 10 miles of a native-only fish community above a constructed fish barrier. As a result of the restoration effort, Fossil Creek is presently home to the largest number of native fish species protected from nonnative fish impacts in Arizona. Another benefit from removing non-native fish from Fossil Creek and restoring full flows was that a drastically declined population of lowland leopard frogs, previously restricted to the Fossil Springs area, boomed and recolonized downstream for miles in the absence of non-native predators. Further, because of the abundance of native fish and frogs in Fossil Creek, nesting common black-hawks benefit from diets that are more similar to historical diets than black-hawks along other perennial streams in the Verde Valley, which are dominated by non-native fish and crayfish.

Across the southwest, upwards of 80% of wildlife species depend on riparian areas for habitat, yet less than 1% of the landscape is comprised of riparian areas. That alone makes the habitat found along Fossil Creek qualified to be an outstandingly remarkable value. However, Fossil Creek is even more unique in that it is a travertine-dominated system. The deposition of travertine and creation of travertine dams results in the impoundment of sediments and the formation of terraces that support submergent, floating, emergent, herbaceous and shrubby vegetation. In addition, the travertine dams result in an increased diversity of pools, riffles, glides, runs, and backwaters. The diversity of structural vegetation combined with travertine formations makes for complex habitats with more areas with slower water and numerous pools of varying depths. Monitoring specific to travertine can be found in the Geology ORV section of this chapter.

The indicators that monitoring for the biological ORV will focus on are common black-hawk populations, Fossil springsnail populations and habitat, and protecting native fish habitat (covered in the fisheries specialist report). These species and habitats are, by proxy, indicators for many wildlife groups; their ability to thrive in Fossil Creek are indicators that conditions are acceptable for other, unmonitored species. Other monitoring throughout this chapter, in particular bare soil and dispersed recreation BMP monitoring addresses habitat indicators.

Common Black-Hawk Pair Occupancy

Common black-hawks in Fossil Creek are used as an indicator for the biological ORV for the following reasons:

1) they are susceptible to disturbance that may result from restoration activities and recreational use of the

corridor; 2) they were a Forest Service Sensitive species prior to 2013; 3) they are a Tonto National Forest Management Indicator Species with a declining population trend; 4) in Fossil Creek, abundant native prey (fish) is available to black-hawks, unlike all other perennial system in the Verde Valley (Etzel et al. 2013); 5) they are a top-level predator that thrives on native prey; 6) they are a good indicator for other canopy nesting, riparian obligate bird species (e.g. summer tanager, warbling vireo, brown-crested flycatcher); and 6) the Fossil Creek population represents reference condition (for comparison to other southwest populations) since nesting and food availability along Fossil Creek reflect historic conditions.

Increasing levels of recreation between restoration of full flows and interim management visitor capacity control raised concern when several common black-hawk (COBH) nest areas near popular recreation sites were abandoned. Black-hawks characteristically nest in remote, pristine habitat but can habituate to low levels of human activity, such as around buildings bordering nest areas, ranching operations, and homesteads (Schnell et al. 1988). However, a parking lot built in a nest area caused nest abandonment within the first year, nonuse in the second year, a month-long postponement of egg-laying in the third year, and eventually permanent abandonment (Schnell 1994). In Aravaipa Canyon a nestling prematurely fledged, resulting in nest failure when visitors camped overnight 46 meters from a nest tree (Schnell 1994).

Because of the length of Fossil Creek, the spatial distribution of recreation sites, and the presence of refugia between recreation sites, there should be ample suitable, undisturbed habitat for black-hawks to nest. However, because black-hawks appear to be susceptible to human disturbance, they are used as an early indicator of the effects of management and visitor use levels. COBH pair occupancy will be used to as an indicator for the population of nesting black-hawks in the Fossil Creek corridor (table 6-b). Additionally, bare soil monitoring (table 6-b) will be used to detect impacts of visitor use in refugia areas generally and in the vicinity of COBH nests specifically.

Fossil Creek is considered a reference site for black-hawks because prey species in Fossil Creek are more similar to historical conditions compared to other perennial streams in the Verde Valley, where non-native species dominate black-hawks' diets. Therefore, Fossil Creek is important as a comparison site for studies and monitoring of black-hawks in other parts of their range.

Black-hawk monitoring has occurred during five field seasons in Fossil Creek. Data collected through this monitoring informed soft and hard thresholds for COBH pair occupancy monitoring. COBH nest monitoring began in 2005, but the survey areas varied among years. The area from Fossil Springs to just downstream of Irving was monitored consistently and over the longest period (2005, 2006, 2007, 2009, and 2011). Surveys between 2005 and 2011 showed a decreasing trend in occupied COBH nests between Fossil Springs and Irving. In 2009, surveys were conducted from Fossil Springs downstream to 0.5 mile below Mazatzal. The area surveyed in 2011 was further extended downstream 1.5 miles below Mazatzal. Since 2011, interim management measures such as visitor capacity control and closure of certain sensitive areas have likely improved conditions for black-hawk nesting, but no black-hawk nest surveys have been conducted during this period because of lack of funding. As a result, it is unknown whether COBH have reoccupied abandoned territories or established new territories in this reach (the upper part of middle Fossil Creek). New baseline monitoring is needed to see if reduced recreation effects have resulted in an increase in the number of black-hawks nesting in Fossil Creek.

Surveys conducted in various portions of Fossil Creek between 2005 and 2011 have detected a total of seven individual nest sites between Fossil Springs and 0.5 mile below Mazatzal. Distances between nest sites have ranged between 0.5 to 1.3 miles, or an average of 0.9 miles. The distance from Fossil Springs downstream to Mazatzal is around 8 miles. Using the 0.9 mile distance between sites yields a density of nine possible COBH nests from Fossil Springs downstream to 0.5 miles below Mazatzal. Such a nest density is similar to other southwest systems (Sadoti 2008). A soft threshold is set at seven active black-hawk territories and/or nests between Fossil Springs and 0.5 miles below Mazatzal. Surveys conducted in various portions of Fossil Creek between 2005 and 2011 have detected a total of 7 nest sites; however, surveys during years with lower visitor use (2005, 2006, and 2007) were only conducted from Fossil Springs downstream to Irving. Therefore, it is reasonable to assume that more than seven nest sites are likely and can be maintained. A hard threshold of six or

fewer active black-hawk territories and/or nests between Fossil Springs and 0.5 miles below Mazatzal is established because this would represent a 33% loss of nest sites, which corresponds with a degraded condition for black-hawks in Fossil Creek.

These thresholds are derived from the available data; however, these data likely do not represent current conditions. Thus, once baseline monitoring is conducted, the thresholds may need to be adjusted. It will be important to conduct several years of monitoring before re-establishing baseline because natural events such as injury or disease may result in a year that particular nest areas are not occupied.

The objective when monitoring for black-hawks during the breeding season (March 15- July 31) will be to confirm the presence of an occupied nest area. This may be indicated by detecting the presence of a territorial pair, observing a pair displaying courtship behaviors, observing an individual displaying nesting behavior (carrying nesting material, carrying food, etc.), detecting black-hawks incubating eggs in a nest, detecting nestlings in a nest, or observing fledged young (as indicated by immature plumage).

Table 6-b. Biological ORV monitoring and adaptive management – common black-hawk pair occupancy

Objective	Maintain common black-hawk nest site occupancy and reproduction in the reach of Fossil Creek from Fossil Springs downstream to 0.5 mile below the Mazatzal recreation site.
Indicator	The presence of black-hawk pairs or fledged young in the reach of Fossil Creek from Fossil Springs downstream to 0.5 mile below the Mazatzal recreation site.
Metric	The number of active black-hawk nest sites from Fossil Springs downstream to 0.5 mile below the Mazatzal recreation site.
Measurement Frequency	After adequate baseline data are collected, monitoring will occur from Fossil Springs downstream to 0.5 mile below the Mazatzal recreation site once every three to five years as long as thresholds are not reached. However, if a threshold value is detected in one year of monitoring, monitoring will be conducted in the breeding season the following year. Additionally, if adaptive management actions are needed, then monitoring would be conducted in the breeding season following implementation of the adaptive management action for those specific nest sites.
Assessment Frequency	By January 1 following the survey season.
Soft Threshold	In two consecutive years (after baseline establishment), seven active black-hawk territories and/or nests are detected between Fossil Springs and 0.5 miles below Mazatzal and there is evidence of increased bare soil caused by visitor use within 400 meters of nest sites.
Adaptive Management Actions	Investigate factors that may be contributing to declining black-hawk numbers to determine if management of visitor use is the likely cause and what adaptive management actions are most likely to be effective. Accordingly, one or more of the following adaptive management actions may be taken: • Increase signage, education and outreach efforts, or ranger presence, with the goal of directing visitors away from nest sites and encouraging visitor use within planned recreation sites. • Improve amenities (such as toilets, picnic areas, and creek access points) within recreation sites. • Better define the boundaries of recreation sites, roads, and trails through signage, barriers, or fencing. • Adjust the distribution of visitor use within the Fossil Creek corridor to reduce use near black-hawk nest sites. • Restore unauthorized trails leading out of recreation sites using passive or active techniques, with priority given to locations that are within 400 meters of black-hawk nest sites. • Conduct black-hawk nest monitoring in the breeding season following implementation of adaptive management actions to assess changes in nesting status.
Hard Threshold	In two consecutive years (after baseline establishment), six or fewer active black-hawk territories and/or nests are detected between Fossil Springs and 0.5 miles below Mazatzal and there is evidence of increased bare soil caused by visitor use within 400 meters of nest sites.
Adaptive Management Actions	Adaptive management actions listed above may be taken if anticipated to be effective. Additionally, one or more of the following actions may be taken: • Change the locations, kinds, or amounts of visitor use in the Fossil Creek WSR corridor. Actions may include, but are not limited to,

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	• Reallocate the number of permits among recreation sites (if permits are used). • Establish permits for access to the WSR corridor (if not already in place), for access to specific locations within the corridor (such as the waterfall or Fossil Springs area), or for specific kinds of use. • Reduce the overall corridor-wide user capacity. • Relocate portions of roads or trails contributing to impacts. • Implement short- or long-term closures of specific location(s) or specific kinds of use within the WSR corridor.
Expected Outcomes	Visitor use does not lead to black-hawk nest abandonment.
Indicator of Success	More than seven pairs of black-hawks are maintained from Fossil Springs downstream to 0.5 miles below Mazatzal.

Common Black-Hawk Habitat as Measured by Bare Soil

Proximity to common black-hawk nest sites (defined as within 400 meters of nests) will be used for early detection of visitor use that may adversely impact common black-hawk habitat and populations, as this species is a key component of the biological ORV and an indicator for potential impacts to other species. Ground disturbance is measured as bare area as an early indicator of dispersed recreation use and will show if recreation is expanding out from recreation sites into the refugia areas in between recreation sites. Increasing human use, as indicated by bare soil, can result in visual and aural disturbance to COBH reducing nest success and even causing site abandonment.

Table 6-c. Bare soil monitoring and adaptive management

Objective	Minimize disturbance from visitor use in refugia areas outside of planned recreation sites, roads, and trails.
Indicator	Unauthorized trails or other bare soil resulting from visitor use outside of planned recreation sites, roads, and trails, classified by vegetation type, hydrological connectivity to Fossil Creek, and proximity to occupied common black-hawk nest sites.
Metric	Acres and/or miles and location of bare soil caused by visitor use, including distance from occupied common black-hawk nest sites.
Measurement Frequency	Baseline is collected for post-decision conditions, then annually.
Assessment Frequency	Annually.
Soft Threshold	New unauthorized trails or other areas of bare soil caused by visitor use are detected in refugia areas.
Adaptive Management Actions	One or more of the following adaptive management actions may be taken: • Investigate factors contributing to visitors recreating outside of recreation sites (such as by assessing management observations of visitor behavior or formal or informal visitor surveys) to determine what adaptive management actions are most likely to be effective at encouraging recreational use within planned recreation sites, roads, and trails. Accordingly, • Increase signage, education and outreach efforts, or ranger presence. • Improve amenities (such as toilets, picnic areas, and creek access points) within recreation sites to encourage use within these sites. • Better define the boundaries of recreation sites, roads, and trails through signage, barriers, or fencing. • Adjust the timing, location, or management (such as through permitting) of camping. • Improve road and trail maintenance. • Change permit terms for outfitters/guides or other special uses if the permitted activities are found to be increasing bare soil in refugia areas. • Restore unauthorized trails or other bare soil areas in refugia areas using passive or active techniques, with priority given to locations that are hydrologically connected to Fossil Creek or within 400 meters of common black-hawk nest sites.

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	If unauthorized trails or bare soil resulting from visitor use are detected within 400 meters of common black-hawk nests, conduct nest monitoring (see table 6-b) in the breeding season following implementation of adaptive management actions to assess changes in nesting status.
Hard Threshold	Unauthorized trails or other areas of bare soil in refugia areas caused by visitor use are expanding despite implementation of adaptive management actions associated with the soft threshold or recreation sites at the segment-wide scale (e.g. recreational segment) are connected by unauthorized trails.
Adaptive Management Actions	Adaptive management actions listed above may be taken if anticipated to be effective. Additionally, one or more of the following actions may be taken: - Actively restore unauthorized trails or other bare soil areas in refugia areas. - Change the locations, kinds, or amounts of visitor use in the Fossil Creek WSR corridor. Actions may include, but are not limited to, - Reallocate the number of permits among recreation sites (if permits are used). - Establish permits for access to the WSR corridor (if not already in place), for access to specific locations within the corridor (such as the waterfall or Fossil Springs area), or for specific kinds of use. - Reduce the overall corridor-wide user capacity. - Relocate portions of roads or trails contributing to impacts. - Implement short- or long-term closures of specific location(s) or specific kinds of use (such as camping) within the WSR corridor.
Expected Outcomes	Unauthorized trails or other areas of bare soil caused by visitor use in refugia areas are detected and eliminated. Visitor use occurs within planned locations and does not result in new impacts to refugia areas.
Indicator of Success	Bare soil in refugia areas that can be attributed to visitor use is absent or decreases year-to-year.

Aquatic Invertebrates

Fossil Springsnails

Fossil Springsnails are a species of interest in Fossil Creek because 1) they are a Forest Service sensitive species; 2) they are only known to occur in the Fossil Creek corridor (they are endemic to Fossil Creek); 3) there are only a few small populations isolated to specialized ecological niches within a narrow geographic range, so they are vulnerable to population die-offs and risk of extinction; and 4) they can be indicators of spring health.

The habitat assessment rating protocol developed by AGFD would be used to assess the condition of riparian areas occupied by Fossil springsnails (table 6-d), and Fossil springsnail population counts would be used to assess the abundance of springsnails at key locations in Fossil Creek (table 6-e). Collaboration with the US Fish and Wildlife Service and AGFD will facilitate monitoring Fossil springsnail populations and habitat. Springs that support suitable habitat for the Fossil springsnail need to be surveyed to protocol in order to determine occupancy. The numerous springs that occur on steep slopes and where access is difficult are lower priority for inventory.

Table 6-d. Biological ORV monitoring and adaptive management – Fossil springsnail habitat

Objective	Springs containing populations of Fossil springsnails persist free from impacts of visitor use; springsnail habitat is rated as high or moderate and does not show a downward trend over the monitoring period.
Indicator	Habitat condition assessment rating on occupied springs.
Metric	Numeric habitat condition ratings for various habitat parameters. The cumulative score is categorized into high, medium, and low habitat ratings.
Measurement Frequency	Continue gathering baseline data for all accessible sites in Fossil Creek. Once baseline is established, conduct springsnail habitat monitoring at priority occupied sites periodically or when an activity at an occupied spring results in habitat impacts.
Assessment Frequency	At the end of each monitoring period.

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Soft Threshold	Monitoring shows the habitat rating of occupied springs is trending downward as a result of visitor use.
Adaptive Management Actions	Investigate factors that may be contributing to declining habitat condition to determine if management of visitor use is the likely cause and what adaptive management actions are most likely to be effective. Accordingly, one or more of the following adaptive management actions may be taken: • Increase signage, education and outreach efforts, or ranger presence, with the goal of reducing visitor impacts on springsnail habitat and encouraging visitor use within planned recreation sites. • Where designated trails cross springs, install footbridges over the extent of the wetted area that is present at the wettest period in time. • Improve amenities (such as toilets, picnic areas, and creek access points) within recreation sites to encourage use within these sites. • Better define the boundaries of recreation sites, roads, and trails through signage, barriers, or fencing. • Adjust the distribution of visitor use within the Fossil Creek corridor to reduce impacts to specific springs. • Restore unauthorized trails that are impacting springs using passive or active techniques. • Restore impacted springs.
Hard Threshold	Visitor use interferes with occupied springs' ability to attain and maintain high or moderate habitat condition in the long term.
Adaptive Management Actions	Adaptive management actions listed above may be taken if anticipated to be effective. Additionally, one or more of the following actions may be taken: • Change the locations, kinds, or amounts of visitor use in the Fossil Creek WSR corridor. Actions may include, but are not limited to, • Reallocate the number of permits among recreation sites (if permits are used). • Establish permits for access to the WSR corridor (if not already in place), for access to specific locations within the corridor (such as the waterfall or Fossil Springs area), or for specific kinds of use. • Reduce the overall corridor-wide user capacity. • Relocate portions of roads or trails contributing to impacts. • Implement short- or long-term closures of specific location(s) or specific kinds of use within the WSR corridor.
Expected Outcomes	Visitor use occurs out of the wetted areas of occupied springsnail sites.
Indicator of Success	Springs maintain high habitat condition ratings.

Table 6-e. Biological ORV monitoring and adaptive management – Fossil springsnail populations

Objective	Visitor use does not impact populations of Fossil springsnails .
Indicator	Relative abundance of Fossil springsnails.
Metric	Number of individual snails counted during timed count surveys, given as an estimate of Catch-Per-Unit-Effort (CPUE).
Measurement Frequency	At least every third year, especially at springs showing human use.
Assessment Frequency	At the end of each monitoring period.
Soft Threshold	Monitoring shows a reduction of 25-50% of the mean cumulative CPUE estimates.

Fossil Creek CRMP – Wildlife, Plants, and Vegetation Report

Adaptive Management Actions	Investigate factors that may be contributing to declining springsnail populations to determine if management of visitor use is the likely cause and what adaptive management actions are most likely to be effective. Accordingly, one or more of the following adaptive management actions may be taken: • Increase signage, education and outreach efforts, or ranger presence, with the goal of reducing visitor impacts on springsnail populations and encouraging visitor use within planned recreation sites. • Where designated trails cross springs, install footbridges over the extent of the wetted area that is present at the wettest period in time. • Improve amenities (such as toilets, picnic areas, and creek access points) within recreation sites to encourage use within these sites. • Better define the boundaries of recreation sites, roads, and trails through signage, barriers, or fencing. • Adjust the distribution of visitor use within the Fossil Creek corridor to reduce impacts to specific springs. • Restore unauthorized trails that are impacting springs using passive or active techniques. • Restore impacted springs.
Hard Threshold	Monitoring shows a reduction of >50% of the mean cumulative CPUE estimates.
Adaptive Management Actions	Adaptive management actions listed above may be taken if anticipated to be effective. Additionally, one or more of the following actions may be taken: • Change the locations, kinds, or amounts of visitor use in the Fossil Creek WSR corridor. Actions may include, but are not limited to, • Reallocate the number of permits among recreation sites (if permits are used). • Establish permits for access to the WSR corridor (if not already in place), for access to specific locations within the corridor (such as the waterfall or Fossil Springs area), or for specific kinds of use. • Reduce the overall corridor-wide user capacity. • Relocate portions of roads or trails contributing to impacts. • Implement short- or long-term closures of specific location(s) or specific kinds of use within the WSR corridor.
Expected Outcomes	Visitor use occurs out of the wetted areas of occupied springsnail sites.
Indicator of Success	Viable populations of Fossil springsnails are maintained in the Fossil Creek corridor.

Other Biological ORV Protections

Lowland Leopard Frog Monitoring

The lowland leopard frog population in Fossil Creek is the sole viable population of this species on the Coconino National Forest and is one of few documented populations on the Tonto National Forest, particularly on the Payson Ranger District. Prior to restoration of full flows and the native fishery, lowland leopard frog numbers in Fossil Creek were at an all-time low and were at risk of disappearing. Phased decommissioning (allowing habitat to establish downstream of the historic dam for four years after restoration of full flows before lowering the dam), along with restoration of the native fisheries, quickly allowed for leopard frogs to expand downstream into newly created habitat and rapid population growth was observed from Fossil Springs downstream to the large waterfall. Elsewhere in Fossil Creek, bedrock-dominated stream reaches limit available habitat. The population of lowland leopard frogs in Fossil Creek was secure enough in the summer of 2009 that it was able to withstand drastic alteration of habitat above the dam after the dam was lowered and then severe scouring of habitat during a large winter flood in 2009/2010.

The main threats to lowland leopard frog populations in Fossil Creek are from non-native predators (particularly fish species), diseases, and natural events such as flooding. To date, no correlation between recreational use and frog population numbers has been detected. Instead, flooding has been observed to result in population decreases. Because visitor use management is unlikely to impact lowland leopard frog populations, the CRMP does not require monitoring of this species; however, because of the importance of the Fossil Creek population it is

anticipated lowland leopard frog populations will continue to be monitored regardless of CRMP implementation in the future. Lowland leopard frog monitoring occurred annually between 2005 and 2010 and in 2012, and 2017.

Bald and Golden Eagle Monitoring

Arizona Game and Fish Department conducts aerial surveys along Fossil Creek to search for new bald or golden eagle nesting sites. If a bald eagle territory is discovered, the Fossil Creek breeding area will be included in the AGFD's statewide bald eagle management and monitoring efforts. Golden eagle breeding areas are monitored at a lower intensity across Arizona, including the one currently documented golden eagle nest along Fossil Creek.

Riparian Breeding Bird Surveys

Long-term riparian breeding bird surveys are currently conducted in Fossil Creek on a rotational basis under the Arizona Bird Conservation Initiative's Coordinated Bird Monitoring Program. Additionally, potential exists to incorporate Fossil Creek into one of the established Important Bird Areas along the Verde River, which would expand the seasons in which surveys occur.

Bat Monitoring

Ongoing monitoring for bats occurs annually in the Fossil WSR corridor on both the Coconino and Tonto National Forests. While various techniques are used, the standardized protocol used for acoustic monitoring comes from the North American Bat Monitoring Program (NABat). NABat, an international and multiagency program, is a continent-wide effort to gather monitoring data to assess changes in bat distributions and abundances.

Affected Environment – Desired Condition, Baseline Condition, and Existing Condition for Vegetation

Desired Future Conditions for both Vegetation and Habitat

A broad diversity of native plants representing all plant groups (bryophytes, ferns and their allies, and seed plants, including grasses and other monocots, forbs, vines, shrubs, and trees) is present within site capability. Native vegetation is able to naturally reproduce. Special status species, endemic species, and species of interest persist where suitable habitat occurs, and are not negatively impacted by human activities.

The composition of native vegetation species reflects potential as defined by the Terrestrial Ecological Unit Inventory or best available science. The density and vertical and horizontal canopy cover of native woody riparian tree species increases where not already at potential capability.

Riparian vegetation is at reference conditions for structure and species composition. Outside of recreation sites or stream access areas, vegetation is untrampled and human impacts to seedling and sapling riparian woody species are minimal.

Upland and riparian vegetation prevents accelerated soil erosion and sedimentation into downstream aquatic habitat. Vegetation within the AMZ serves as a natural filter to keep sediment out of the stream, reduce soil erosion, and buffer the stream from damage.

Mesquite bosque stands support productive and diverse understory conditions and remain intact and undeveloped.

Evergreen or live oaks (species known to be present are Emory oak, *Quercus emoryi*; Palmer oak, *Quercus palmeri*; and Nettle oak, *Quercus rugosa*) occur in shrub or tree forms where conditions allow and are sustainable across the landscape. Large live oak trees provide food, roosts, and hibernation sites for wildlife and contribute to culturally important settings.

Invasive plants rarely occur in the Fossil Creek corridor, and where they exist their populations are declining or limited to regularly disturbed areas.

Existing Conditions for both Vegetation and Habitat

The Fossil Creek Wild and Scenic River Corridor occurs in the Transition Zone Province and ranges in elevation from about 2550 feet above sea level at the confluence of the Verde River and Fossil Creek to 5000 feet. The watersheds are located in a land of extremes. Within the project area, large elevational gradient produces a wide range of temperatures and amounts of precipitation leading to a high diversity of vegetation.

Annual precipitation is distributed bimodally with peaks in the winter and summer. Fifteen to twenty inches in semi-desert grasslands, eighteen to twenty-two in pinyon-juniper woodlands, twenty to twenty-four in ponderosa pine, and up to twenty-eight in mixed conifer.

Summers are usually hot with average high temperatures exceeding 95 degrees for June, July, and August (data for Montezuma Castle NM from the Western Regional Climate Center). Winters are typically mild at low elevations.

The analysis area is comprised of four 6th code watersheds: Upper Fossil Creek, Lower Fossil Creek, Hardscrabble Creek, and Mud Tanks Draw. Based on a GIS query, there are nine major vegetation types in the analysis area (Table 7) and seven within the corridor (table 8 and figure 1). The spatial data source for upland vegetation was Terrestrial Ecological Unit Inventory. The spatial data used for riparian was Regional 3's RMAP since this data is more recent and better represents actual riparian on the ground.

Table 7. Vegetation Type and Acreage within the Four 6th Code Watersheds

Vegetation Type	Acres
Mixed Conifer	6,305
Ponderosa Pine Forest	14,888
Ponderosa Pine/Gambel Oak	7,112
Alligator/Utah Juniper Savanna	6,591
Pinyon/Juniper Woodland	32,626
Juniper Woodland- Semi Desert Grassland Transition	3,872
Plains Grassland	14,208
Semi-Desert Grassland	2,329
Riparian	1,408
Total:	89,339

Table 8. Vegetation Type and Acreage within the Fossil Wild and Scenic River Corridor

Vegetation Type	Acres
Mixed Conifer	112
Ponderosa Pine Forest	4
Alligator/Utah Juniper Savanna	43
Pinyon/Juniper Woodland	4,275
Juniper Woodland- Semi Desert Grassland Transition	935
Semi-Desert Grassland	272
Riparian	652
Total:	6,293

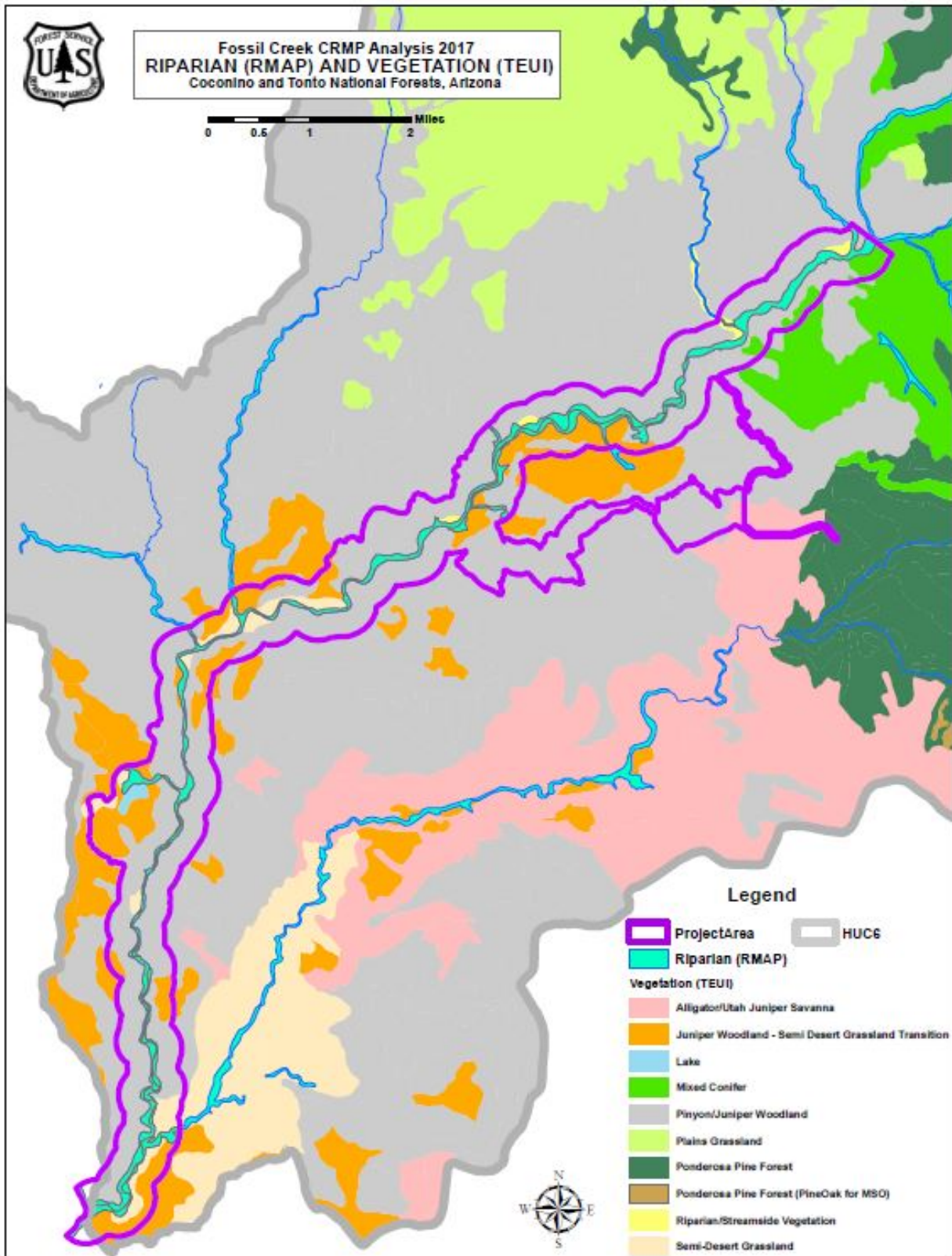


Figure 1. Vegetation Types within the Fossil Creek Analysis Area

Upland Vegetation

Pinyon/Juniper Woodland Conditions:

This vegetation type comprises the largest overall aerial extent, 37% of the project area and 70% of the cumulative effects area (see Table 9). Vegetative ground cover and species composition vary according to slopes and ungulate access. Slopes greater than about 40 – 50 % have higher vegetative ground cover, species composition, diversity, and productivity than lesser slopes. The pinyon/juniper woodland type contains inclusions of turbinella oak chaparral that were too small to map at scale of the original Terrestrial Ecosystem Survey (TES) mapping. The chaparral vegetation consists of dense stands of shrubs with little herbaceous cover.

Juniper/Semi-Desert Grassland Transition Conditions:

This vegetation type exists in the ecotone between pinyon-juniper woodlands and semi-desert grasslands. It occupies only about 4% of the project area and 15% of the cumulative effects area (see Table 9). It is characterized by low canopy coverage of juniper and shrubs with variable grass and forb understory depending on level of disturbance.

Semi-Desert Grassland:

Semi-desert grassland types occupy 4% of the project area and 3% of the cumulative effects area (see Table 9). This type is characterized by low canopy cover of shrubs (5 – 25 %) and a variable understory comprised of perennial and annual grasses and forbs. Vegetative conditions vary but generally vegetative ground cover, species composition, diversity, and productivity are less than what would be predicted in the PNC. Small inclusions of Sonoran Desert vegetation occur on steep south facing slopes at lower elevations within polygons of semi-desert grasslands.

Plains Grassland:

Plains grassland types occur at higher elevation than semi-desert grasslands, have greater precipitation, and are therefore generally more productive. They occupy 16 % of the cumulative effects area; none occur within the project area (see Table 9). This type is characterized by low canopy cover of trees shrubs and normally an understory comprised of perennial grasses and forbs often dominated by western wheatgrass and blue grama. In some areas the plains grasslands grade into pinyon/juniper woodlands where the overstory cover of trees and shrubs may exceed 25%.

Alligator/Utah Juniper Savanna Conditions:

This vegetation type normally occurs at the same elevation as the Pinyon/Juniper Woodland and comprises 7 % of the cumulative area and less than 1 % of the project area (see Table 9). The canopy cover of trees is normally around 1-10% but coverage may exceed 10% where this type grades into juniper woodlands. There is normally mixture of Utah and alligator juniper but Utah juniper becomes more dominant at lower elevations while alligator juniper is more dominant at higher elevations. Parts of this type have had juniper control projects in the past that have opened the canopy.

Ponderosa Pine Forest Conditions:

This vegetation type occurs at higher elevations and north facing slopes and comprises about 25 % of the cumulative effects area but less than 1% of the project area. Approximately 8% of the ponderosa pine forest contains Gambel oak forest in the cumulative effects area (no Gambel oak forests occur within the project area). (see Table 9). As mapped for the analysis, this type is highly variable and contains both cold gradient ponderosa pine (those areas having cold winters and containing Gambel oak) and mild ponderosa pine (those areas having mild winters and containing evergreen oaks). Vegetative ground cover and species composition vary according to slopes and ungulate access.

Mixed Conifer Forest Conditions:

This vegetation type occurs at highest elevations and north facing slopes and comprises about (7%) of the cumulative effects area. About 2% of the project area is comprised on mixed conifer forests (see Table 9). Common overstory species include Douglas fir, white fir, and ponderosa pine. Most of this type within the Cumulative effects area occurs on slopes of greater than 40%. While nearly all of soils within this type are in satisfactory condition, areas that loose cover tend to be erosive. Some areas mapped as mixed conifer may have major inclusions of ponderosa pine forest.

Riparian Vegetation Conditions:

Riparian vegetation consists of lotic (riverine), lentic (springs), and wetland systems. Based on RMAP, the total of all riparian vegetation is less than 2% for the cumulative effects area and 10 % of the project area (see Table 9).

Table 9: Acres and Percent of Veg Types within the Project Area (PA) and Cumulative Effects (CE) Area

TES Soil Vegetation Type	Acres in PA	Percent Total PA	Acres in CE Area	Percent Total CE Area
Alligator/Utah Juniper Savanna	43	<1%	6,591	7%
Juniper Woodland - Semi Desert Grassland Transition	935	15%	3,872	4%
Mixed Conifer	112	2%	6,305	7%
Pinyon/Juniper Woodland	4,275	70%	32,626	37%
Ponderosa Pine Forest	4	<1%	14,888	17%
Ponderosa Pine Forest (PineOak for MSO)	0	0%	7,112	8%
Riparian/Streamside Vegetation	652	10%	1,408	2%
Plains Grassland	0	0%	14,208	16%
Semi-Desert Grassland	272	4%	2,329	3%
Grand Total for Project Area	6,293	100%	89,339	100%

Lotic (Riverine) Riparian

A total of 20.24 miles of stream occur in the analysis area. Of these, only Fossil Creek and the Verde River are perennial. Intermittent streams include Boulder Canyon, Sally May Wash, Mud Tank Draw, Tin Can Draw, and Hardscrabble Creek.

Numerous vegetative surveys from the 1970s through the present have provided initial baseline information for the riparian communities and general botany of Fossil Creek. Smith and Bender (1973) and Welsh and Toft (1972) described a deciduous riparian forest diverse in species composition with endemic hanging gardens around Fossil Springs (Wong, 1996). Many trees were noted to be greater than 35 feet in height forming a nearly closed canopy above the springs and stream. Ground cover was described as being more than two feet tall in places (Smith and Bender, 1973). Other reports list plant species present along Fossil Creek (Baker 1998, Phillips 1996, Phillips et al. 1979, 1982, and 1991, Menasco 1985, Collins et al. 1974, Sayers 1998, Goodwin 1979, Wong 1996). All plant species in available reports were entered into an Access Database (Appendix C) up until around 2010. A query of this database revealed approximately 350 species for the greater Fossil Creek area were recorded. In 2017, Desert Botanical Garden (DBG) botanists provided a list of additional documented species that were missing from the Access dbase (Appendix C). In total there are approximately 537 plant species known from Fossil Creek, with potential for numerous additional species to be present. After restoration of full-flows the baseline for riparian conditions was reset since full flows widened the stream, increased the wetted area, and the dynamic nature of travertine formations creates changing conditions in the reach with the most rapid deposition.

Throughout Fossil Creek, dominant tree species include sycamore, ash (*Fraxinus velutina*), alder (*Alnus oblongifolia*), Fremont cottonwood (*Populus fremontii*), walnut (*Juglans major*), and willows (*Salix spp.*). In the intermittent reach above Fossil Springs, there is an Arizona sycamore (*Platanus wrightii*) dominated overstory.

Dominant substrate is bedrock, followed by boulders, and cobble. Perennial pools persist in a few locations, but mainly this section is dry. A complex of many springs begins the perennial portion of Fossil Creek. Beginning at Fossil Springs and continuing down through the entire perennial portion of Fossil Creek, there is a diverse deciduous riparian forest. Above the historic Fossil Springs dam, there is little travertine deposition and as a result, the creek is purely riverine, and the substrate is slick. The reach located a short way below the historic Fossil Springs dam and continuing downstream for several miles contains the most rapid-growing and well-formed developed travertine formations. There, travertine formations that have survived flood events have continued to build to heights of 6-8 feet resulting in deep and long pools. The tops and downstream sides of the dams are covered in aquatic vegetation and the edges of the pools contain aquatic and emergent vegetation. Newer developing travertine formations create complex aquatic and riparian habitat by supporting more aquatic vegetation (submerged, emergent, and floating), broader wetted areas, much more step pools, more areas with slower water, and pools of varying depths. From the springs downstream through the middle portion of Fossil Creek the majority of the riparian herbaceous vegetation is dominated by tall fescue (*Festuca arundinacea*). Around Irving, active travertine dam formation is greatly reduced and dams that formed from the last few decades of water release at Irving are no longer functioning as dams. The mixed broadleaf riparian forest continues downstream until closer to the confluence where a transition from mixed deciduous forests to cottonwood/willow riparian forest occurs. Closer to the Verde River, tall fescue becomes less common and native emergents (*Carex*, *Equisetum*, *Juncus*) become more common. Even at the confluence of Fossil with the Verde, the substrate is coated in a layer of travertine.

The riparian corridor along Fossil Creek has changed from before construction of hydropower infrastructure, through the years of hydropower operation and after restoration of full flows in 2005. Two areas have had notable change: below the dam and below Irving. Prior to restoration of full flows in 2005, APS had to discharge 10-15 cfs of flow from the Irving powerplant back into Fossil. This created a section of travertine formations. However, since full flows were restored up at Fossil Springs, a new travertine section began forming below the historic Fossil Springs dam. The change in travertine formation below the historic Fossil Springs dam is documented through a series of photos (Figures 2-4). Soon after restoration of full flows, travertine deposition below the dam created a complex network of floating dams. In this section during the several years after restoration of full flows, the stream channel was covered in watercress and monkeyflower. However some dams continued to develop but softer, more vulnerable dams were impacted by flood events. Surviving dams grew in height and more significant pools became evident.



Figure 2. Newly forming travertine structures below the historic Fossil Springs dam in 2007



Figure 3. Further developed travertine formations below the historic Fossil Springs dam in 2012



Figure 4. Mature, well-developed travertine formations with deep, long pools below the historic Fossil Springs dam in 2017

At Irving, the travertine formations that had formed there in the last few decades of hydropower operation (when 10-15 cfs were released from Irving in the 1990s and early 2000s), have persisted over recent years. However, recent floods (between October 2016 and Sept 2017) have breached some of these dams. During a fall 2017 site visit to known travertine pools below Irving and at Homestead, the pools were drained and full flows were back in one main channel (personal observation, Janie Agyagos). The more complex habitat supported by these travertine formation and pools was lost. In essence, recent floods are resetting this reach to its natural potential which is for less travertine deposition, much fewer and smaller travertine structures, and deeper and swifter water due to a narrower channel.

Lentic (Springs) Riparian

The majority of springs in the project area are associated with the spring complex termed collectively as Fossil Springs. This series of springs includes at least 60 individual spring orifices. There are other springs and seeps in

the Fossil corridor that are not associated with the Fossil Springs complex. Some occur adjacent to Fossil Creek while others occur well in the uplands, such as those along the Flume Trail.

Fossil Springs Botanical Area

The richness of species diversity around Fossil Springs led to the creation of the Fossil Springs Botanical Area in 1987 (Wong, 1996). The Botanical Area is proposed to be increased to approximately 33 acres in size (Figure 5). Many endemic species were identified within the Botanical Area in the proximate uplands as well as immediately adjacent to the springs, and many of those endemic species were specific to individual springs and to the geology of the canyon containing Fossil Creek (Appendix C). A query of the Fossil Creek plant database revealed approximately 187 species from the Fossil Botanical Area were recorded.

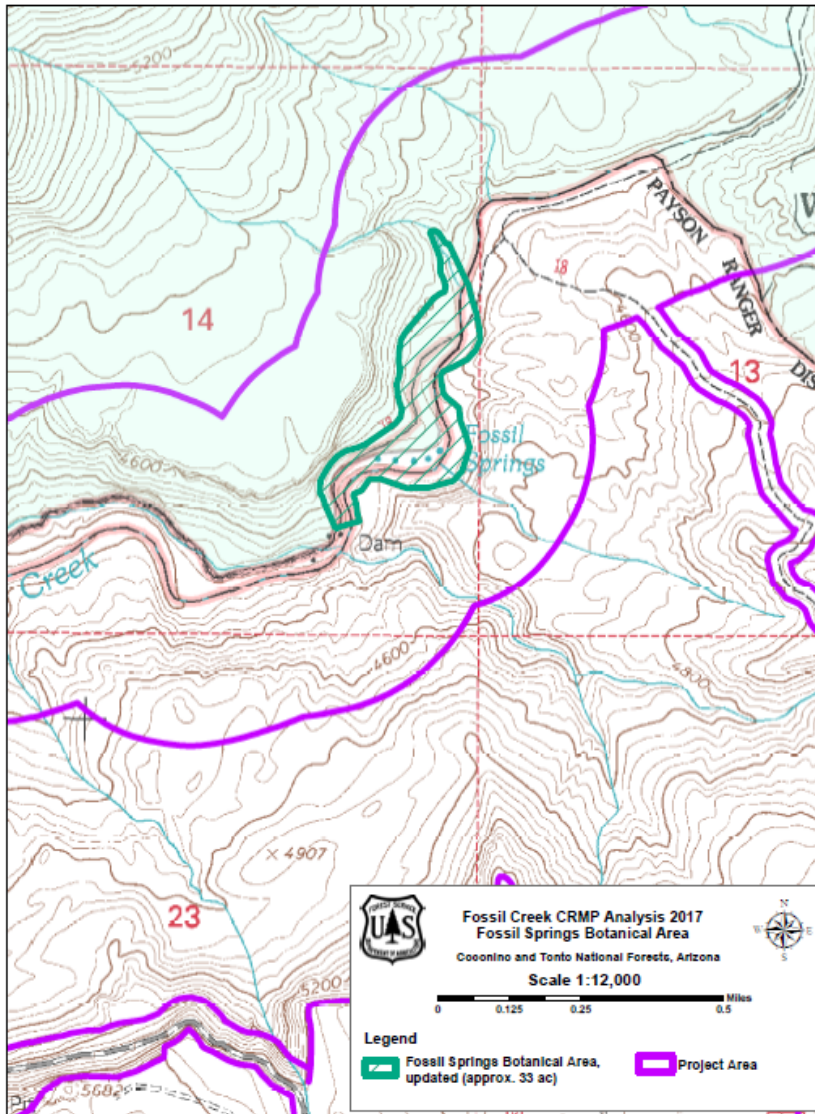


Figure 5: Fossil Springs Botanical Area boundary (recommended updated boundary)

Bare Soil Conditions in WSR Corridor

Campsite Comparisons 2005 - 2009

Since much of the recreational use in Fossil Creek occurs along the greenline adjacent to water, where new vegetation is establishing, young plants are vulnerable to trampling and displacement through camping, unauthorized trails, and day use activities. Unauthorized trails in the uplands, as well as bare soil areas in the

uplands increase the potential for sedimentation into Fossil Creek. In order to track the changes to vegetation over time and in response to management changes, the Forest Service began monitoring bare soil (Rotert 2009). Data was collected at campsites in 2005 and 2009. Results are summarized in the following paragraphs.

The overall number of campsites along Fossil Creek increased by 68% from 2005 to 2009 (Table 10). The greatest increase was seen in pinyon-juniper, followed by riparian. The number of campsites in shrub-grassland decreased by 20%.

Table 10. number of campsites in Fossil Creek, 2005-2009

# Campsites	2005	2009	% Change
in Riparian	36	58	61
in Pinyon-Juniper	46	93	102
in Shrub-Grassland	15	12	(20)
Total:	97	163	68

The cumulative area of campsites documented in 2009 was 175,375 ft² (4.02 acres). This was a 73.2% increase over the 2005 survey which documented a total area of 101,205 ft² (2.32 acres). Of the total campsite area, 27% (46,650 ft²) was in the riparian zone. This was an 82.2% increase in area from the 2005 survey, which documented 25,600 ft² of riparian campsite area. Of the total campsite area, 63% (110,550 ft²) was in the Pinyon-Juniper vegetation type. This was an 89.0% increase from the 2005 survey, which documented 58,500 ft² of campsite area in this vegetation type. The Shrub-Grassland vegetation type made up 10% (18,175 ft²) of the total campsite area documented in 2009. This was a 6% increase from the 2005 survey, which documented 17,150 ft² of campsite area in this vegetation type.

The 2009 survey data shows that the Tonto Dispersed Camp Zone contains both the highest number of camp sites, as well as the greatest cumulative area. The Waterfall contains the second highest number of campsites, and Fossil Springs, the third (See Figure 6 and Figure 7 in Rotert, 2009).

The Waterfall trail showed the largest increase in both the number of campsites and total campsite area from 2005 to 2009. The number of campsites increased from 6 sites in 2005 to 27 sites in 2009. This amounts to a 350% increase in campsite quantity. The cumulative campsite area along the waterfall trail increased from 4,100 ft² in 2005 to 19,700 ft² in 2009. This amounts to a 380% increase in total campsite area along the trail (See Figures 6 and 7 and Tables 6 and 7 in Rotert, 2009).

Fossil Springs contains the highest number of riparian area campsites with 72% of campsites (18 sites) being located within the riparian zone. Fossil Springs also contains the greatest riparian zone campsite area at 13,750 ft². This composes 68% of the total campsite area at Fossil Springs and 29% of all riparian zone campsite area along Fossil Creek (See Figure 8 and Tables 6 and 7 in Rotert, 2009).

2002-2013

A total of six campsite condition assessments have been conducted at Fossil Creek since 2002 (Rotert 2013). A comparison of campsite bare soil area across years is shown in Figure X. With vegetation loss noticeably increasing, it was decided in 2010 to broaden the scope of monitoring to include all vegetation loss resulting from recreation related impacts. Inventory efforts were expanded to include the assessment of unauthorized trails, spur roads, vehicle pullouts, parking lots, and day use areas and to quantify the bare soil area contribution of each of these elements. The data collection protocol for the assessment of these various elements was developed and first utilized in the 2010 bare soil inventory. A comparison of all bare soil acre categories across years is shown in Figure 6 and across recreation sites is shown in Table 11. The cumulative area of open campsites documented in 2013 was 3.45 acres, compared to 4.02 acres in 2009. It is important to note that interim measure were put into place starting in 2010 and 2011 to block off previously unvegetated areas, stabilize trails, and to close unauthorized roads and trails. This explains the decrease in bare area after 2011.

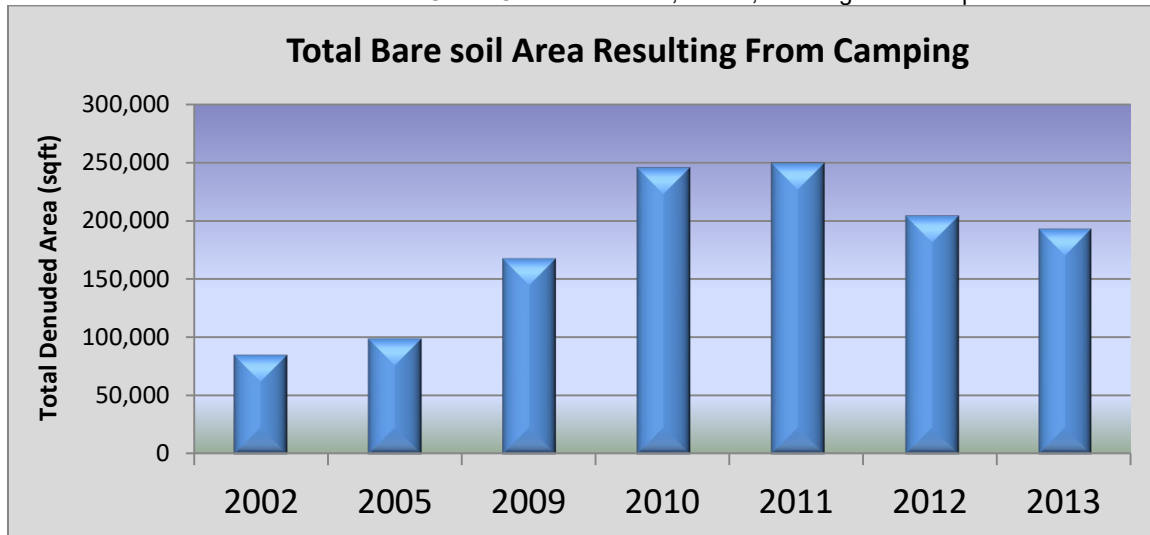


Figure 6. Total bare soil area of campsites from all years of available data (open and closed sites)

Table 11. Bare soil area resulting from camping and other activities, by location, by year (both open and closed sites)

LOCATION	YEAR OF INVENTORY					
	2005	2009	2010	2011	2012	2013
Springs	17,950 Ft ² .41 acres	20,075 Ft ² .46 acres	36,100 Ft ² .83 acres	38,300 Ft ² .88 acres	45,300 Ft ² 1.04 acres	40,650 Ft ² .93 acres
Waterfall Complex	7,400 Ft ² .17 acres	28,375 Ft ² .65 acres	39,800 Ft ² .91 acres	37,550 Ft ² .86 acres	24,380 Ft ² .56 acres	19,380 Ft ² .44 acres
Irving	0 Ft ² 0 acres	2,075 Ft ² .05 acres	1,100 Ft ² .03 acres	950 Ft ² .02 acres	1100 Ft ² .03 acres	1,000 Ft ² .02 acres
Tonto Bench	19,450 Ft ² .45 acres	29,350 Ft ² .67 acres	38,425 Ft ² .88 acres	34,475 Ft ² .79 acres	18,385 Ft ² .42 acres	16,775 Ft ² .39 acres
Bridge	3,800 Ft ² .09 acres	6,100 Ft ² .14 acres	6,150 Ft ² .14 acres	6,150 Ft ² .14 acres	6,350 Ft ² .15 acres	6,350 Ft ² .15 acres
Homestead	13,600 Ft ² .31 acres	29,750 Ft ² .68 acres	41,700 Ft ² .96 acres	45,400 Ft ² 1.04 acres	46,750 Ft ² 1.07 acres	49,250 Ft ² 1.13 acres
Old Corral	16,900 Ft ² .39 acres	16,550 Ft ² .38 acres	27,625 Ft ² .63 acres	29,150 Ft ² .67 acres	19,850 Ft ² .46 acres	18,250 Ft ² .42 acres
Sally May	4,800 Ft ² .11 acres	13,650 Ft ² .31 acres	20,175 Ft ² .46 acres	21,050 Ft ² .48 acres	17,325 Ft ² .40 acres	17,575 Ft ² .40 acres
Purple Mountain	1,400 Ft ² .03 acres	8,825 Ft ² .20 acres	17,125 Ft ² .39 acres	17,100 Ft ² .39 acres	14,685 Ft ² .34 acres	10,250 Ft ² .24 acres
Mazatzal	950 Ft ² .02 acres	12,550 Ft ² .29 acres	17,025 Ft ² .39 acres	19,025 Ft ² .44 acres	9,865 Ft ² .23 acres	8,050 Ft ² .18 acres

When looking at bare soil area in categories other than camping, only data from 2010- 2013 is available. A total of 15 acres of bare soil areas occurred in 2013. Refer to table 12 for the bare area in 2013 by each category.

Table 12. Summary of all Fossil bare soil area by impact type as of 2013

FOSSIL CREEK BARE SOIL AREA TOTALS	
Element	Total Area
Campsites	150,375 ft ² (3.45 acres)
Closed Campsites (Not Rehabilitated)	42,380 ft ² (0.97 acres)
Day Use Areas	23,650 ft ² (0.52 acres)
Vehicle Pullouts	35,825 ft ² (0.78 acres)
Parking Lots	25,275 ft ² (0.58 acres)
Spur Roads	62,998 ft ² (1.45 acres)
Closed Spur Roads	31,031 ft ² (0.71 acres)
Trails (Social and Designated)	151,715 ft ² (3.48 acres)
Non-Categorical Bare soil Area	129,875 ft ² (2.98 acres)

Total Bare soil Area (ft²)	653,124 ft²
Total Bare soil Area (Acres)	14.99 acres

Refer to Table 13 for a comparison of all bare soil categories across all years.

Table 13. Summary of categorical bare soil area by type of impact vector across all years of available data

	YEAR INVENTORIED						
	2002	2005	2009	2010	2011	2012	2013
CAMPSITE DATA							
Total Number of Open (unrestricted) Campsites	87	97	163	109	106	104	99
Total Denuded area of Open Sites	96,600 ft ² 2.22 acres	101,250 ft ² 2.32 acres	175,375 ft ² 4.03 acres	168,050 ft ² 3.86 acres	174,975 ft ² 4.01 acres	160,125 ft ² 3.68 acres	150,375 ft ² 3.45 acres
TRAIL DATA							
Number of Social Trails	No Data	No Data	No Data	87	92	114	95
Total Denuded Area of Social Trails	No Data	No Data	No Data	198,787 ft ² 4.56 acres	251,554 ft ² 5.77 acres	130,592 ft ² 2.99 acres	105,141 ft ² 2.41 acres
VEHICLE PULLOUT DATA							
Number of Vehicle Pullouts	No Data	No Data	No Data	28	31	27	27
Total Denuded Area of Vehicle Pullouts	No Data	No Data	No Data	36,670 ft ² 0.84 acres	41,830 ft ² 0.96 acres	38,825 ft ² 0.88 acres	35,825 ft ² 0.82 acres

In addition to the Forest Service bare area monitoring, NAU conducted effectiveness monitoring. The following discussion comes from the Marks Lab 2012 report for the Fossil Creek Riparian Vegetation, Water Quality and Visitor Use Monitoring Plan (Adams et al 2013; NAU 2010). The objective of this report was to determine the effectiveness of the Middle Fossil Creek Riparian Habitat Protection and Restoration Project, specifically the results of riparian vegetation monitoring 2010, 2011 and 2012. In 2012 they found no significant change in vegetation coverage compared to 2011, however the increases in grasses and herbaceous cover recorded in 2011 were still evident. This underlines the potential for vegetation recruitment and establishment in the Fossil Creek riparian area under favorable climatic conditions.

In the Marks Lab study plant community composition and structure is determined for the Fossil Creek middle reach from ten sites starting below Irving Waterfall to Mazatzal, each with two 15 m transects (reference & restoration) with nested plot sampling of plant frequency and cover. Improvement in restoration areas appears to still be influenced by past legacies of disturbance from recreational use as evidenced by the greater equivalency ratios of the coverage of bare soil when compared to reference areas. One concern in 2011 was a significant general increase in disturbance from trampling and garbage in both restoration and reference transects. Overall trampling showed a general decrease in 2012, however it continues to be an issue at four sites. The overall decrease in trampling across all sites was likely an indicator of management restrictions put in place and the resultant slight decrease in recreational use in 2012. The restoration transects at the Bridge, Above Irving 1, Sally May, and Mazatzal sites had a significantly greater mean percentage coverage of trampling than the other six sites combined. The 2012 report (Adams et al 2013) concluded that continued monitoring will help determine if current mitigation practices are effective and are not being undermined by recreational impacts.

In order to compare vegetative and habitat impacts in Fossil Creek across years and to correlate it to changes in visitor use, it is helpful to see a summary of visitor use number data collected by the Forest Service since 2009 (Table 14).

Table 14. Maximum number of people per day by location, 2009-2012¹

Site Name	2009	2010	2011	2012
Fossil Springs	320	296	316	336
Waterfall	160	234	247	88
Irving	33	48	73	108
Bridge	39	44	54	112

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Homestead	102	165	171	120
Sally May	63	113	127	92
Tonto Bench	91	127	115	88
Old Corral	72	65	87	32
Purple Mtn	58	50	59	40
Mazatzal	40	41	37	28
Total	1138	1183	1286	1044

¹Using weekend data; numbers taken based on daily maximum number of vehicles, Rotert 2011 and 2012

Visitor impacts from recreational use in 2011 caused significant resource damage to the riparian vegetation in the project area (Rotert 2012 and Marks 2012). Increased Forest Service presence and management to implement interim measures approved in 2010 and 2011 had an overall positive effect on the vegetation resources in the Fossil Creek riparian sites as seen in Rotert 2013 and Adams 2013. Management efforts including both restoration, capacity control, and implementation of a reservations system had further beneficial effects in 2016 and 2017. In addition, camping was prohibited between the dam and Irving in 2010 (benefitting the Waterfall and Irving sites), and then in 2016 camping was prohibited in the permit area April 1-October 1 (benefitting all sites), with camping allowed downstream of the bridge and upstream of the dam the rest of the year.

Invasive Weeds/ Non-Native Vegetation

Non-native invasive plants continue to be a concern in Fossil Creek. The Forest Service places highest priority for prevention, eradication, and containment for Class A and continuous control of Class E species. Class A species are defined as those newly established or have the potential to become established and pose unacceptable threat to watershed condition. Class E (for extreme) species have wide distribution within a particular area and pose an unacceptable, extreme hazard to watershed condition. Class B are those with limited distribution but pose substantial threat to areas and natural resources. Class C species are widely distributed but do not pose additional threats to watershed condition. Species in Class B and C have lower priority for eradication, control or restoration compared to Class A and E species. Newly emerging species that are highly invasive but have not yet been added to the list will be included in monitoring and eradication efforts. One example of such a plant is yellow bluestem. Repetitive treatments are often necessary and reflect the nature of persistent woody invasives that re-sprout after initial treatments. In between treatments seed germination often results in newly established individuals within previously treated areas; this too requires an area to be retreated on multiple entries.

A noxious weed survey of the Childs and Irving power plant sites was completed in 2003 for Arizona Public Service Company (APS) (Bouchard and Associates, 2003; Appendix D). A total of forty eight species of invasive exotic plants were identified in the uplands and along the riparian corridor. Sixteen target species were further identified for treatment (Appendix D). Some species, such as tall fescue and Bermuda grass (*Cynodon dactylon*), are prevalent and naturalized within the riparian corridor and would be difficult to remove. Other species were planted ornamentals, such as cultivated iris, sweetpea, periwinkle and tea rose, in areas that would be dewatered by the APS decommissioning and were monitored for persistence. APS developed a noxious weed control plan in cooperation with the Forest Service (Bouchard, 2004) to treat 16 key species identified as needing some form of control during the decommissioning process (refer to Table 15). Herbicide, mechanical, and passive treatments were conducted by APS between 2005 and 2009 where targeted species occurred in deconstruction areas only. This included near the historic Fossil Springs dam (blackberry), along the flume and flume roads (tree of heaven, Siberian elm, giant reed), near flume tunnels (Lehmann's lovegrass), at the surge tank (malta starthistle), around Stehr Lake (salt cedar, Russian thistle, malta starthistle), Irving powerplant (tree of heaven, giant reed, Siberian elm, periwinkle, sweet pea, iris), Child's powerplant (Tree of heaven, periwinkle, giant reed, honey locust), and along the road to Verde Hot Springs (Siberian elm). Treatments of select species were monitored by FS botanists and were determined to be effective.

Since APS's involvement, the Forest Service has continued to inventory and treat invasive plant species in Fossil Creek. Class E species including tamarisk (*Tamarix ramosissima*), tree of Heaven (*Ailanthus altissima*), Siberian

elm (*Ulmus pumila*) giant reed (*Arundo donax*), Himalayan blackberry, and malta star-thistle (*Centaurea melitensis*), have been targeted by the Forest Service for eradication or control.

The Forest Service has completed invasive plant surveys and has mapped the presence of target invasives from Irving to approximately four miles downstream of Purple Mountain, Stehr Lake area, and the last 0.75 miles of Fossil down to the confluence with the Verde River (see Figure 7). The Forest Service has yet to formally inventory from the confluence of Sand Rock and Calf Pen drainages (the beginning of the corridor) downstream to Irving and an approximate 2 mile remote stretch around the “narrows”. However, some invasive populations are known in unsurveyed reaches. For example, it is acknowledged that the presence of non-native Himalayan blackberry (*Rubus procerus*) is compromising the native plant species diversity at the springs (refer to Figures 8-12 for photographic change in blackberry invasion). Also, salt cedar is known to occur at the waterfall and Russian olive is at Waterfall trailhead.

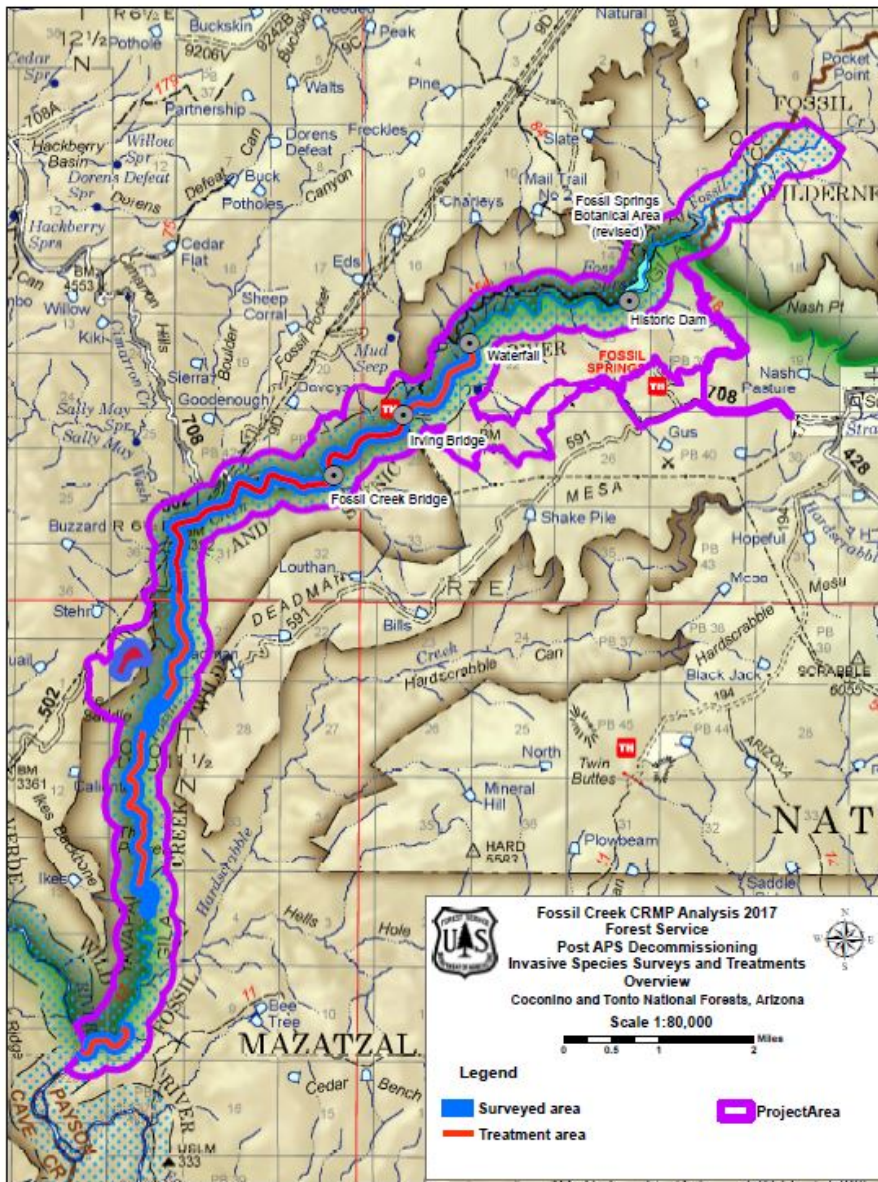


Figure 7: Invasive Plant Surveys and Treatments in the Fossil Corridor



"A Wonderful Water Power" ... "the water pours in torrents from the mountainside, hedged about with columbine, maidenhair and other ferns of great variety ..."

The title of this book is taken from an article published about 100 years ago. In 1901 F.E. Santos celebrated the beauty of Fossil Creek for readers of *Electrical Review*. Yet, true to his day, Santos' focus was on harnessing the creek's hydroelectric potential, for which plans were already being laid. Santos describes the endeavors of "Three enterprising gentlemen [who] have recently secured title to these springs for electrical power purposes."

Figure 8. Fossil Springs, pre-hydro power era



Figure 9. 2007 – Ferns, monkey flower predominant – some blackberry present



Figure 10. 2008 – Ferns, monkey flower predominant – some blackberry present



Figure 11. 2010: Spring orifices still fairly visible among encroaching blackberry



Figure 12. 2017 –same location as 2007, 2008, 2010 and 2012 photos but obscured by wall of blackberry; note spring orifices under blackberry

Forest Service has used mechanical and herbicide treatments on the tree of heaven; salt cedar; giant reed; and Russian olive through repetitive treatments in 2010, 2012, 2013, and 2014 from the Irving to two miles below the permanent fish barrier, the Stehr Lake area, and the last 0.75 miles of Fossil Creek down to the Verde River confluence (see Figure 13). No treatments were done in 2015 and 2016 due to lack of funding. In the fall 2017, invasives to be treated included the four species mentioned above from the waterfall downstream to Purple Mountain and test samples of Himalayan blackberry including at Fossil Springs. Stands of giant reed that are out of the water are treatable, but stands in or very close to water are not treatable with herbicide since the only approved herbicides are for upland use only; these stands instead will only be treated mechanically. Refer to Table X for list of invasive known to have occurred in Fossil Creek and their control class.

Table 15: Invasive weed species detected in Fossil Wild and Scenic River Corridor

SCIENTIFIC NAME	COMMON NAME	OBJECTIVE	Control Class
<i>Conium maculatum</i>	poison hemlock	Eradicate/Control	A
<i>Centaurea melitensis</i>	Malta starthistle	Eradicate	A
<i>Aegilops cylindrical</i>	jointed goatgrass	Contain/Control	B
<i>Bromus japonicas</i>	Japanese brome	Contain/Control	B
<i>Bromus rigidus</i>	ripgut brome	Contain/Control	B
<i>Bromus rubens</i>	red brome	Contain	B
<i>Bromus tectorum</i>	cheatgrass	Contain	B
<i>Cirsium vulgare</i>	bull thistle	Contain/Control	B
<i>Eragrostis lehmanniana</i>	Lehmann lovegrass	Inventory/Contain	B
<i>Rubus procerus</i>	Himalayan blackberry	Contain/Control	B
<i>Vinca major</i>	periwinkle	Contain/Control	B
<i>Avena fatua</i>	wild oats	Contain	C

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<i>Chorispora tenella</i>	blue mustard/ crossflower	Inventory/Control	C
<i>Cynodon dactylon</i>	Bermudagrass	Contain/Control	C
<i>Hordeum murinum ssp. leporinum</i>	hare barley	Inventory/Control	C
<i>Medicago polymorpha</i>	bur clover	Monitor/Control	C
<i>Melilotus officinalis</i>	yellow sweetclover	Inventory/Control	C
<i>Phalaris arundinacea</i>	reed canary grass	Inventory/Control	C
<i>Polypogon monspeliensis</i>	rabbitfoot grass	Inventory/Control	C
<i>Salsola kali</i>	Russian thistle	Inventory/Control	C
<i>Sorghum halepense</i>	Johnson grass	Inventory/Control	C
<i>Tribulus terrestris</i>	puncture-vine	Contain	C
<i>Verbascum thapsus</i>	common mullein	Contain	C
<i>Tragopogon dubius</i>	salsify	Monitor/Control	C
<i>Marrubium vulgare</i>	horehound	Monitor/Control	C
<i>Ailanthus altissima</i>	tree of heaven	Eradicate/Control	E
<i>Arundo donax</i>	giant reed grass	Eradicate/Control	E
<i>Eleagnus angustifolia</i>	Russian olive	Contain/Control	E
<i>Tamarix ramosissima</i> or spp.	salt cedar or tamarisk	Eradicate/Control	E
<i>Ulmus pumila</i>	Siberian elm	Contain/Control	E
<i>Chloris virgata</i>	Wooly top/Feathered Fingergrass	Not yet ranked	N/A
<i>Cortaderia selloana</i>	Pampas grass	Not yet ranked	N/A
<i>Lathyrus latifolius</i>	Perennial sweetpea	Not yet ranked	N/A
<i>Gleditsia triacanthos</i>	Honey locust	Not yet ranked	N/A
<i>Eragrostis cilianensis</i>	Stinking lovegrass	Not yet ranked	N/A
<i>Iris</i> sp.	Iris	Not yet ranked	N/A

Affected Environment –Desired Condition, Baseline Condition, and Existing Condition for Special Status Species, Critical Habitat, and General Wildlife

Desired Conditions Common to all Species

Wildlife, fish, and aquatic species are diverse and abundant, and populations are viable where suitable habitat exists. Native wildlife, particularly special status species, demonstrate high reproductive success rates.

Refugia from human-caused disturbance are abundant and accessible to wildlife, fish, and aquatic species.

Diminishing populations of native species remain stable or increase over time to ensure population viability.

Habitat conditions contribute to the survival and recovery of listed species, allow for repatriation of extirpated species, contribute to the delisting of species under the Endangered Species Act, and contribute to keeping common native species common.

The status of special status species is improving, contributing to recovery of these species. Special-status species populations are not adversely affected by land use and land management activities.

In Middle Fossil, stretches of relatively undisturbed habitat exist outside of recreation sites. These less-disturbed areas provide aquatic and riparian obligatory terrestrial species refugia from human disturbance. Unauthorized trails and other denuded areas do not become established between recreation sites.

Information about the consequences of introduction and spread of non-natives (plants, fish, crayfish, mussels, and diseases) is available to visitors and visitors take measures to inspect, remove, and clean equipment before entering Fossil Creek to prevent spread of exotic species. New invasive exotic species are prevented from being introduced or established in the Fossil Creek corridor through public education, signage, and law enforcement. Known invasive species are contained, their spread is controlled, and populations are declining. Species that are the most invasive and pose the greatest threat to biological diversity, forest health, and watershed condition are eradicated. Natural population dynamics and predator-prey relationships previously damaged by non-native species are re-established, such as between native leopard frogs, garter snakes, and fish.

Wildlife Specific Desired Conditions

A diverse assemblage of bats is present in healthy populations, and a diversity of roosting structure is present. Disturbance of bat roosts within the river corridor is minimal.

Baseline conditions for major wildlife taxa (reptiles, amphibians, mammals, birds, and terrestrial invertebrates) are known.

Pollinators are diverse in Fossil Creek and food plants, larval host plants, nesting sites, and over-wintering sites are available throughout the river corridor. Fossil Creek serves as a nectar corridor connecting the Verde River corridor to the Mogollon Rim.

Human activities do not result in black-hawk nest site abandonment. No detections of nesting mortalities or nest failures attributed to human influences occur. Black-hawks continue to have high nesting success. Native prey constitutes the majority of black-hawks' diets.

Lowland leopard frogs colonize suitable habitat,⁹ and population numbers reflect site potential. Non-native species or human activities do not contribute to population declines.

Populations of predators (jays, ravens, grackles, skunks, ringtails), nest parasites (cowbirds), and nuisance wildlife (skunks, rodents, squirrels, and ants) do not increase as a result of garbage and food left unsecured or improperly disposed of.

Desired Conditions for Fish and Aquatic Invertebrates

Fossil Creek supports a diverse assemblage of native fish and aquatic invertebrates. Species and population abundances reflect the diversity, quantity, quality, and capability of habitats in the Fossil Creek corridor.

In the **recreational segment**, stretches of relatively undisturbed aquatic habitat (refugia) exist between recreation sites. These refugia represent all types of habitat present in Fossil Creek and support the ability of native fish to successfully survive and reproduce.

Baseline conditions for fish taxa, especially imperiled taxa, are known.

New and existing instream water rights are procured or maintained in the Fossil Creek corridor to ensure enough water is available to provide for habitat needs of special status aquatic species.

Human-caused sources of sediment input to Fossil Creek are minimized. Sediment and ash delivery to Fossil Creek resulting from wildfire is rare.

Re-introduced populations of native fish species are self-sustaining and future re-introductions of native fish and other native species support population viability.

⁹ From Irving to the permanent fish barrier, crayfish are present and likely contribute to lowland leopard frogs not colonizing that section. From the permanent fish barrier downstream to the confluence with the Verde River, it is unlikely lowland leopard frogs will become established and persist due to the presence of non-native fish and crayfish.

Non-native fish remain absent in Fossil Creek above the permanent fish barrier.

Fossil Creek supports an abundant and diverse aquatic macroinvertebrate community and rare species are present within the ecosystem's capability.

Listed Species

The Threatened, Endangered and Sensitive Species (TES) List for the Tonto and Coconino National Forest was reviewed by forests biologists and a list of TES species was created for this project based on known occurrence or, in the absence of survey data, the presence of suitable habitat. Federally listed species addressed in this report that are known to occur, or have existing or potential habitat within the analysis area include six species: Mexican spotted owl, Southwestern willow flycatcher, Western yellow-billed cuckoo, Chiricahua leopard frog, northern Mexican gartersnake, and narrow-headed gartersnake. In previous analyses for the Fossil Creek area, the Yuma clapper rail (*Rallus longirostris yumanensis*) was analyzed based on the presence of marginal habitat, primarily Stehr Lake. Since decommissioning (which resulted in Stehr Lake drying up and being recontoured) and upon further investigation, it has been determined that Yuma clapper rail habitat is no longer present and therefore this species is excluded from this analysis. Refer to Appendix E for a list of threatened, endangered, and sensitive species; both those that occur in the analysis area (or those for which suitable habitat occurs in the analysis area) and those that do not and are therefore excluded from this analysis.

Mexican Spotted Owl and its Critical Habitat

Habitat and Survey Data:

The Mexican spotted owl (MSO) was listed as a federally threatened species in March 1993 (USFWS 1993). Critical habitat was established in 1995 and revised in 2012 (USFWS 2012). The Forest is encompassed by the Upper Gila Mountain Ecological Management Unit. The MSO Recovery Plan was revised in September 2012.

On the Forest, the Mexican spotted owl occupies mixed conifer and ponderosa pine/Gambel oak vegetation types, usually characterized by high canopy closure, high stem density, large trees, multi-layered canopies within the stand, numerous snags and downed woody material. Frequently, suitable nesting and roosting habitat is located on steep slopes or in canyons with rocky cliffs, where dense vegetation or crevices or caves provide cool moist microsites for nests and roosts.

No Mexican spotted owl Protected Activity Centers (PACs) occur within the Fossil CRMP project area. Since MSO only occur outside of the project area, a larger analysis area is considered and includes four six code watersheds: Upper Fossil, Lower Fossil, Hardscrabble Creek, and Mud Tank Draw. Five MSO PACs occur in the broader Fossil CRMP analysis area: Calf Pen, Horse, Sand, Sandrock, and Cove. These five PACs comprise 3139 acres of PAC habitat within the Fossil CRMP analysis area. Table 16 shows the breakdown of MSO habitat within both the project area and the broader analysis area.

Table 16: MSO Habitat by Vegetation Type within the Project and Analysis Areas

MSO Habitat Type	Project Area Acres	Analysis Area Acres
PACs	0	3139
Mixed Conifer	112	6305
Ponderosa Pine/Gambel Oak	0	7112
Ponderosa pine (no Gambel Oak)	4	14888
Riparian	652	1408
Pinyon-juniper woodland	4,275	32,626

Figure 13 shows the location of the closest MSO PACs to the CRMP boundary. Table 17 shows the reproductive status of the four PACs.

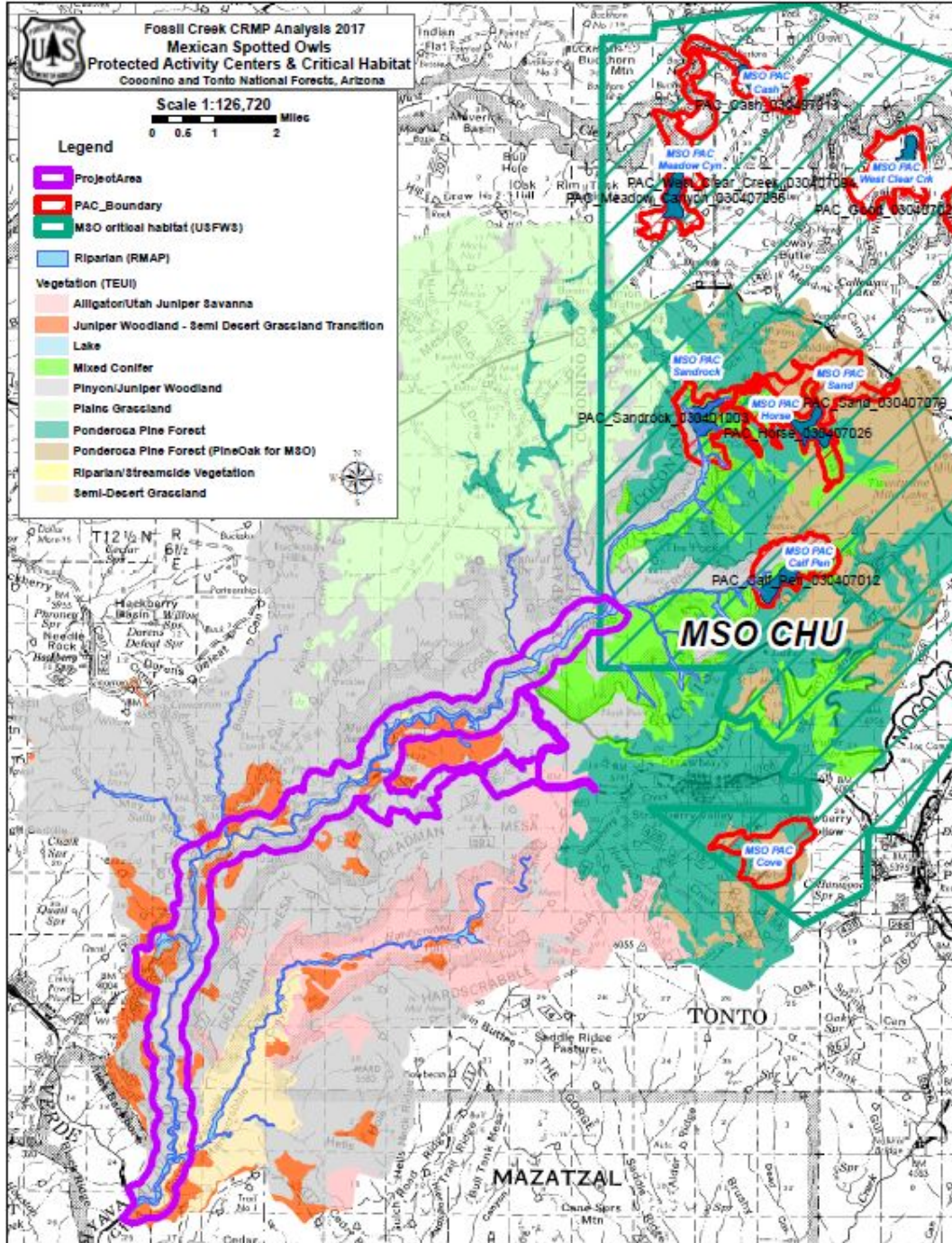


Figure 13: Mexican Spotted Owl Protected Activity Centers and Critical Habitat near Fossil CRMP project area.

Table 17. Mexican spotted owl reproductive success for PACs within Fossil Creek WSR Corridor during the years monitoring occurred.

PAC Name	PAC #	90	91	92	93	94	95	96	97	98	99	00	01	02	13
Sandrock	040103	NI	NI	NI	1Y	M, NU	NI	NI	M, NU	NI	M	NI	S	NI	NI

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Calfpen	040421	O-NU	F-NU	O-NU	NI	O-NY	NI	NI	NI	NI	NI	O-NU	NI	NI	NI
Horse	407026	NI	NI	NI	NI	NI	NI	NI	NI	NI	O-2Y	O-NU	F-NU	O-NU	NI
Sand	407080	NI	NI	NI	NI	NI	NI	NI	NI	NI	O-NU	NI	NI	NI	NI
Cove	120405	O-NU	O-NY	A	A	A	A	A	A	A	NI	NI	NI	NI	A

O = Pair Occupancy

S = Single detected (sex unknown)

M = Male detected

F = Female detected

Y = Number of young fledged

NU = Nesting status unknown

NY = No young produced

NI = No Information (unsurveyed)

A = Absence or Unoccupied

Recovery Habitat

Recovery habitat is comprised of ponderosa pine/Gambel oak forest, mixed-conifer forest, and riparian forest outside of PACs that have the potential for becoming nest/roost habitat or could provide foraging, dispersal, or wintering habitat. The total acres of recovery habitat in the project area is 764 of mixed conifer and riparian; no ponderosa pine/Gambel oak occurs in the project area. The total acres of recovery habitat in the analysis area is 14,825 acres.

Other Forest and Woodland Types

The total acres of ponderosa pine forest (without Gambel oak) and pinyon juniper woodland habitat in the project area is 4,279 and in the analysis area is 47,514 acres.

Critical Habitat

Primary constituent elements (PCEs) described in the final rule for listing critical habitat for the Mexican spotted owl include the following:

(A) Primary constituent elements related to forest structure:

- (1) A range of tree species, including mixed conifer, pine-oak, and riparian forest types, composed of different tree sizes reflecting different ages of trees, 30 percent to 45 percent of which are large trees with a trunk diameter of 12 inches (0.3 meters) or more when measured at 4.5 feet (1.4 meters) from the ground;
- (2) A shade canopy created by the tree branches covering 40 percent or more of the ground; and
- (3) Large dead trees (snags) with a trunk diameter of at least 12 inches (0.3 meters) when measured at 4.5 feet (1.4 meters) from the ground.

(B) Primary constituent elements related to maintenance of adequate prey species:

- (1) High volumes of fallen trees and other woody debris;
- (2) A wide range of tree and plant species, including hardwoods; and
- (3) Adequate levels of residual plant cover to maintain fruits, seeds, and allow plant regeneration.

(C) Primary constituent elements related to canyon habitat include one or more of the following:

- (1) Presence of water (often providing cooler and often higher humidity than the surrounding areas);
- (2) Clumps or stringers of mixed conifer, pine-oak, pinyon-juniper, and/or riparian vegetation;
- (3) Canyon wall containing crevices, ledges, or caves; and

(4) High percent of ground litter and woody debris.

Recreation and associated activities will have no effect on PCEs related to forest structure or canyon habitats, the volume of fallen trees and other woody debris, the range of tree and plant species, prey species and their cover. No further discussion of the other PCEs will occur in this document.

MSO critical habitat normally consists of mixed conifer, pine-oak, riparian forest or canyons. The designated critical habitat in the analysis area is mainly comprised of pinyon-juniper and chaparral on canyon slopes, mixed conifer on north facing aspects, ponderosa pine forests above the rim, and riparian in the drainage bottoms. Since the Sandrocks and Calf Pen PACs occur nearby, it is reasonable to assume that owls forage in the northern portion of the Fossil CRMP corridor within the designated critical habitat area, especially during the winter when owls disperse seasonally from their nesting areas.

The CRMP corridor contains 112 acres of designated critical habitat, all in the very northern portion of the CRMP corridor. There is no mixed conifer, or pine-oak in the Fossil CRMP corridor within designated critical habitat; only ephemeral riparian. The analysis area contains 24,037 acres of critical habitat.

Southwestern Willow Flycatcher

Southwestern willow flycatchers, federally listed as endangered with critical habitat, prefer dense riparian thickets in areas where perennial flow, surface water, or saturated soil is present when nesting from April through September. In most riverine situations, associated channels are wide and shallow with a well-defined floodplain and a broad valley. Streams are slightly entrenched with well-defined meanders and riffle/pool bed features. Quiet water dominates, as in backwaters, pools, beaver ponds, or non-riffle stream stretches.

Vegetative species composition and structure varies across the range of the southwestern willow flycatcher. The variation ranges from homogeneous patches of one or several species with a single canopy layer to heterogeneous patches of numerous species with existing under, mid, and over stories. Canopy covers are consistently high (>90%) throughout the range (Spencer et al. 1996). In the Verde Valley, nesting willow flycatchers occur in tamarisk and mixed riparian habitats. Patch width of breeding sites in both tamarisk and mixed riparian habitat types tend to be more linear, varying from 460 feet to 1,640 feet in maximum width (Sferra et al. 1995). Overstory canopies average between 50 and 55 feet tall (Spencer et al. 1996). Patch size varies from 5 to 121 acres in mixed riparian and tamarisk (Spencer et al. 1996).

Surveys and Habitat in the Analysis Area:

Surveys for the southwestern willow flycatcher have been conducted at several locations in the analysis area. In 1994, USFS personnel conducted surveys at Fossil Springs, “Aqueduct Spring” which was actually a leak in the flume on the other side of the road from Homestead, and at Stehr Lake. Fossil Springs was determined potential habitat. Since decommissioning, neither “Aqueduct Spring” nor Stehr Lake provide any flycatcher habitat. Environet surveyed two additional sites along Fossil Creek in 1998. These sites included from Irving downstream to the 708 bridge and from the 708 bridge downstream to the Boulder bridge. Surveys conducted in 1994 and 1998 at these sites failed to detect any southwestern willow flycatchers.

Prior to restoration of full flows, riparian habitat along Fossil Creek differed from habitats typically occupied by southwestern willow flycatcher in Arizona due to the higher gradient, the narrow band of riparian vegetation and the relatively open mid- and under-story vegetation layers. Since full flows were restored in 2005, travertine formation have formed step pools with slower water, resulting in better quality habitat for willow flycatchers. In 2011, Matt Johnson from NAU, through an agreement with the Forest Service, conducted surveys for the southwestern willow flycatcher in Fossil Creek in various locations. Routes were placed at these locations based on the marginal flycatcher habitat that is present. Most other areas in Fossil Creek do not meet the habitat requirements. Refer to Figure 14. All surveys in 2011 were negative. No further surveys have been conducted since 2011.

Because even the best habitat within Fossil Creek is marginal and surveys have been negative, it is the determination that there is a very low possibility that southwestern willow flycatchers nest in the FC WSR boundary.

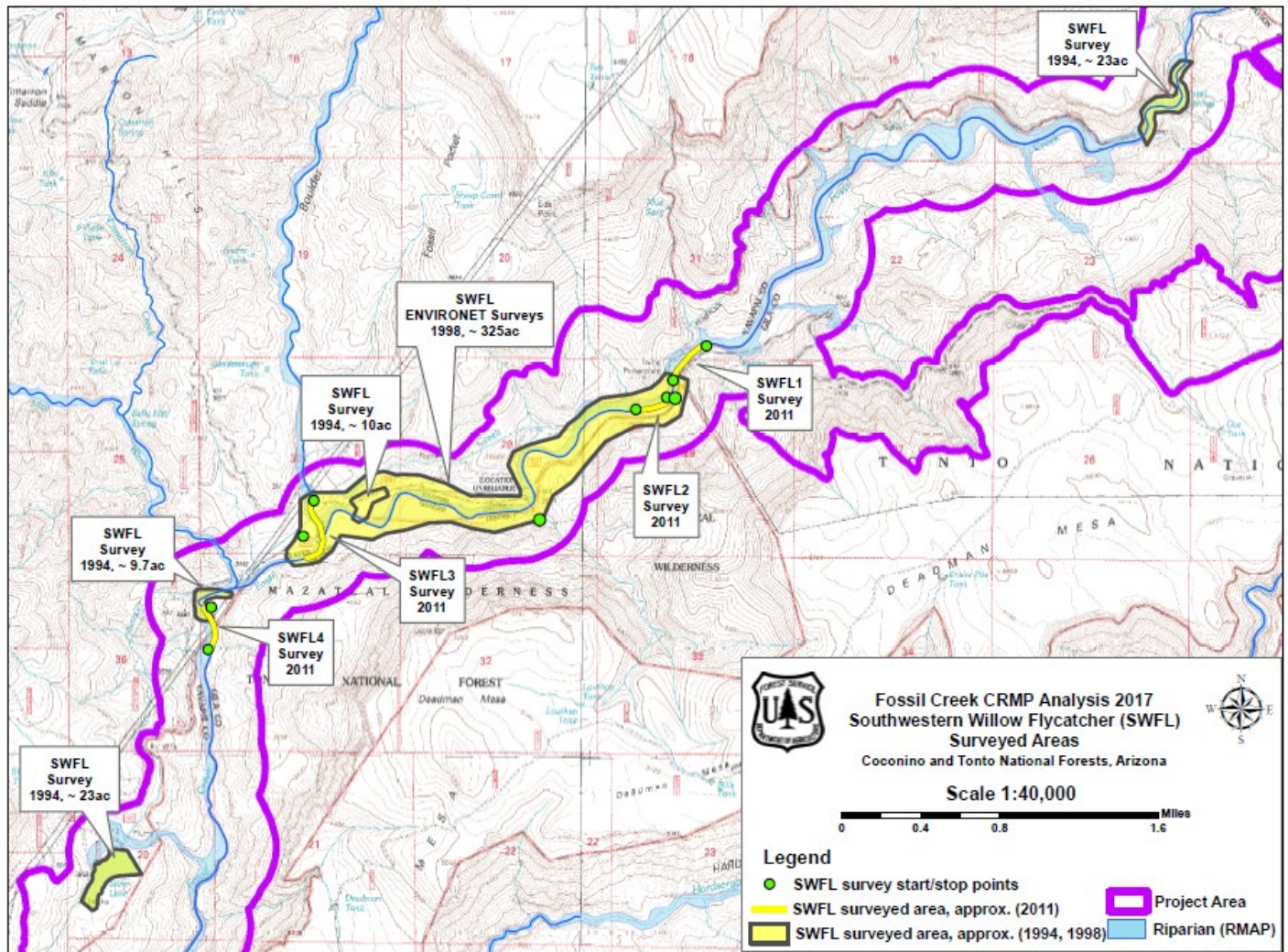


Figure 14: Southwestern Willow Flycatcher Survey Locations

Critical Habitat

Although revised critical habitat has been designated for southwestern willow flycatchers, there is no critical habitat near or within the Fossil CRMP boundary.

Western Yellow-billed Cuckoo

The yellow-billed cuckoo, federally listed as threatened with proposed critical habitat, is a late spring/summer migrant associated with large tracts of undisturbed riparian deciduous forest where willow, cottonwood, sycamore, or alder occur. Yellow-billed cuckoos in higher elevations may be found in mesquite and tamarisk. The yellow-billed cuckoo feeds almost entirely on large insects, and if food stressed, may also feed on berries and fruit.

Habitat and Surveys in the Analysis Area

A query of the Fossil Creek database (Appendix C) shows that a yellow-billed cuckoo was detected in the Fossil Creek riparian area in 1999 by former Coconino biologist Cathy Taylor. The exact location is unknown, however. AGFD conducted a survey for the cuckoo at Verde Hot Springs along the Verde River, however no cuckoos were

detected. Although recent surveys in the most suitable habitat were conducted in three main areas of Fossil Creek from just below Irving Power Plant up through the Fossil Springs area by NAU in 2005, 2006, 2007, 2008, and 2009, there have been no detections of yellow-billed cuckoos. Surveys have not been conducted in the remaining two thirds of Fossil Creek but there is suitable habitat in areas where the channel is not canyon-bound and where adjacent mesquite woodlands occur. Mesquite bosques adjacent to riparian are important for cuckoos for foraging. Based on personal observation by wildlife biologist Janie Agyagos between 2004 and 2012, the largest patches of mesquite woodland in Middle Fossil occur at Homestead, Old Corral, Purple Mountain, Mazatzal, and Stehr Lake. Smaller, mixed stands of mesquite occur in various other locations within the middle section and may provide suitable cuckoo foraging habitat. In addition, a GIS mapping exercise combined with Google Earth mapping indicated numerous stands of adjacent mesquite woodlands in the Mazatzal wilderness that has never been surveyed. Refer to Figure 15 for the approximate locations of mesquite woodlands that provide suitable foraging habitat for cuckoos.

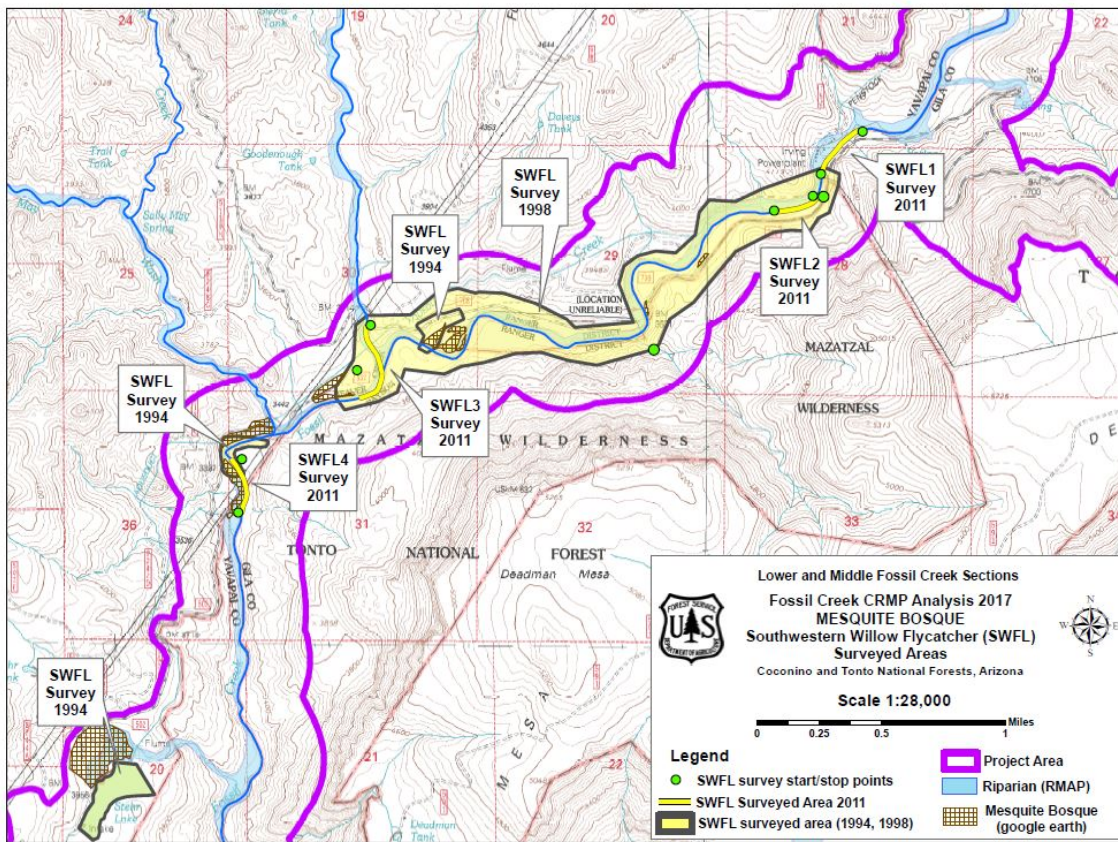


Figure 15: Approximate locations of mesquite bosques along Fossil Creek

The following information was obtained directly from the report “2008 Common Black-Hawk and Yellow-Billed Cuckoo Distribution and Abundance in the Upper Reach of Fossil Creek, AZ” (Johnson et al, 2008) and provides an explanation as to why cuckoos have not been detected along Fossil despite the presence of important habitat components:

The Western Yellow-billed Cuckoo may be experiencing what the Southwestern Willow Flycatcher is experiencing, a recent low population level at many sites in the southwest making local populations susceptible to extirpation (Sogge et al 1997, Hughes 1999, USFWS 2002). It is possible that as cuckoo populations in Arizona riparian corridors have become reduced and more fragmented than in the past, and local breeding groups may have produced insufficient young to offset adult mortality. Similar local extirpation of Southwestern Willow Flycatchers has recently been documented (Sferra et al. 1997) and can be driven by habitat loss. As Yellow-billed Cuckoos became rarer in the region, the likelihood of recolonization of former breeding areas could be greatly reduced. Therefore, suitable habitat may currently be unoccupied because the cuckoo is now so rare that there are not enough cuckoos to



Although critical habitat has been proposed for western yellow-billed cuckoos, there is no critical habitat near or within the Fossil CRMP boundary.

As described in Sredl and Jennings (in press), Chiricahua leopard frogs are habitat generalists, breeding in slack waters in a variety of natural and man-made aquatic systems. They are federally listed as threatened with critical habitat. Their elevational range is from 3,281 to 8,890 feet (USFWS 2002) but occur in the Buckskin Hills Conservation Management Zone (CMZ) between 5,020 and 5,780 ft. Adult frogs are found in perennial and near-perennial habitats, and reproduction is aquatic. Habitat heterogeneity is important in providing habitat for the frog's different life stages and seasonal requirements.

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eggs from March through late summer, with most activity occurring before June, while populations above 5,900 ft (1,800 m) bred in June July and August.

Known populations of Chiricahua leopard frogs on the Forest are referred to as the Rim form, since these populations occur along the southern edge of the Colorado Plateau and are disjunct from the southeastern form that inhabits portions of southeastern Arizona, southwestern New Mexico, and the Sierra Madre Occidental in Mexico (Sredl et al 1997b). From 1993–1997, the Rim form Chiricahua leopard frogs were documented at 15 sites, 4 of which were on the Coconino National Forest (Sredl et al 1997b), located in the Fossil watershed, but well outside of the Fossil Wild and Scenic River corridor. This represented 27% of occupied sites. Chiricahua leopard frogs are absent from many locations that previously supported populations as recently as the late 1970's and early 1980's (Sredl et al 1997b).

As natural habitats have been altered or destroyed, stock tanks constructed for watering livestock have become important habitats for Chiricahua leopard frogs (Sredl and Saylor 1998). As of 1997, 39% of known Rim form Chiricahua leopard frog sites were livestock tanks (Sredl et al 1997b). In some areas, tanks provide the only suitable habitat available (USFWS 2002). To date, the only extant populations within the Buckskin Hills/Mud Tanks area are located in stock tanks, as have all the known occupied sites on the Fossil Allotment. While important for frogs, the dynamic nature of stock tank habitats and the relatively small populations they support makes it unlikely that frog populations that occupy them will persist indefinitely at any given tank (USFWS 2002). Tanks are susceptible to drying out in drought years, and flooding may breach impoundments or cause siltation, resulting in impacts to frogs and their habitats. Tanks that provide suitable habitat have open water and at least some perimeter vegetation. While bigger tanks often provide more diverse habitats, the permanency of water is more important than the size of the tank (M. Sredl, pers. comm., Sept. 2001).

Surveys in the Project Area:

Leopard frog and other herpetofauna surveys have been conducted on the Forest since the early 1990s. Most of the early surveys have been conducted by the Arizona Game and Fish Department (AGFD) and results have been documented in several reports (Sredl and Howland 1992, Sredl et. al 1993, Sredl et al 1995, Windes et al 1997). Sredl et al (1997b) summarized the results of statewide surveys for Arizona native ranid frogs, including the Chiricahua leopard frog, to describe their current status and distribution. Surveys since 1997 have been conducted by agency biologists from AGFD, USFWS and USFS.

The only extant populations of Chiricahua leopard frogs in the analysis area occur in the southern part of the Coconino National Forest, in an area known as Buckskin Hills/Mud Tanks. Records exist from other locations along the Mogollon Rim, including East Clear Creek and West Clear Creek drainages, but these sites have been unoccupied since at least the mid-1980s. There are no records of Chiricahua leopard frogs in Fossil Creek proper; the species of leopard frog in Fossil Creek is the lowland leopard frog.

While the occupied sites occur in the broader Fossil CRMP analysis area, they do not occur near the CRMP corridor and project analysis area. Currently occupied, previously occupied, suitable unoccupied, and critical Chiricahua leopard frog habitat occurs in the upper portion of the Fossil Creek watershed, approximately 2.5 to 3 miles from the CRMP corridor; refer to Figure 17.

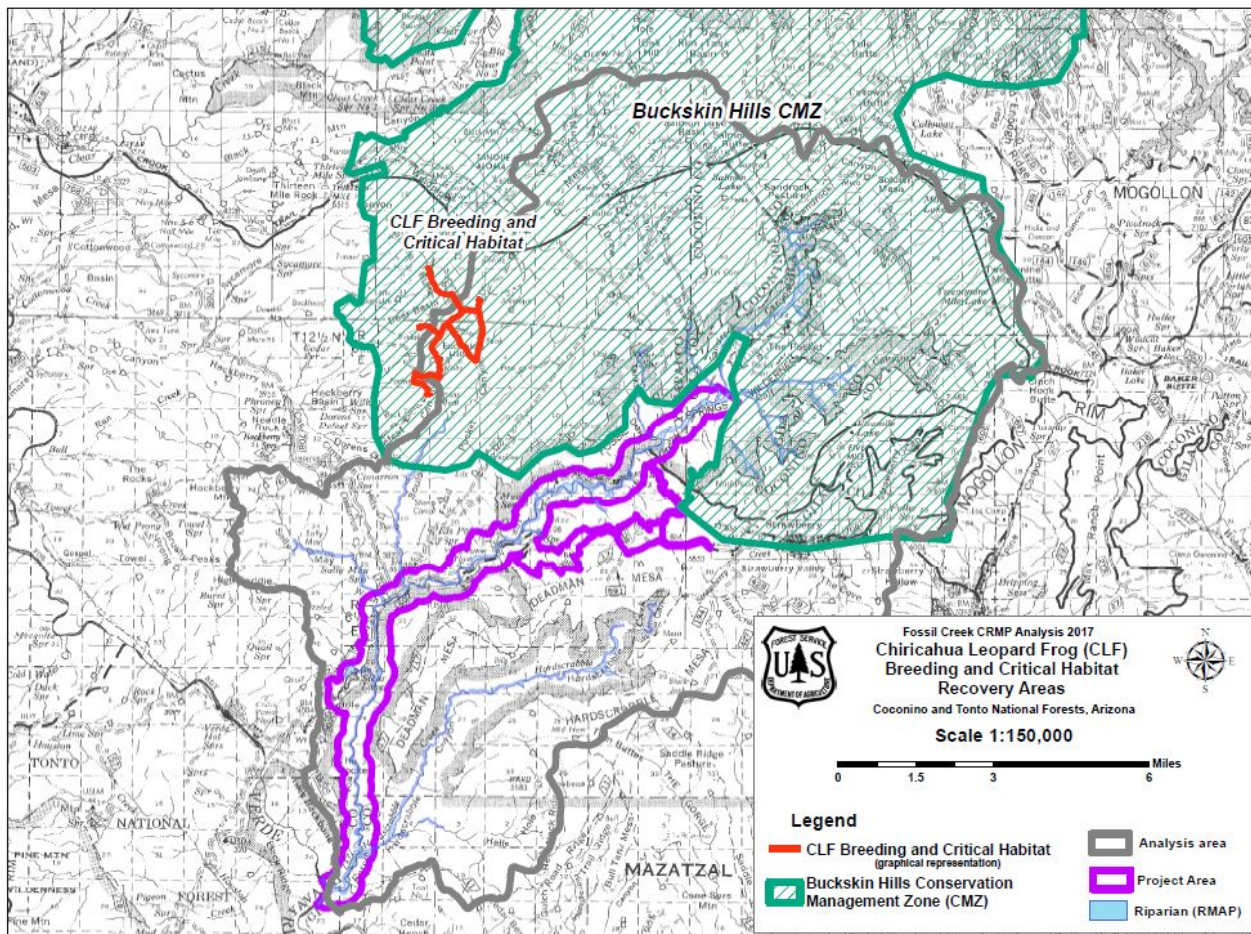


Figure 17: Historic, recently occupied, suitable, and occupied Chiricahua leopard frog sites near Fossil WSR Corridor.

Critical Habitat

Although critical habitat for the Chiricahua leopard frog does not occur within the Fossil CRMP project area boundary, it does occur within the Upper Fossil Creek watershed and the broader analysis area.

Mexican Gartersnake and its Proposed Critical Habitat

The Northern Mexican gartersnake, which is federally listed as threatened with proposed critical habitat, is usually found in or near streams and ponds in canyons up to 6,200 feet in elevation. This gartersnake is most closely linked to shallow slow-moving or impounded waters, though it also occurs in other aquatic environments. Where Mexican gartersnakes currently exist along Oak Creek, they occur in marsh-like situations where slow water is shallow enough to support dense stands of emergent vegetation. The diet of the Mexican gartersnake consists of leopard frogs, toads, tadpoles, and various native fishes. Lizards and small rodents are taken during occasional terrestrial forays. The Mexican gartersnake is known to be associated with several species of leopard frogs which are a major prey species. As a result of telemetry work on the extant population on Oak Creek, Mexican gartersnakes have been detected in the uplands mostly during brumation where they occur under rocks but also during summer months.

Habitat in the Analysis Area:

There are no records that herp surveys occurred before the hydropower operations dewatered Fossil in the early 1900s. So, the historical record is not complete enough to say whether Mexican gartersnakes historically occurred in Fossil Creek. Due to the lack of historical and contemporary records for gartersnakes in Fossil Creek, Erika Nowak, USGS herpetologist, has indicated that Fossil Creek riparian is potential habitat for the Mexican

gartersnake. Almost one hundred years of diverting flow greatly altered habitat and inhibited travertine formation reducing the habitat potential for Mexican gartersnakes. In recent decades, years of non-native aquatic organisms (fish and crayfish) reduced, and in some cases extirpated populations of native aquatic prey species (fish, tadpoles, frogs, and toads). Since restoration of the native fisheries in 2004, abundant prey (native toads, frogs, and fish) is present in Fossil from the springs downstream to the permanent fish barrier, approximately 10 miles. Since restoration of full flows in 2005, prime suitable habitat exists especially between the historic Fossil Springs dam and the waterfall where high travertine deposition rates result in the formation of travertine formations which allows for sluggish waters with dense aquatic emergent vegetation. Various herpetological surveys in the last few decades have not resulted in the detection of Mexican garter snakes in Fossil Creek. The nearest closest sightings of Mexican garter snakes have been along the Verde River (in the upper Verde River) and several of its tributaries, particularly Oak Creek but also Houston Creek on the Tonto.

Critical Habitat

Critical habitat is proposed for the northern Mexican gartersnake along the Verde and therefore a slight amount (600 feet of Fossil upstream from the Verde River) occurs within the project area boundary down by the confluence of Fossil with the Verde River.

Narrow-headed Gartersnake and its Proposed Critical Habitat

The narrow-headed gartersnake, which is federally listed as threatened with proposed critical habitat, is the most aquatic of the gartersnakes, seldom found far from quiet, rocky pools in large streams and rivers. It is primarily a Mexican species, but occurs in various areas along the Mogollon Rim. Food items include fish (native species preferred), frogs, tadpoles, and salamanders. Population declines have been attributed to loss of habitat, decline in native fish that are prey items, introduction of predaceous nonnative aquatic organisms (crayfish, bullfrogs, and fish) that eat or displace native prey species, and killing by humans (Nowak and Santana-Bendix 2002). Narrow-headed gartersnakes escape from threatening situations by diving underwater and hiding under rocks. Narrow-headed gartersnakes are highly aquatic, but move to the uplands during periods of shedding and during brumation. During brumation narrow-headed gartersnakes have been radio-tracked and found underneath rocks.

Habitat and Surveys in the Analysis Area

Agency biologists have conducted numerous herpetological surveys along Fossil Creek, particularly from the springs downstream to the Mazatzal Wilderness boundary. No narrow-headed gartersnakes have been detected. However, in 2005, an AGFD fish survey crew documented a narrow-headed gartersnake on the Verde River near the Verde confluence. This observation was validated to be an accurate identification of species (J. Agyagos pers. comm. with Bill Burger).

Like Mexican gartersnakes, it is likely that narrow-headed gartersnakes historically occurred in Fossil Creek. However, years of non-native aquatic organisms (fish and crayfish) reduced, and in some cases extirpated populations of native aquatic prey species (fish, tadpoles, frogs, and toads). In addition, almost one hundred years of diverting flow greatly altered habitat and travertine formation reducing the habitat potential for narrow-headed gartersnakes. Currently habitat conditions for narrow-headed gartersnakes are much improved due to the restoration of full flows, development of travertine formations, establishment of deeper pools, and the removal on nonnative fish species throughout nine miles of stream.

Critical Habitat

Critical habitat is proposed for the narrow-headed gartersnake along the Verde and therefore a slight amount (600 feet of Fossil upstream from the Verde River) occurs within the project area boundary down by the confluence of Fossil with the Verde River.

Forest Service Sensitive and Locally Important Species

All species on the Coconino and Tonto National Forests Regional Forester's Sensitive Species List Threatened, Endangered and Sensitive Species List were reviewed for this project. Of these, 16 sensitive species and locally

important species are present or have potential habitat within the analysis area and are included in this analysis. Table 18 summarizes these species.

Table 18. List of sensitive and locally important species the Fossil Creek Wild and Scenic River Corridor

Common Name	Scientific Name	Status
Birds (4)		
Common Black-hawk*	<i>Buteogallus anthracinus</i>	LIS
Bald Eagle	<i>Haliaeetus leucocephalus</i>	Sen
American Peregrine Falcon	<i>Falco peregrinus anatum</i>	Sen
Northern Goshawk	<i>Accipiter gentiles</i>	Sen
Amphibians (2)		
Lowland Leopard Frog	<i>Rana yavapaiensis</i>	Sen
Arizona Toad*	<i>Bufo microscaphus microscaphus</i>	LIS
Mammals (4)		
Western Red Bat	<i>Lasiurus blossevillei</i>	Sen
Allen's Lappet-browed Bat	<i>Idionycteris phyllotis</i>	Sen
Pale Townsend's Big-eared Bat	<i>Corynorhinus townsendii pallescens</i>	Sen
Spotted Bat	<i>Euderma maculatum</i>	Sen
Snails (1)		
Fossil Springsnail	<i>Pyrgulopsis simplex</i>	Sen
Plants (5)		
Arizona Phlox	<i>Phlox amabilis</i>	Sen
Cochise Sedge,	<i>Carex ultra</i>	Sen
Metcalf's Tick-trefoil	<i>Desmodium metcalfei</i>	Sen
Mt. Dellenbaugh Sandwort	<i>Eremogone aberrans</i> formerly <i>Arenaria aberrans</i>	Sen
Eastwood Alumroot	<i>Heuchera eastwoodii</i>	Sen

*Common black-hawk and Arizona toad were on the Regional Forester's Sensitive Species list up until 2013. These species continue to be analyzed as locally important species. Plus, the common back-hawk is a management indicator species on the Tonto National Forest.

Legend:

Sen = 2013 Regional Forester's Sensitive Species

LIS = locally important species

Birds

Common Black-hawk

Habitat in the Analysis Area:

The black-hawk can be found in low elevation riparian areas. The black-hawk is dependent upon a mature, relatively undisturbed habitat supported by a permanent flowing stream. Groves of tall trees must be present along the stream course for nesting. Black-hawks are still hunters, hunting from tree and cliff perches although they will also wade into water and chase after prey including crayfish, amphibians, reptiles, and fish. Streams of low to moderate gradient and less than one foot deep with scattered boulders are ideal for foraging.

The black-hawk has been observed in all reaches of Fossil Creek. Suitable nesting habitat is present from Fossil Springs downstream to the Verde. Monitoring data exists for black-hawk nest sites along Fossil creek. Refer to figures 18 and 19 for black-hawk nest locations by year.

Common black-hawks were reported to nest at densities of 0.64 pairs/mile in Aravaipa Canyon, Arizona just south of the Tonto National Forest (Schnell 1994). In New Mexico, linear nesting density was 0.93 pairs/mile (Sadoti, 2008). Linear nesting density in Fossil Creek was approximately 0.93 pairs/mile in 2006 (four nests occupied along 4.25 miles between Fossil Springs and Irving). In 2011, with six nests, linear nesting density was approximately 0.78 pairs/mile but two nest sites had been abandoned that year. If all territories had been occupied in 2011, the linear nesting density would have been approximately 1.03 pairs/mile (Sadoti, 20012).

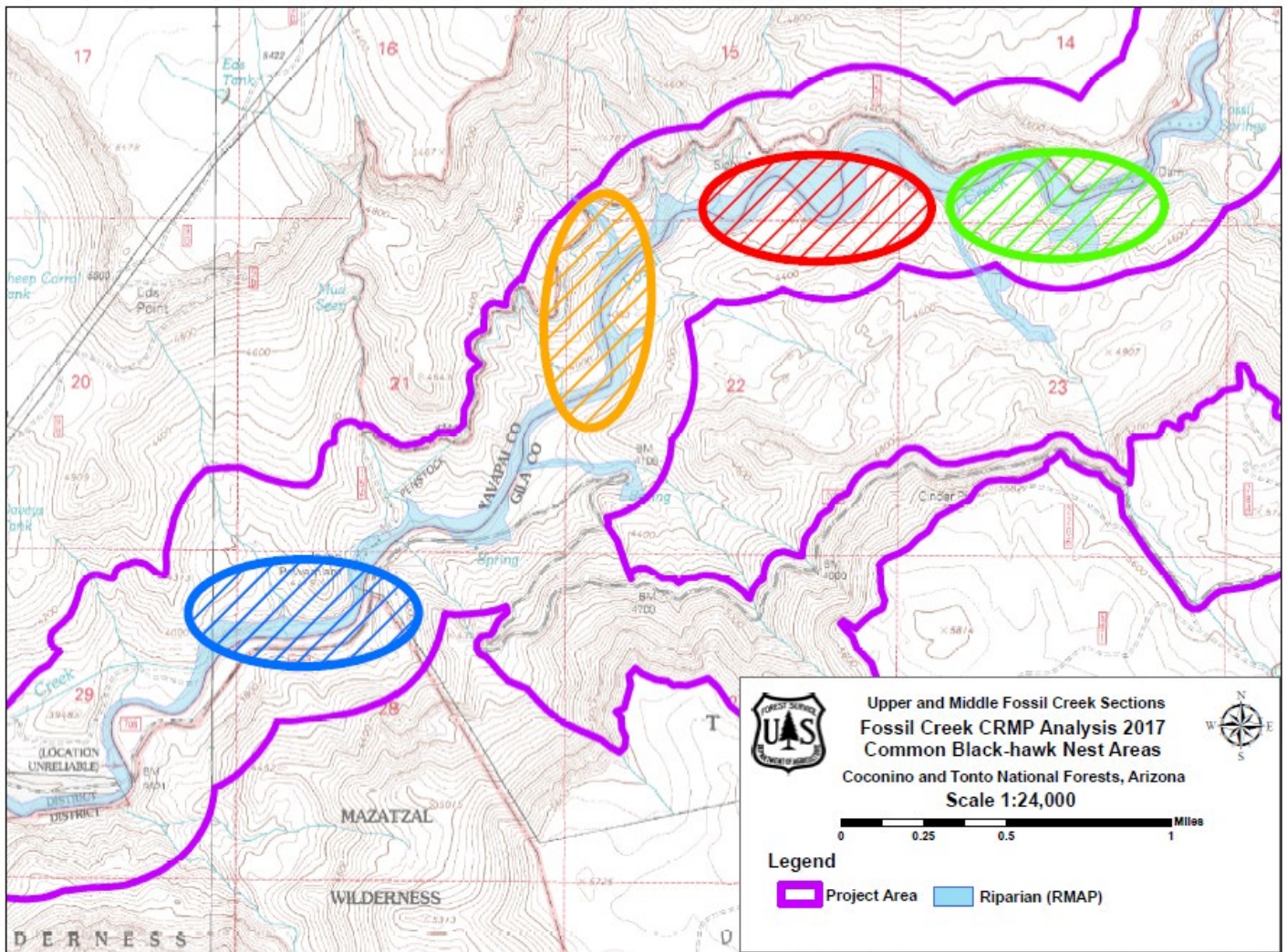


Figure 18. Known black-hawk nest sites in Middle Fossil from NAU monitoring

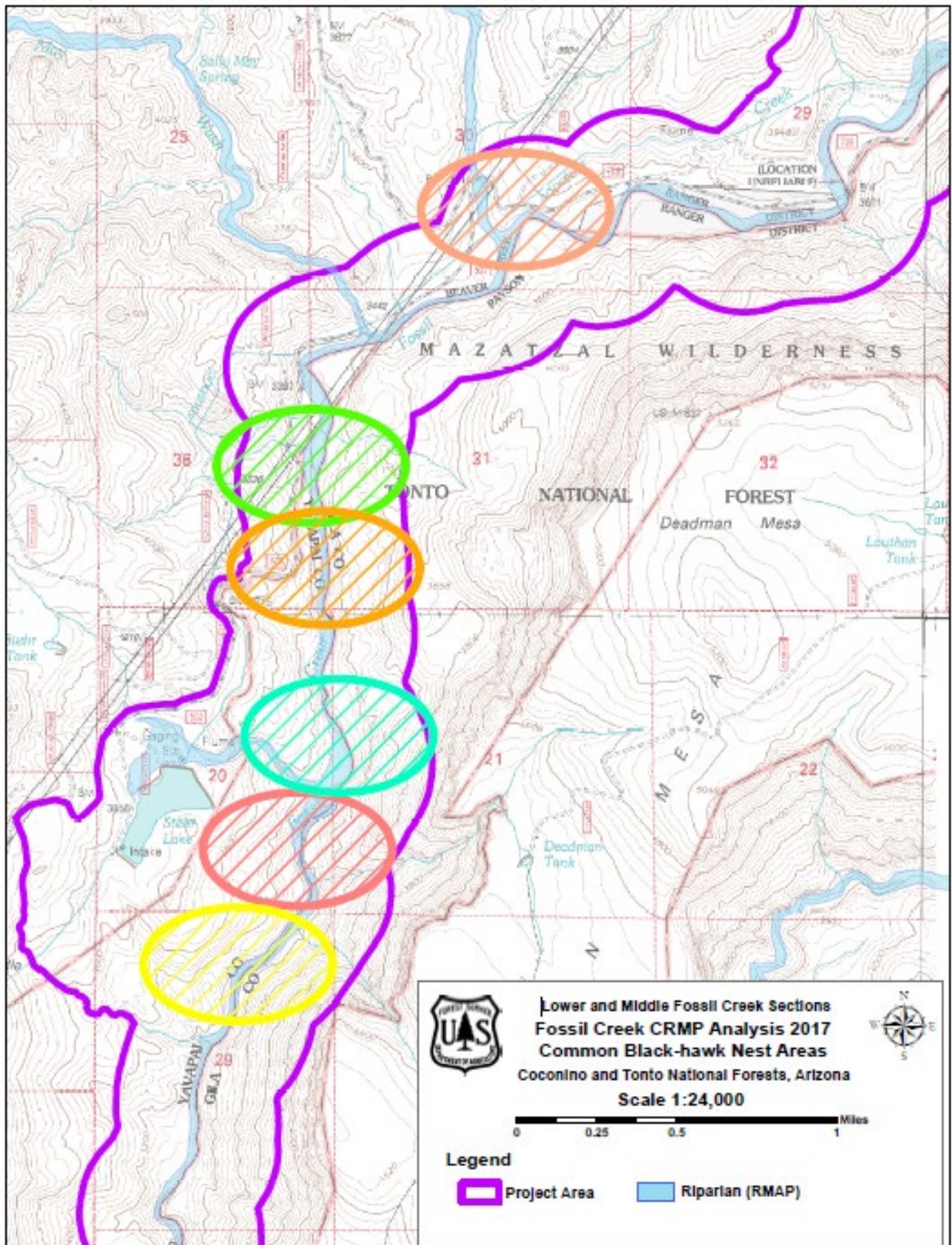


Figure 19. Known black-hawk nest sites in Middle Fossil from NAU monitoring

Desired condition

Recreation and recreation management activities in Fossil Creek do not result in black-hawk nest site abandonment and black-hawks continue to have high nesting success due to the abundance of native prey species and compatible recreational levels.

Black-hawk nest sites and a 200 meter buffer around nests are largely free from visual and aural disturbance during the breeding season (March 15-Aug 30). More specifically, the desired condition is to have eight or more nesting pairs from the spring source (Fossil Springs) downstream to 0.5 mile below Mazatzal. This includes the 2011 nests plus re-occupancy of nests near the waterfall and historic Fossil Springs dam. Based on the distance between known nest sites in Fossil Creek (average of 0.9 miles), theoretically, there is potential for upwards of 16 black-hawk nests throughout the entire Fossil Creek WSR corridor. Desired black-hawk nest success will be 90% or higher (higher than the 2011 levels of 83%). There would be no detections of nesting mortalities or nest failure attributed to human influences. Native prey will constitute 95% or more of black-hawk diets (Johnson et al 2009). Emergency helicopter landings occur so infrequently as to not cause nest or area abandonment.

Baseline Condition (2009)

Surveys for black-hawks were conducted in 2005, 2006, 2007, 2009, and 2011. Following in Table 19 is a summary of black-hawk nests up until time of wild and scenic river designation in 2009. By 2009, numbers of nest sites from Fossil Springs Dam downstream to just below Irving had decreased from four to two. A nest site by the historic Fossil Springs dam and a nest site by the waterfall had been abandoned after 2007 but before 2009. Surveys in 2009 detected two additional black-hawk nests in Fossil; both downstream of the Mazatzal site.

Table 19. Blackhawk survey results, 2005-2009

Nest Site Location	2005	2006	2007	2009
Historic Fossil Springs dam	O	O	O	UO
Between Dam and Large Waterfall	UO	O	O	O
Large Waterfall	O	O	O	UO
Irving	O	O	UO	O
Homestead	NI	NI	NI	UO
Downstream of Purple Mountain	NI	NI	NI	UO
0.5 mile Downstream of Mazatzal	NI	NI	NI	O
Downstream of Mazatzal #2	NI	NI	NI	O
Above fish barrier #1	NI	NI	NI	NI
Above fish barrier #2	NI	NI	NI	NI

Legend: O = Occupied, UO = unoccupied, and NI = No information since not surveyed

In 2008 and 2009 NAU conducted a prey delivery study (Etzel et al, 2014) and compared Fossil prey deliveries to those of other Verde Valley tributaries (Oak Creek, Wet Beaver Creek, and Red Tank Draw). They found that Fossil black-hawks delivered a much higher percentage of native aquatic prey (fish and amphibians) to nestlings than black-hawks in other systems (where prey deliveries were predominately crayfish and reptiles). This supports that the restoration of full flows and the native fish restoration efforts in Fossil has resulted in an increase in native prey. Despite this increase in native prey, monitoring results show a decrease in the number of Black-hawk detections. Areas of nest abandonment correspond to areas with increased recreational activity. Even with restored flows and restored native fish (prey), 2009 or higher recreation levels in Fossil Creek will continue to

result in adverse effects to black-hawks. Sadoti et al. (2014) states that although black-hawks can persist with minor amount of human activity, sustained disturbance may cause delayed nesting or nesting abandonment when these activities occur near a nesting pair of black-hawks.

For the two recreation sites where black-hawk nests had been abandoned (the waterfall and Fossil Springs), bare area monitoring in 2009 revealed:

- The Waterfall recreation site contained the second highest number of campsites, and Fossil Springs, the third.
- The Waterfall trail showed the largest increase in both the number of campsites and total campsite area from 2005 to 2009.
 - The number of campsites increased from 6 sites in 2005 to 27 sites in 2009. This amounts to a 350% increase in campsite quantity.
 - The cumulative campsite area along the waterfall trail increased from 4,100 ft² in 2005 to 19,700 ft² in 2009. This amounts to a 380% increase in total campsite area along the trail (See Figure 6-7 and Table 6-7).
- Fossil Springs contains the highest number of riparian area campsites with 72% of campsites (18 sites) being located within the riparian zone. Fossil Springs also contains the greatest riparian zone campsite area at 13,750 ft².
 - This composes 68% of the total campsite area at Fossil Springs and 29% of all riparian zone campsite area along Fossil Creek (See Figure 8 and Table 6-7 in Rotert,2009).

After restoration of full flows, recreation numbers in Fossil Creek increased steadily between 2005 and 2009. There was almost a doubling in visitation between 2008 and 2009 alone. Refer to Figure X for the total estimated number of people (estimated from vehicle count data).

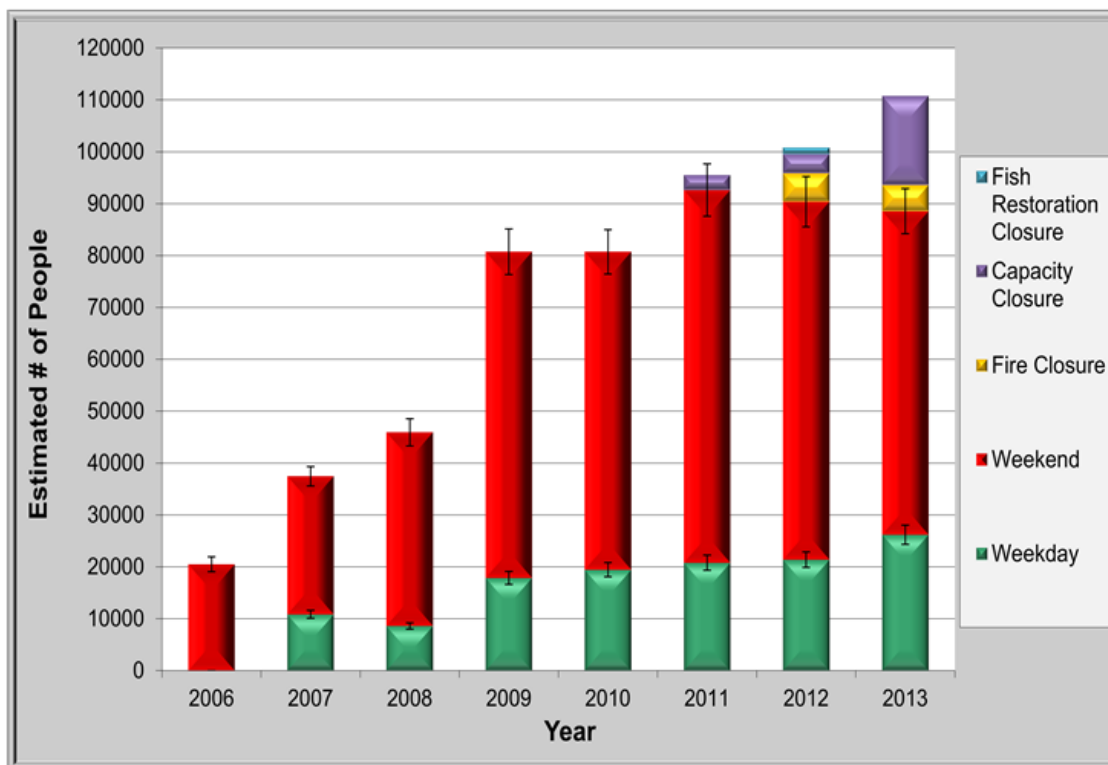


Figure 18. Total estimated number of people (estimated from vehicle count data)

Existing Condition

Table 20. Blackhawk survey results, 2005-2011

Nest Site	2005	2006	2007	2009	2011
Historic Fossil Springs dam	O	O	O	UO	UO
Between Dam and Large Waterfall	UO	O	O	O	O
Large Waterfall	O	O	O	UO	UO
Irving	O	O	UO	O	O
Homestead	NI	NI	NI	UO	O
Downstream of Purple Mtn	NI	NI	NI	UO	O
0.5 mile Downstream of Mazatzal	NI	NI	NI	O	UO
Downstream of Mazatzal #2	NI	NI	NI	O	UO
Above fish barrier #1	NI	NI	NI	NI	O
Above fish barrier #2	NI	NI	NI	NI	O

Legend: O = Occupied, UO = unoccupied, and NI = no information since not surveyed

Recreation use data from 2011 is used in the following discussion since 2011 is the last year in which black-hawk monitoring was conducted. Common black-hawks are known to be susceptible to sustained human disturbance (Sadoti et al., 2014). Sadoti et al. (2014) states that although black-hawks can persist with minor amount of human activity, sustained disturbance may cause delayed nesting or nesting abandonment when these activities occur near a nesting pair of black-hawks. Sadoti et al. (2014) also stated that the majority of nesting black-hawks (80%) were more than 128 meters from human activity. During the seven years of black-hawk monitoring in Fossil Creek a decline in nesting activity and detections has been observed in the upper reach of Fossil Creek (Table 20). Prior to increase in recreation there were four black-hawks nesting from the Fossil Springs area downstream to just below Irving, more specifically at the dam, near the sunfish barrier, at the waterfall, and just downstream of Irving. By 2011, black-hawks breeding areas in this reach decreased by 50% with black-hawks no longer nesting at the dam or the waterfall site. A likely explanation is the increase in recreational activity in this section since these nests were within the Fossil Springs and Waterfall recreation sites. Before restoration of full flows in 2005, this portion of the stream was largely dewatered and recreation activity was extremely low. Since restoration of full flows in 2005, the median number of people per weekend day increased from 180 in 2006, 233 in 2007, 327 in 2008, 551 in 2009, 537 in 2010, and 630 in 2011 (Rotert 2012). Use on holiday weekends in 2011 were 1900 Memorial Day, 2400 4th of July, and 1700 Labor Day (Rotert, 2011). In addition, bare soil from camping in the Fossil Springs area more than doubled between 2005 and 2011 (0.41 acres to 0.88 acres). The number of campsites increased from 87 in 2005 to 106 open campsites (or 158 campsites when including campsites upstream of the bridge) in 2011. Bare soil from camping at the waterfall increased by 406% from 2005 to 2011. In addition, the period of high recreational use in Fossil Creek is from May through August and coincides with the most critical portion (1 June – mid July) of the black-hawks breeding period (April- July). There is concern that increasing levels of recreation will further alter black-nesting in areas where recreation activity is high.

While monitoring shows the upper portion of Fossil Creek supported twice as many nesting black-hawks in 2004 than in 2011, there are other inferences to be made from seven years of monitoring. First it helps to have an understanding of the current (2011) distribution of nesting black-hawks in Fossil Creek:

- From the Springs to the downstream-most surveyed area (below Mazatzal) which is approximately 7 miles, there are 6 nesting pairs of black-hawks.

- In the upper reach from the Springs down to Irving (approximately 3 miles), there is only one nesting pair.
- From Irving downstream to Purple Mountain (the last recreation area with current high use), there are only two nesting pairs occupying this three mile reach.
- From Purple Mountain to ½ mile downstream of Mazatzal (a little over a mile reach), there are three nesting pairs.

Refer to Figure 19 for the total estimated number of people (estimated from vehicle count data) and table 21 for the estimated number of people by recreation site (estimated based on the number of cars per parking area).

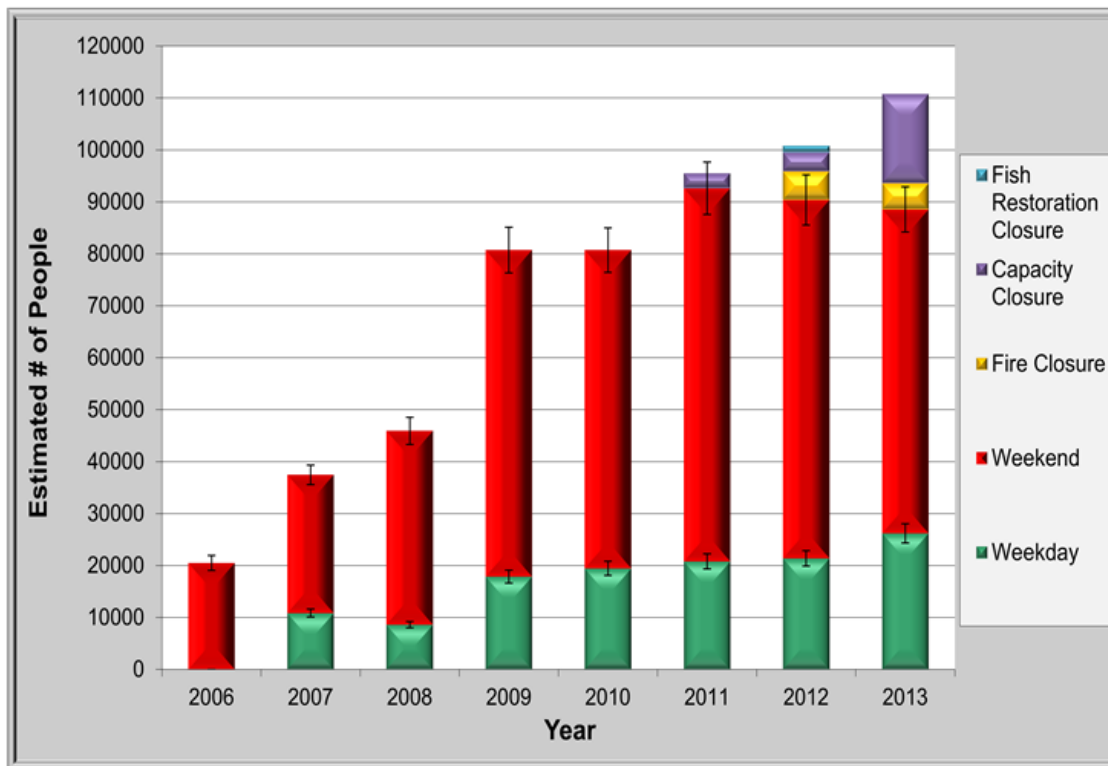


Figure 19. Total estimated number of people (estimated from vehicle count data)

Table 21: Estimated Maximum Number of People per Day per Site.

Table X: Max # of People per day (using weekend data) by Location. 2009 – 2011 numbers taken based on Daily Max # Vehicles (using weekends data) by Location, (Rotert 2011 and Rotert 2012).

Site Name	2009	2010	2011	2012
Fossil Springs	320	296	316	336
Waterfall	160	234	247	88
Irving	33	48	73	108
Bridge	39	44	54	112
Homestead	102	165	171	120
Sally May	63	113	127	92
Tonto Bench	91	127	115	88
Old Corral	72	65	87	32
Purple Mtn	58	50	59	40
Mazatzal	40	41	37	28

Bald Eagle

Nesting Bald Eagles:

Bald eagles in central Arizona prefer to nest on cliff ledges or pinnacles or in tall trees (USDI 1982). They mainly forage on waterfowl and fish found along major streams, however, they do hunt in the uplands and forage on various mammal species, especially in the winter. The Arizona Game and Fish Department has been conducting and coordinating surveys and monitoring of nesting eagles for many years.

No bald eagle nest sites are known to occur in Fossil Creek, although one immature bald eagle was observed constructing a nest by an agency biologist in 2004 near the Irving power plant. More recently, AGFD periodically flies up Fossil creek and has observed eagles in the area, but no nesting attempts have been observed. AGFD will continue flying up Fossil Creek to investigate (personal comm. Kenneth Jacobson 1Feb10).

Bald eagles are known to nest along the Verde River on the Prescott, Coconino, and Tonto National Forests. The Coldwater bald eagle breeding area (BA) occurs along the Verde River several miles upstream of the Fossil confluence. Nests associated with the Coldwater BA are located as far upstream as 6.0 miles upstream of the Child's power plant and downstream to halfway between the Child's Power Plant and the confluence of Fossil with the Verde. However, this breeding area has been unoccupied since 2014. The East Verde BA occurs along the Verde downstream of the East Clear Creek confluence and those eagles may forage along Fossil Creek. Refer to Table 21 for the reproductive success of these two bald eagle breeding areas.

Table 22: Nesting Results for Coldwater and East Verde Bald Eagles

Site Name	Year	Nesting Status
Coldwater	1999	Failed
	2000	Failed
	2001	Failed
	2002	2 Fledged
	2003	1 Fledged
	2004	1 Fledged
	2005	2 Fledged
	2006	1 Fledged

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	2007	2 fledged
	2008	1 Fledged
	2009	Failed
	2010	Failed
	2011	2 Fledged
	2012	1 Fledged
	2013	Occupied, Nesting Success Unknown
	2014	Unoccupied
	2015	Unoccupied
	2016	Unoccupied
	2017	Unoccupied
East Verde	1995	1 Fledged
	1996	1 Fledged
	1997	Failed
	1998	Failed
	2000	2 Fledged
	2001	Failed
	2002	Failed
	2003	Occupied, Nesting Success Unknown
	2004	1 Fledged
	2005	Occupied, Nesting Success Unknown
	2006	Failed
	2007	Failed
	2008	Occupied, Nesting Success Unknown
	2009	Failed
	2010	Failed
	2011	Failed
	2012	2 Fledged
	2013	1 Fledged
	2014	1 Fledged
	2015	1 Fledged
	2016	2 Fledged
	2017	Failed

Wintering & Roosting Bald Eagles:

Bald eagles occupy northern Arizona primarily as a winter resident or migrant. Wintering eagles arrive in the fall, usually late October or early November, and leave in early to mid-April. Numbers of eagles peak in February and March. They feed on fish, waterfowl, terrestrial vertebrates, and carrion. Eagles are often seen perched in trees or snags near water or next to roadways where they feed on road-killed animals. However, bald eagles are highly mobile in the winter, and can fly great distances in search of aquatic or terrestrial prey and suitable nighttime roosting habitat. Wintering bald eagles could occur throughout the Fossil area, particularly along the riparian corridor where they forage on fish and waterfowl. Wintering bald eagles may also forage opportunistically throughout the uplands.

National bald eagle winter surveys have been ongoing since 1979. They were initiated and organized by the National Wildlife Federation (NWF) from 1979-1991, and have since been coordinated by the Raptor Research Technical Assistance Center (Bureau of Land Management). The AGFD is the coordinating agency for the annual statewide survey. Mid-winter surveys were conducted on the Coconino National Forest in 1979-1985 and 1992-present.

There are no survey routes that occur close to the Fossil CRMP corridor. The nearest route, Highway 87S occurs from the intersection of Highway 87 and FH-3 at Clint's Well southeast to Highway 87 and west on Highway 260 to the Verde Ranger Station just outside of Camp Verde (both Coconino and Yavapai Counties). Bald eagles were detected in 16 of 22 years of surveys. Of the 16 years in which eagles were detected, more than one bald eagle was detected on counts in 11 different years. The average count for that route is 1.6 eagles. Refer to Table 23 for a summary of winter bald eagle county survey results.

Table 23: Bald Eagle Winter Count Survey Results for Routes near Fossil CRMP Corridor.

Route Name	93	94	95	96	97	98	99	00	01	02	03	04	05	06
Hwy 87 South	2	3	2	1	n/c	1	3	1	0	0	0	n/c	2	0
Route Name	07	08	09	10	11	12	13	14	15	16	Ave			
Hwy 87 South	3	3	3	1	3	0	1	2	3	0	1.60			

n/c = Route was not surveyed that year.

In addition to vehicle route already discussed, AGFD conducts annual flights along the Verde River (Yavapai County) during the mid-winter bald eagle count period. Eagles are consistently detected during midwinter surveys in the reach of the Verde River from the East Verde up to the West Clear Creek confluence (Beatty 1992, Beatty et. al 1995a, Beatty et. al 1995b, Beatty et. al 1999).

Fossil Creek above its confluence with the Verde River (Yavapai County) is not included in any midwinter survey routes. Prior to restoration of flows, the fishery supported by minimal flows in Fossil Creek provided limited foraging habitat for eagles. Now that full flows have been restored Fossil will support suitable food sources for bald eagles.

Bald eagles use night communal roosts that may be related to food finding (Hansen et al. 1980) or energetic considerations (Keister 1981, Knight et al. 1983). Night roosts are often on slopes (Platt 1976, Hansen et. al 1980, Dargan 1991) or are protected from prevailing winds by surrounding vegetation (Sabine 1981, Steenhof 1976). Individual roost trees are larger than trees in adjacent stands and have open canopies (Stalmaster and Newman 1979, Hansen et al. 1980, Anthony et al. 1982, Keister and Anthony 1983, Dargan 1991).

On the Forest, wintering eagles occupy most habitat types and elevations, but are most frequently seen within ponderosa pine and pinyon-juniper habitats, often near water. They roost at night in small to moderate-sized groups (typically 2-48) in clumps of large trees in protected locations (Grubb and Kennedy 1982, Dargan 1991). These roosting areas are ponderosa pine stands that are variable in size (less than an acre to 43 acres), are on north or northeast-facing slopes, and are close to daytime foraging areas (Dargan 1991). On the CNF, there are currently 38 eagle roosts that have been spatially identified in GIS; none of which occur near the project area boundary. In Fossil CRMP corridor, communal roosting may potentially occur where ponderosa pine forests are present, especially where suitable conditions such as steep slopes, wind protection, open canopy, and larger trees occur. Grubb and Kennedy (1982) document Fossil Springs (Yavapai County) as an area where there was either historic or reported use. Due to the presence of large trees protected from the wind by adjacent slopes along portions of the creek, potential roosting habitat occurs along Fossil Creek.

American Peregrine Falcon

The peregrine falcon was removed from the Federal List of Endangered and Threatened Wildlife in August 1999 (USDI 1999a) and is now a Forest Service Sensitive species. The essential habitat for the peregrine falcon includes rock cliffs for nesting and a large foraging area. Suitable nesting sites occur on rock cliffs with a mean height of 200 to 300 feet. The subspecies *anatum* breeds on isolated cliffs and is a permanent resident on the Tonto and Coconino National Forests. Peregrines prey mainly on birds found in wetlands, riparian areas and meadows within a 10 to 20 mile radius from the nest site. They also prey on doves, pigeons and passerines. The peregrine breeding season is from March 1 to August 31.

Surveys and Habitat in the Analysis Area

Suitable nesting habitat occurs in the project area where cliff faces greater than 200 feet in elevation occur. AGFD conducted habitat suitability surveys along the 708 road. AGFD biologists did not consider the cliffs along Fossil Creek from one mile below Fossil Springs to Stehr Lake as suitable nesting habitat. Surveys were not conducted below Stehr Lake yet cliffs in excess of 200 feet do occur there and along other sections of Fossil Creek. Since the peregrine's recovery, peregrine nests are being discovered in habitat previously thought to be less than suitable. Therefore, it is now believed that peregrine falcons could occur throughout most of Fossil Creek. Environet biologists identified and mapped 7,230 acres of potential nesting habitat along Fossil Creek (Figure 20). Additionally, peregrine falcons may forage all along Fossil Creek where prey species such as

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swallows, swifts, and waterfowl may occur. In addition peregrine falcons may use the seasonal or semi-permanent wetlands or stock tanks as foraging areas in the surrounding uplands.

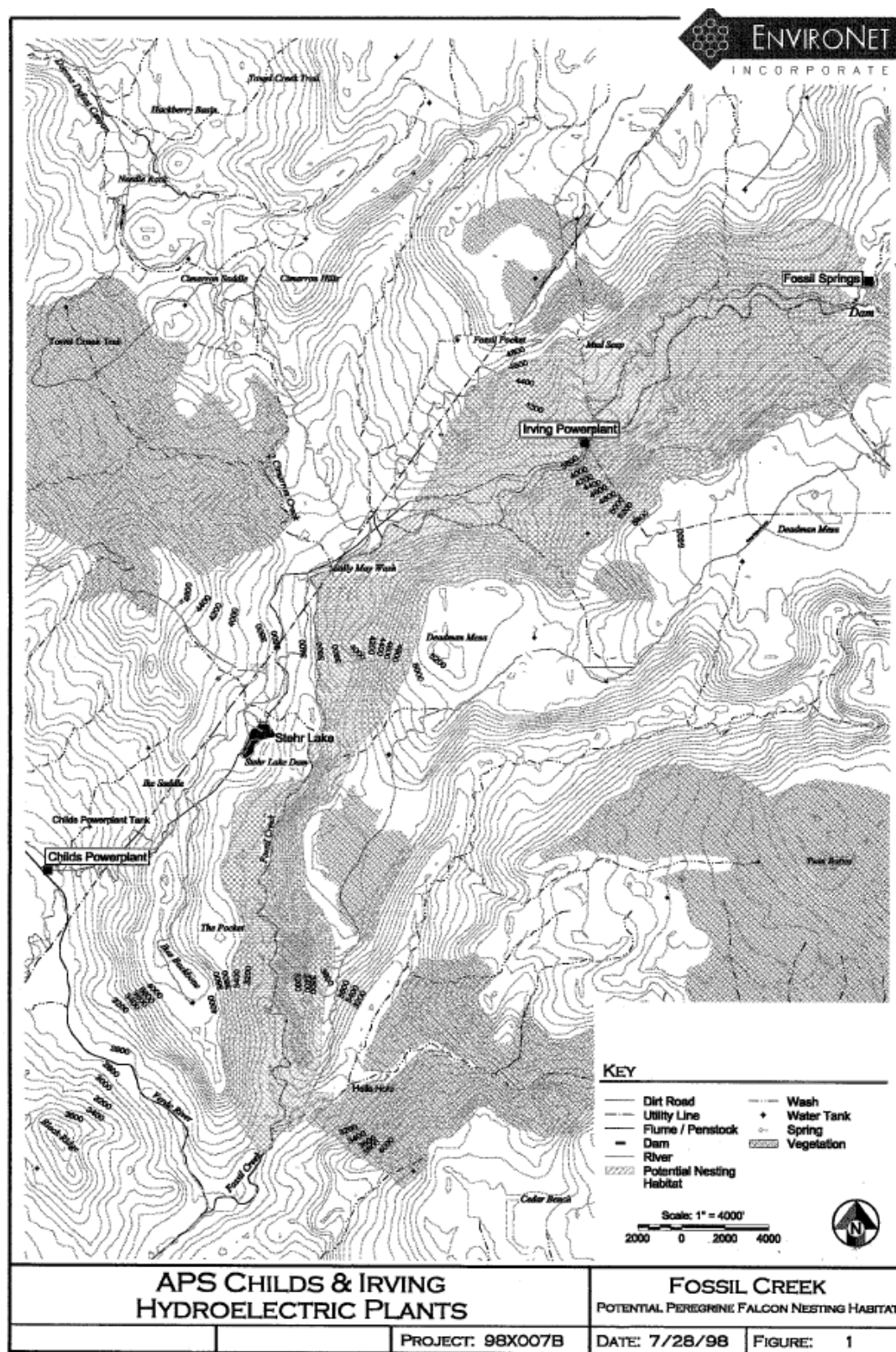


Figure 20: Suitable peregrine falcon nesting habitat along Fossil Creek

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There are no known Peregrine falcon eyries within the Fossil CRMP corridor, however there have been reports of adults with young by biologists during black-hawk and cuckoo surveys. In addition, a pair of peregrines were seen flying into a crevice on a cliff face at Fossil Springs in March of 2014. There was no sign of whitewash during a follow-up investigation in 2015 but that occurred in October, well after the breeding season. It's possible that whitewash was present but not visible. The nearest known eyries are Nash Point, 1.3 miles east Fossil CRMP corridor, Calf Pen 3.1 miles east, and East Verde 1.2 miles southeast of the corridor. Table 24 displays the known reproductive history for these three eyries during years surveyed and Map X shows the eyries in relation to the corridor. A management buffer of 900 meters is used for mapping but does not include special management requirements.

Table 24: Reproductive summary for peregrine falcons nearest the planning area

Eyrie Name	89	90	91	92	93	94	95	96	04	05	06
Calf Pen	NI	O	O	2F	O	O	NI	NI	NI	O	O, 1F
Nash Point	1F	2 F	O	1F	F	2Y	O	O	O	O	O

NI = No information
O = Occupied
F = # Young fledged
Y = # Young in nest

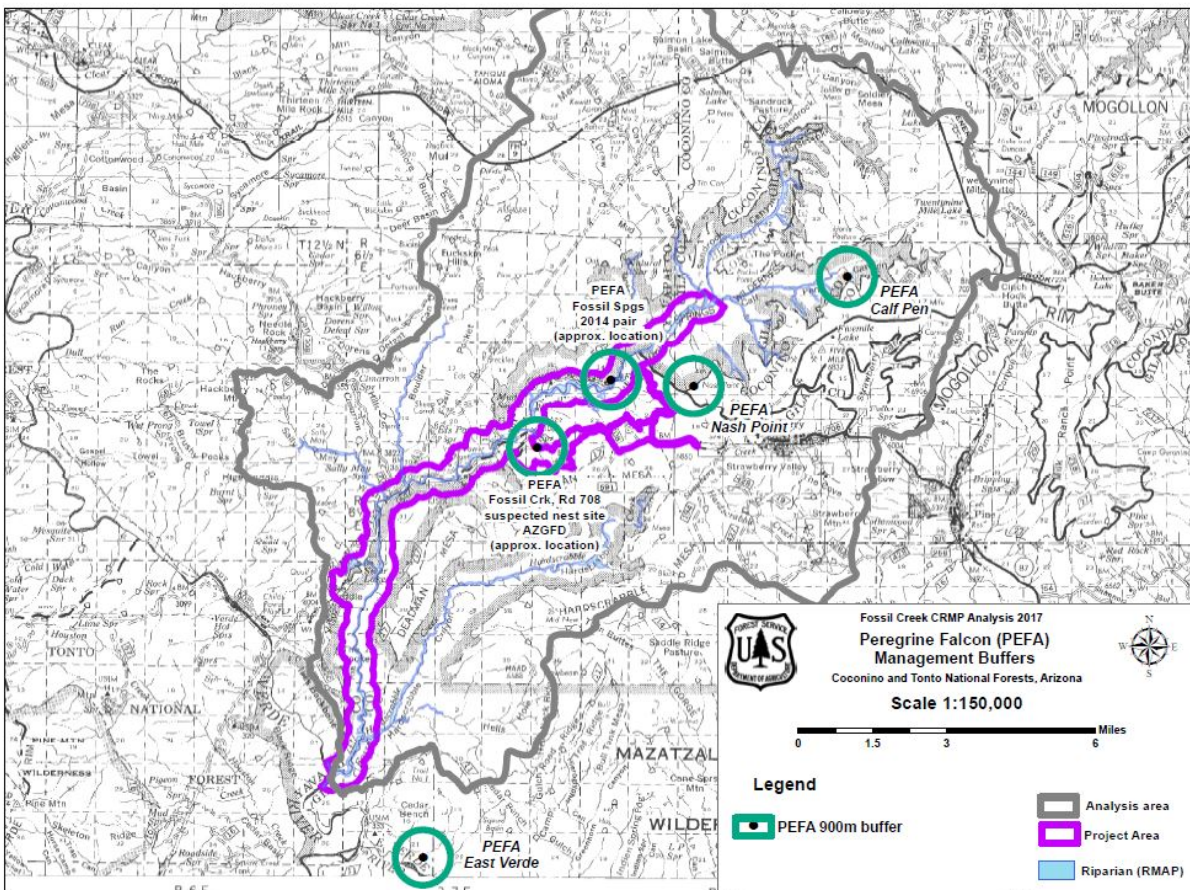


Figure 21: Peregrine falcon eyries near Fossil CRMP Corridor

Northern Goshawk

The principle forest types occupied by the goshawk in the Southwest are ponderosa pine, mixed conifer, and spruce-fir. The goshawk is a forest habitat generalist that uses a wide variety of forest stages. The goshawk preys

on large to medium sized birds and mammals which it captures on the ground. It prefers stands of intermediate canopy cover for nesting, while more open areas are used for foraging.

Research indicates that goshawks may use pinyon-juniper woodlands for foraging in the winter. Radio telemetered goshawks on the Coconino National Forest began using the ponderosa pine-juniper woodlands transition zone toward the end of the breeding season. Some radio-telemetered goshawks moved into the juniper woodland for most of the winter (Hall pers. comm.). One nest site in pinyon-juniper woodland has been reported from the Kaibab National Forest. There are no known nests in pinyon-juniper woodlands on the Coconino National Forest.

The nearest Post Fledgling Area (PFA) is located seven miles northeast of the analysis area. However, there is some potential for nesting within the corridor in the 4 acres of ponderosa pine. In addition, birds may use 4275 acres of pinyon-juniper woodland during the winter. There have been no reports by agency biologists or citizen science participants of northern goshawk in the corridor.

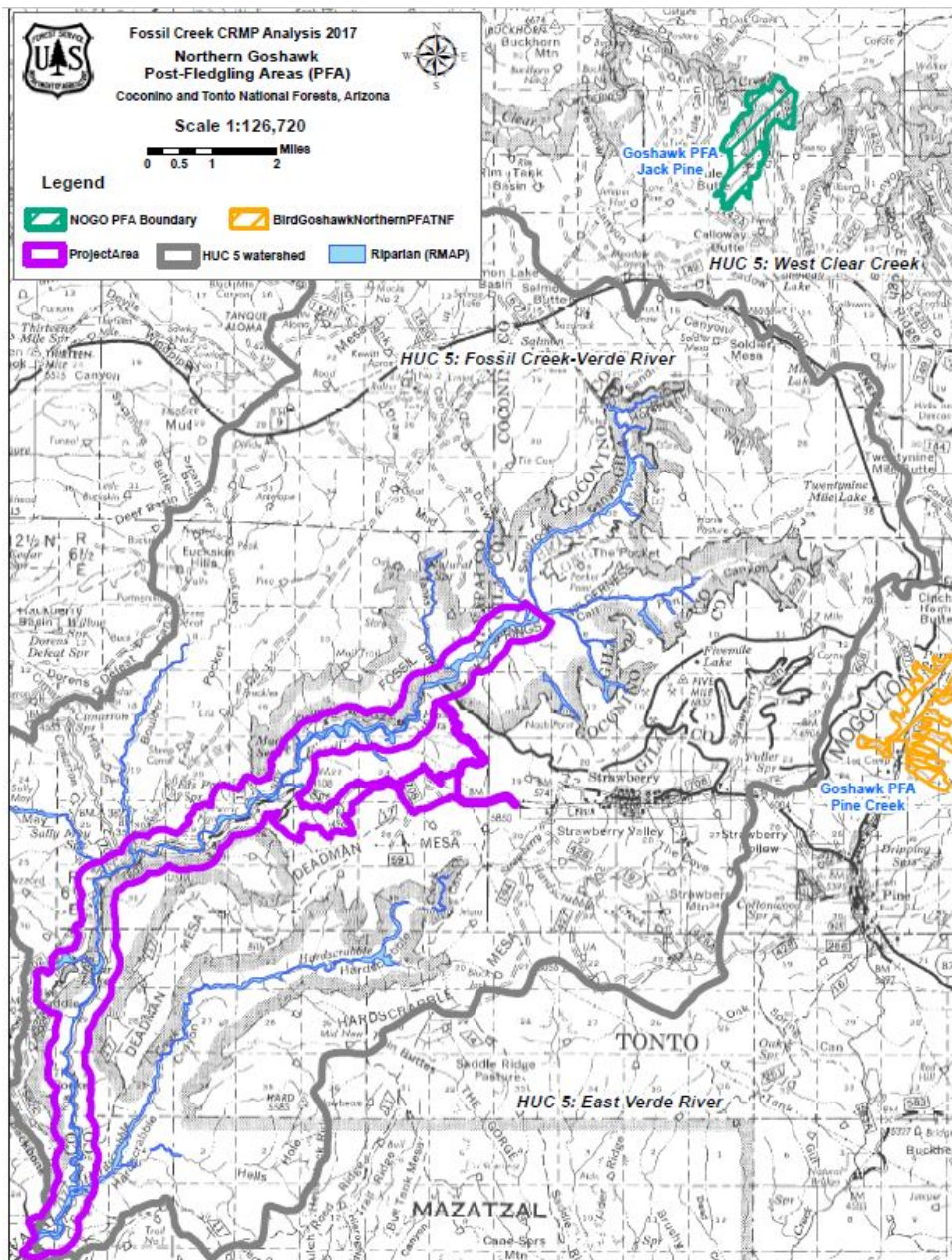


Figure 22. Northern goshawk PFAs near the Fossil Creek WSR Corridor

Amphibians

Lowland Leopard Frog

Habitat Requirements:

The lowland leopard frog prefers permanent stream pools, springs, stock tanks, and side channels of major rivers from almost sea level to 8,200 feet in elevation but more commonly under 6,400 feet. Leopard frogs are seldom found in association with bullfrogs or crayfish. The main cause for the decline of leopard frogs is attributed to the introduction of predacious non-native organisms including fish, crayfish, and bullfrogs, following by damming/water diversion and disease.

In Arizona, the lowland leopard frog is now only below the Mogollon Rim in central and southeastern Arizona with almost 60% of populations occur in central Arizona below the Mogollon Rim (AZGFD, HDMS 200X).

Surveys in the Analysis Area:

Arizona Game and Fish Department, Environet, and the Forest Service have conducted surveys for the lowland leopard frog in Fossil Springs, Fossil Creek, and nearby stock tanks. All life stages of leopard frogs have been observed in high to moderate abundance from Fossil Springs area down to above the waterfall and in low abundance from the waterfall downstream to above the waterfall trailhead. Based on all known surveys of lowland leopard frogs conducted throughout the Coconino National Forest, Fossil Creek supports the only viable population of lowland leopard frogs on the Coconino National Forest and is a significant population for the Tonto National Forest.

Prior to restoration of flows and the restoration of the native fishery, very few leopard frogs were found below the Fossil Springs dam. Historically, lowland leopard frogs were found near the 708 bridge over Fossil Creek in 1950 but not in 1985, 1990, 1992, or 1995. A survey in 1998 by Environet did not turn up any leopard frogs from the bridge to the Irving Power Plant and further upstream to approximately 3,840 feet.

Desired Condition:

Specifically for lowland leopard frog, the desired condition is that lowland leopard frogs are well established from Fossil Springs downstream to the waterfall and occur in lower numbers below the waterfall down to Irving and possibly even the permanent fish barrier in the Mazatzal Wilderness. Non-native fish and crayfish below the permanent fish barrier would preclude lowland populations from persisting. Withstanding flooding, introduction of non-native species, or disease, frog numbers should climb into the hundreds for each reach down to Irving.

Baseline Condition:

Post full-flow frog surveys from 2005 through 2009, conducted by USFS biologists, show that leopard frogs responded well to more flows, complex habitats created by travertine formations, and lack of non-native fish. Between restoration of full flows in 2005 and dam-lowering activities in 2009, lowland leopard frogs had recolonized Fossil Creek below the dam and reached viable population levels.

Existing Condition:

After APS lowering of the historic Fossil Springs dam in December of 2008, the new channel height above the lowered dam was very unstable with raw exposed banks and no vegetation to hold soil in place. Exacerbating this condition were several large flood events in 2009 and 2010 that further scoured the banks and channels and blew out established frog habitat below the dam. As a result frog monitoring showed much lower population levels. Combined with this was an increase in recreation at Fossil Springs and down by the waterfall. Surveyed areas after the flood of 2009 showed much reduced frog densities. However, limited surveys in 2010, 2011 and 2012 showed frog numbers were increasing as the population recovered from the floods. Surveys in 2017 showed that lowland leopard frogs were persisting and abundant in the Fossil Springs area but were not present in middle Fossil Creek below the waterfall trailhead.

As of 2017, lowland leopard frogs are known to persist in viable numbers from above the springs all the way downstream below the waterfall, but not as far downstream as the Waterfall Trailhead (See Figure 23). Frog densities are highest from the Fossil Springs downstream to just upstream of the large waterfall. While this reach contains the most developed travertine formations and the most complex habitat, suitable habitat exists downstream of there. Lowlands occur in very low numbers from the waterfall downstream to an area above the waterfall trailhead. Why lowland leopard frogs have not recolonized to viable numbers from just above the waterfall downstream is thought to be a limitation of habitat. The habitat below the waterfall has fewer travertine formations, has more bedrock with swift flows, and in general has less aquatic vegetation than above the waterfall.

Figures 23 through 27 summarize survey results lowland leopard frogs (RAYA) in Fossil Creek.

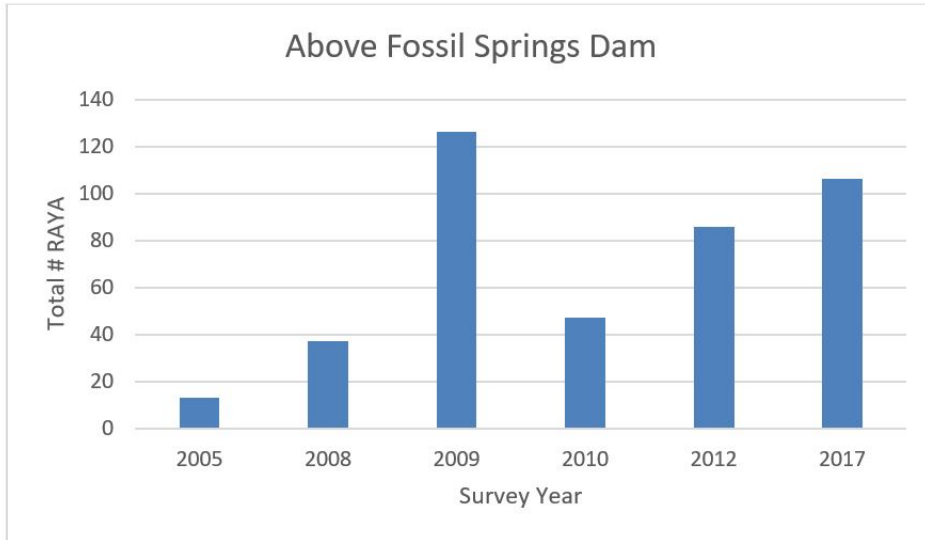


Figure 23. Lowland leopard frog survey results above Fossil Springs Dam

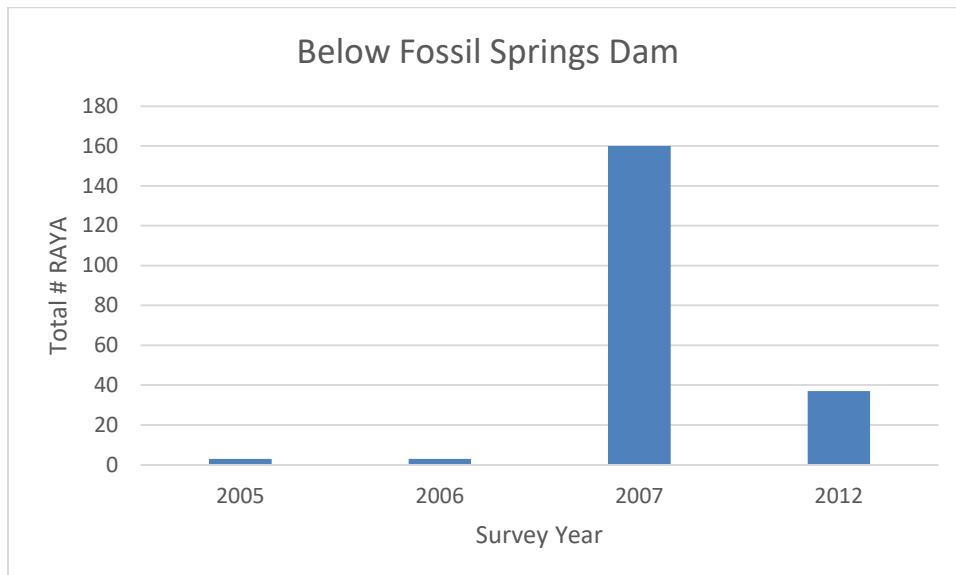


Figure 24. Lowland leopard frog survey results below Fossil Springs Dam

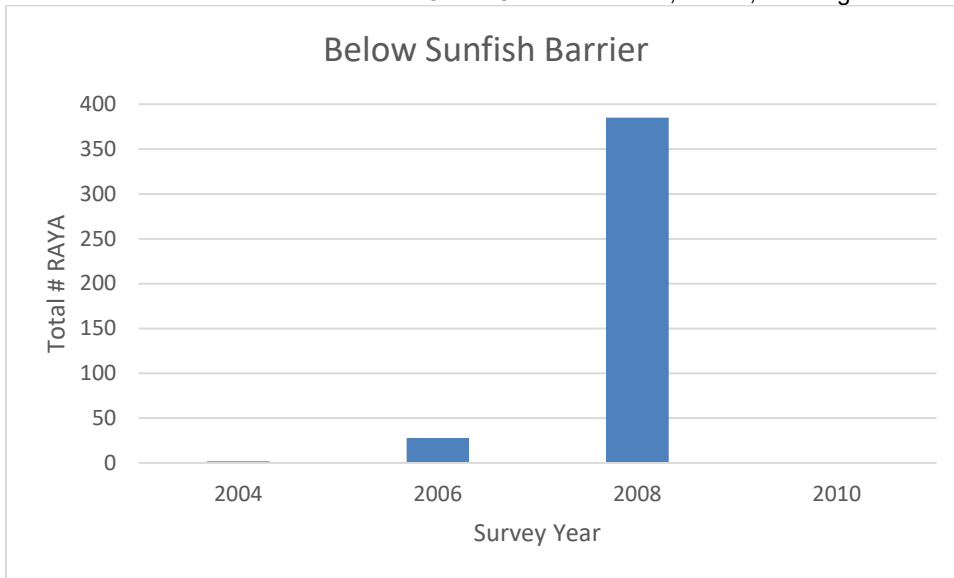


Figure 25. Lowland leopard frog survey results below the sunfish barrier

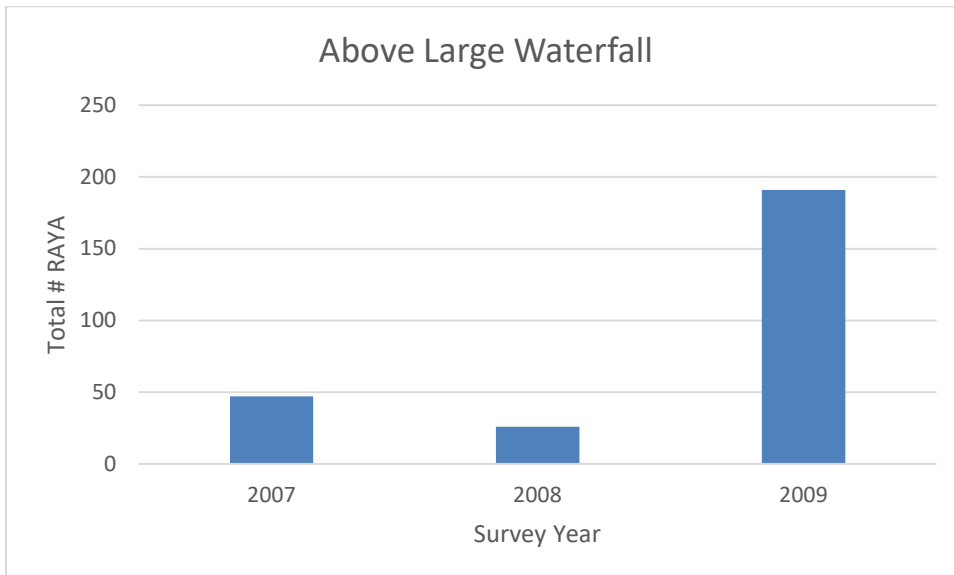


Figure 26. Lowland leopard frog survey results above the large waterfall

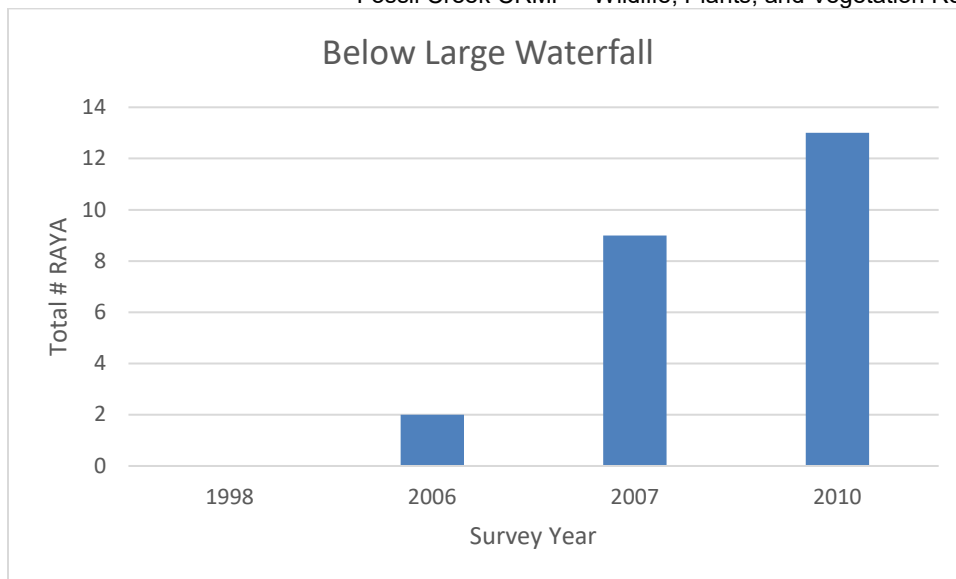


Figure 27. Lowland leopard frog survey results below the large waterfall

Surveys for leopard frogs below the Waterfall parking area/trailhead (now called Lewis Trailhead) have been negative (Tables 25-29).

Table 25. Lowland leopard frog surveys at Irving Power Plant

Year Surveyed	Results	Notes
1994	No RAYA detected	Irving power plant
1995	No RAYA detected	Irving power plant
2012	No amphibians detected	Irving Falls to just upstream of low water crossing.
2017	No RAYA detected	PM survey of pool above low water crossing

Table 26. Lowland leopard frog surveys Below Irving

Year Surveyed	Results	Notes
2004	Larvae, may have been HYAR	just below Irving power plant
2006	No RAYA detected	just below Irving Power Plant
2007	No RAYA detected	below Irving
2008	No RAYA detected	above the bridge upstream to Irving
2009	No RAYA detected	Above the bridge upstream to Irving
2017	No RAYA detected	PM survey of old road crossing area below Irving

Table 27. Lowland leopard frog surveys at Forest Boundary (Bridge)

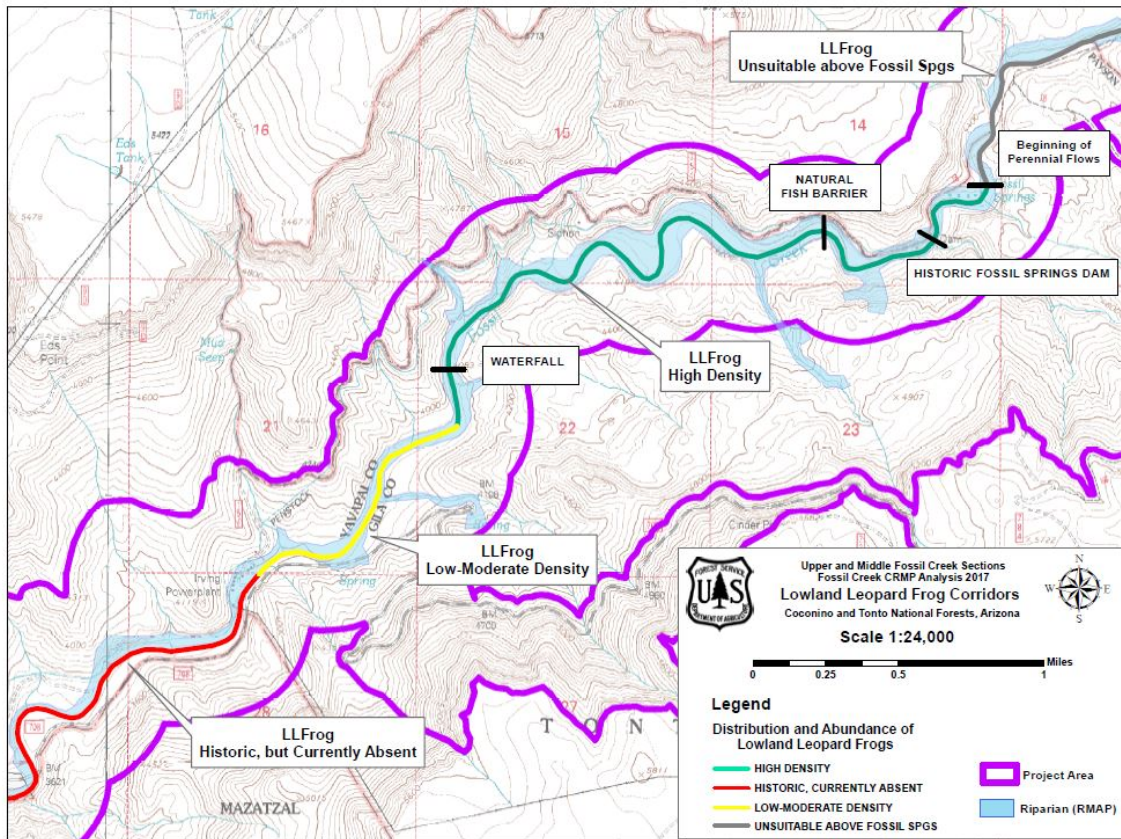
Year Surveyed	Results	Notes
1950	RAYA detected, no data on #s	
1985	No RAYA detected	
1990	No RAYA detected	
1995	No RAYA detected	

Table 28. Lowland leopard frog surveys at Reach 3: Bridge Crossing downstream to the Native Fish Barrier

Year Surveyed	Results	Notes
1998	RAYA detected, no data on #s	Bridge downstream to Barrier
2006	No RAYA detected	just below the private land
2006	No RAYA detected	last vehicle access point along Fossil Creek
2017	No RAYA detected	During PM survey at Homestead, Old Corral, and Sally May

Table 29. Lowland leopard frog surveys at Reach 4: Below Native Fish Barrier to Confluence with Verde

Year Surveyed	Results	Notes
1998	No RAYA detected	Barrier to confluence
2006	No RAYA detected	just below the native fish barrier
2011	No RAYA detected	Surveyed area where Deadman Mesa trail comes down to Fossil.

**Figure 28: Distribution and Abundance of Lowland Leopard Frogs in Fossil Creek**

Arizona Toad

The Arizona toad occurs in rocky streams, canyons, and floodplains between 2,000 and 6,000 feet. They breed in the early spring along gently flowing waters with rocky or sandy substrate. They select pools or slow water where tree canopy is relatively open. Eggs are laid in stringers on the bottom; clutches range from about 3,150-4,280 eggs. Eggs hatch in 3-6 days, and tadpoles typically metamorphose in 1-3 months. Arizona toads feed on a variety of invertebrates, including snails. They spend their days underground in burrows, loose soil, or under organic material such as leaf litter.

Habitat in the Analysis Area:

Sullivan (1991) reported Arizona toads from the Verde River just northwest of Childs power plant. Sullivan and Richardson (1993) reported that Arizona toads could potentially occur along the Verde River from West Clear Creek to the East Verde confluences. Fossil Creek offers suitable habitat for the Arizona toad. Visual encounter surveys for lowland leopard frogs have not resulted in the detection of Arizona toad, but this likely due to timing. Lowland leopard frog surveys have occurred in the summer and fall months, whereas toad surveys need to occur in very early spring when breeding toads are found along perennial stream courses. In March and April of 2017, surveys for Arizona toad were conducted once a week for six weeks by listening at pools for calling toads after dark. Call points were located at the Waterfall trailhead, Irving, Tonto Bench, Bridge, Homestead, Sally May, Purple Mountain, and Mazatzal. On the same dates, surveyors listened at call points on the Verde River down at Childs near the 1991 report. No Arizona toads were detected.

Mammals

Western Red Bat

Habitat in the Analysis Area

In Arizona, the western red bat is thought to be a summer resident only. It occurs statewide, except in desert areas, but primarily along riparian corridors among oaks, sycamores, and cottonwoods at elevations between 2,400 and 7,200 feet. Red bats typically roost in dense clumps of foliage in riparian or other wooded areas. Roost sites are shaded above and tend to be open below, permitting the bats to drop into flight. Red bats feed mainly on flying insects. The chief threats to the red bat in Arizona are its apparently low numbers and the loss of riparian and other broad-leaved deciduous forests and woodlands. Habitat for the red bat occurs along Fossil Creek and upland springs that support deciduous riparian tree species. Red bats have been radio tracked and found roosting in Gambel oak trees on the Forest, so potential exists for red bats to roost in Gambel oak trees within the corridor. Red bats emerge from their roosts several hours after dusk to forage on a variety of flying insects. Wintering behavior of this migratory bat is unknown, but other species of tree roosting bats over-winter in leaf litter.

Surveys in the Analysis Area

Until 2011, limited bat surveys were conducted in Fossil Creek and there was no record of red bat detection from those efforts. In 2011, a multi-agency effort resulted in hundreds of mist net hours with additional efforts in 2013. Two western red bats were mist netted in the middle portion of Fossil Creek. None were captured in the Fossil Springs area or the earthen tanks in the uplands above the rim.

Allen's Lappet-browed Bat

Habitat in the Analysis Area

Although known to occur over a wide range of elevations and vegetation types, the Allen's lappet-browed bat is found primarily in ponderosa pine forests where they roost underneath exfoliating bark on standing ponderosa pine snags. On the Coconino, Allen's lappet-browed bats have been detected in pinyon juniper woodlands. While 14,888 acres of ponderosa pine forests occur in the analysis area, none occur in the project area. A total of 43,089 acres of pinyon juniper vegetation (all types combined) occur in the analysis area while 5,253 acres occurs in the project area.

Surveys in the Analysis Area

Until 2011, limited bat surveys were conducted in Fossil Creek and there was no record of Allen's lappet-browed bat detection from those efforts. Bat surveys in 2011 and 2013 resulted in mist netting one Allen's lappet-browed bat in the drainage upstream of Fossil Springs (riparian with uplands of primarily pinyon juniper with some chaparral), but not in the uplands above the rim nor the middle section of Fossil Creek.

Pale Townsend's Big-eared Bat

Habitat in the Analysis Area

The distribution of this wide-ranging bat tends to be geomorphically determined, and is strongly correlated with the availability of caves or cave-like roosting habitat e.g. mines and other man-made structures including cliff dwellings and abandoned shacks. In the Fossil area, possible roosting habitat occurs in caves, in various bat-gated APS flume tunnels, cliff dwellings near Fossil Springs, and abandoned buildings.

Townsend's big-eared bats hang from open ceilings of mines and caves during the day. They do not use cracks or crevices, and may use open abandoned buildings as a night roost. In Arizona, they hibernate during the winter in cold caves, lava tubes, and mines mostly in uplands and mountains from the vicinity of the Grand Canyon to the southeastern part of the state, south of the Mogollon Rim. The presence of suitable shelters seems to be one of the important limiting factors for this species. Townsend's big-eared bats have been mist netted on several occasions

along Fossil Creek. Roost inspections of various sites (caves, bridges, and tunnels) have detected use by bats, but it is unknown if Townsend's big-eared bats used these roost. Additional suitable roost sites are unsurveyed.

Surveys in the Analysis Area

Bat surveys on the Tonto National Forest in 1993 and 1994 did not result in the detection of Townsend's big eared bats in Fossil near Flume Trailhead (which back then was the current Waterfall/Lewis trailhead) and at a tank on Hardscrabble Mesa in pinyon-juniper woodland.

In 2010, mist netting in May and June at three locations around Fossil Springs also did not result in the detection of Townsend's big-eared bats. Also, in 2010, potential Townsend's roosts were inspected. While bats were not observed, one cave had staining and guano, two caves did not have bat sign (but for one cave, the presence of an active bee hive may have been the reason for a lack of bats). One set of caves were not seen until after hiking down; roost inspections there are needed. In addition a fissure (a wide near vertical crack) was inspected at the entrance; no bat sign was detected.

In 2011, a multi-agency effort resulted in hundreds of mist net hours. Additional surveys were conducted in 2013. One Townsend's big-eared bat was mist netted in the drainage upstream of Fossil Springs, but not in the uplands above the rim nor the middle section of Fossil Creek.

On June 29, 2016, Forest Service inspected bridges along FR 708 and FR 502 within the Fossil corridor. While no bats were observed and use was not significant, there was evidence that the Boulder and Sally May bridges are being used at least as night roosts. Sally May bridge had a tiny amount of staining indicating light night use.

In 2017, volunteers mapped and scouted out the seven flume tunnels that were closed during the decommissioning phase. Nine of the tunnel entrances/exits were gated before closing the tunnels to the public. Five tunnels entrances/exits were buried and/or sealed and there was no obvious entrance or exit to these tunnels. Exit counts were conducted at a total of seven gated sites in 2017. While none of the tunnels supported large roosts, bats were using four of the seven gated sites; bats were not detected at three sites. Exit counts are still needed at Tunnel 3 entrance and exit.

Spotted Bat

Habitat in the Analysis Area

Roost site characteristics are poorly known for this species, but limited observations suggest that spotted bats roost singly in crevices, with rocky cliffs and surface water characteristic of localities where they occur. Its diet consists of moths, June bugs, and grasshoppers as well as other insects.

Spotted bats are rarely and unpredictably encountered in various habitats in scattered localities and elevations throughout Arizona, but especially in the extreme northwestern corner. It has been found from low desert areas in southwestern Arizona to high desert and riparian habitat in the northwestern part of the state. It has also been found in conifer forests in northern Arizona and other western states. Since this bat occurs in a variety of vegetation types where suitable rocky cliffs occur, the majority of the corridor, especially, Calf Pen and Sand Rock Canyons, Fossil Creek between the Fossil Springs and Irving powerplant, and the narrows, would provide suitable roosting conditions for this bat.

Surveys in the Analysis Area

No spotted bats have been detected during bat inventory efforts in Fossil Creek.

Snails

Fossil Springsnail

Fossil springsnails are found only in the headsprings and upper sections of perennial free-flowing springs and seepages feeding Fossil Creek in Yavapai and Gila counties. Springsnails of the genus *Pyrgulopsis* typically occur

in moderate currents on rock or aquatic macrophytes. They occurs in rheocrene springs (water forced directly out of the ground under pressure and forming a stream) on firm sediment (from pebble up to cobble sized substrate). They prefer shallower areas of spring and usually occur closer to the spring source where their requirements for stable water chemistry and flow is provided. Springsnails occur under water and adhere to submerged substrate, aquatic and emergent vegetation and organic litter (leaves, woody material) upon which they graze and lay eggs. Because springsnails have only a partial operculum, they cannot withstand any desiccation, and occur only in water that is perennially flowing. Other characteristics of suitable habitat include unpolluted water, spring orifices and channels free of embedded substrate, the presence of aquatic vegetation, algae and leaf litter from overstory tree canopy, and sufficient sunlight.

Threats include: activities that result in the loss or degradation of habitat from activities such as wildfires and suppression activities, livestock grazing, recreation, manipulation of springheads; predation from non-native predators such as crayfish and bullfrogs; loss of water or increased water temperatures due to climate change, drought, and/or groundwater depletion; and contamination from soap, sunblock, and herbicides. In addition to crushing individual snails, these activities alter or destroy the structural and biological needs for this species in ways that: reduce water quality (from sediment, ash, and contaminants); increase sedimentation and embeddedness of substrate which reduces places for adhering and egg laying; disturb vegetation and substrate; introduce chemicals such as retardant, soap, bug spray and sunblock; and reduce flows.

Habitat and Populations in the Analysis Area

Some surveys for springsnails have occurred in the Fossil Creek watershed, however numerous seeps and springs have not yet been inventoried. Many seeps and springs are inaccessible due to extremely steep terrain or the spring orifices being tucked back in narrow spaces in travertine formations (such as at the hanging gardens). In a mapping effort to highlight potential springsnail habitat, the light filters in aerial photographs were adjusted to accentuate deciduous vegetation. This resulted in the identification of potential seeps that may have enough above-ground water to support springsnails. Of those mapped, 11 have not yet been visited due to inaccessible terrain. These maps have not been updated to reflect recent survey results, so are not included in this report.

Between the 1970s and 1990, Landye and Hershler conducted various surveys and documented seven populations of springsnails in the Fossil corridor; in two springs above the historic Fossil Springs dam, one spring uphill of the Flume trail, and four springs on the southern side of Fossil Creek along FR 708.

Northern Arizona University conducted surveys in 2005 and 2009 around Fossil Springs, Irving power plant, and Below Sally May Wash. They documented springsnails in six out of nine surveyed sites in the Fossil corridor (Marks et al 2009). However, two of these sites were listed as non-reproducing sites.

Surveys by FWS in 2012 and 2013 monitored five known sites (Fossil Springs and four along FR 708). They documented that springsnails continue to exist in four springs (they were unable to relocate the occupied Fossil Springs site) and that population counts at one site had declined.

In 2005 and 2013, AZ Game and Fish (AZGFD) monitored existing populations. In 2017, the AZGFD with the Forest Service monitored existing populations (noting an increase at two sites where counts in previous years were low and of concern) and documented an additional population of springsnails near the Waterfall trail.

In the fall of 2017, Forest Service biologists conducted surveys for springsnails in five locations in the Fossil Springs area; none were detected, including at a spring that previously was known to support springsnails.

During various efforts, there has been difficulty in relocating occupied sites from surveys by previous surveyors. This was likely due to differences in GPS datums or error of GPS waypoints or even possibly that springsnail populations may have disappeared from some sites. As a result, it is difficult to make an actual crosswalk count of occupied and unoccupied sites amongst the various efforts.

In total, there are as many as 11 known occupied sites, at least 8 unoccupied sites, and at least 11 unsurveyed sites that have potential to support springsnails.

During CRMP interim management years from 2011 on, the Forest Service closed camping and decommissioned a user-created trail that crossed an occupied seep just downhill from the FR 708 and Waterfall Trail, however, it took several years of effort for the closure to be effective. Also during that time, footbridges were installed over several channels leading from springs along the Waterfall trail. Those springs, in 2017, were inventoried and discovered to be occupied by springsnails. The following pictures in Figures 29 and 30 document the recovery in habitat after the footbridges were in place for several years.



Figure 29. Denuded springsnail habitat at time footbridges were installed in 2011



Figure 30. Springsnail habitat recovery after several years of having footbridges

Other springsnail sites, such as in the Fossil Springs area, are accessible to visitors. One of these springs has had a user-created trail leading to it from the Fossil Springs trail. There has been some concern over the years that visitors can crush snails as they walk in occupied habitat to get up to the spring orifice to filter drinking water. At this and other spring orifices in the area, it was noticed recently that the presence of non-native Himalayan blackberry (*Rubus procerus*) has compromised springsnail habitat in the Fossil Springs area through shading and reduction of vegetative diversity. The blackberry have covered the ground as well as climbed existing trees and even hang from overstory trees, totally obscuring the spring orifice. This has resulted in an increase in the amount of shading and has reduced the diversity of plant species in the immediate area around the springsnail site. Additionally, according to Jeff Sorensen, invertebrate biologists with AZGFD, “the blackberry may degrade the springsnail habitat by overgrowing open water sections and shading the habitat, which will likely affect algal growth, and periphyton and diatom abundance which the snails rely on as forage.”

Plants

There have been numerous surveys over the years and several plant lists are available for the greater Fossil Creek planning area. Species of plants from older lists (Baker, Phillips, Lutz, Sear, Menasco, Collins, Sayers, Goodwin, Wong), were entered into an Access Database (Appendix C). Approximately 350 species for the greater Fossil Creek area and 187 species from the Fossil Botanical Area were recorded. More recently Desert Botanical Garden botanists provided a list of additional documented species that were missing from the Access dbase (Appendix C). In total there are approximately 537 plant species known from Fossil Creek.

The sensitive species in Table 30 below are included in this analysis because either they are known to occur in the FC WSR corridor or the corridor occurs within their range and contains suitable habitat. Sensitive plant species known to occur in the Fossil planning area include Cochise sedge and Mt. Dellenbaugh sandwort. There have been no collections, records or observations of the remaining sensitive species. See Figures 31 and 32.

Table 30: Sensitive Plant Species in Fossil Creek Project Area.

Species	Status	Habitat in Project Area	Habitat and Known Occurrence in Project Area
Arizona phlox (<i>Phlox amabilis</i>)	Forest sensitive	This plant is a central Arizona endemic. It occurs in open, exposed, limestone or basalt rocky slopes within pinyon-juniper and ponderosa pine-Gambel oak communities. Plants have been observed in Coconino, Mohave, Navajo, and Yavapai counties in elevations from 3500-7500 feet. Has also been found in Graham and Gila counties.	Verified collection from a canyon 2 mi southwest of project area.
Cochise sedge (<i>Carex ultra</i>)	Forest sensitive	This herbaceous perennial grows at about 2,000 to 5,000 feet in elevation on southeast-facing, often shaded exposures in moist soil near perennially wet springs and streams. It is typically found in wet alluvial soil, sand and gravels, associated with aquatic/riparian woodlands or oak-pinyon woodlands.	One record exists for within the project area. See Figure 33 for locality information from SEINet.
Metcalf's tick trefoil (<i>Desmodium metcalfei</i>)	Forest sensitive	This plant is broadly distributed but has a limited occurrence. It is found on rocky slopes and in canyons within grasslands, pinyon-juniper and oak woodlands, and riparian forests between 4,000 and 6,000 feet in elevation. This perennial plant is deciduous. It produces purple pea-shaped flowers from August to October.	There are few recent collections of this rare plant. The nearest is 45 miles southwest and a lower elevation than the project habitat. Possibly collected in the project area, but is yet to be positively identified.
Mt. Dellenbaugh Sandwort (<i>Eremogone aberrans</i> formerly <i>Arenaria aberrans</i>)	Forest sensitive	This species is known only from northern and north-central Arizona usually between 5,500 and 9,000 ft elevation. Occurs mainly in oak and pine forests but is also found in open pine and pinyon pine woodlands, and among junipers.	Collected in project area. See Figure 34 for locality information from SEINet.
Eastwood Alumroot	Forest Sensitive	Only known from central Arizona and is found on moist slopes in ponderosa pine forests and	Occurs outside of but near the project area.

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Species	Status	Habitat in Project Area	Habitat and Known Occurrence in Project Area
(<i>Heuchera eastwoodii</i>)		canyons at elevations between 5,000 and 6,000 feet in elevation	

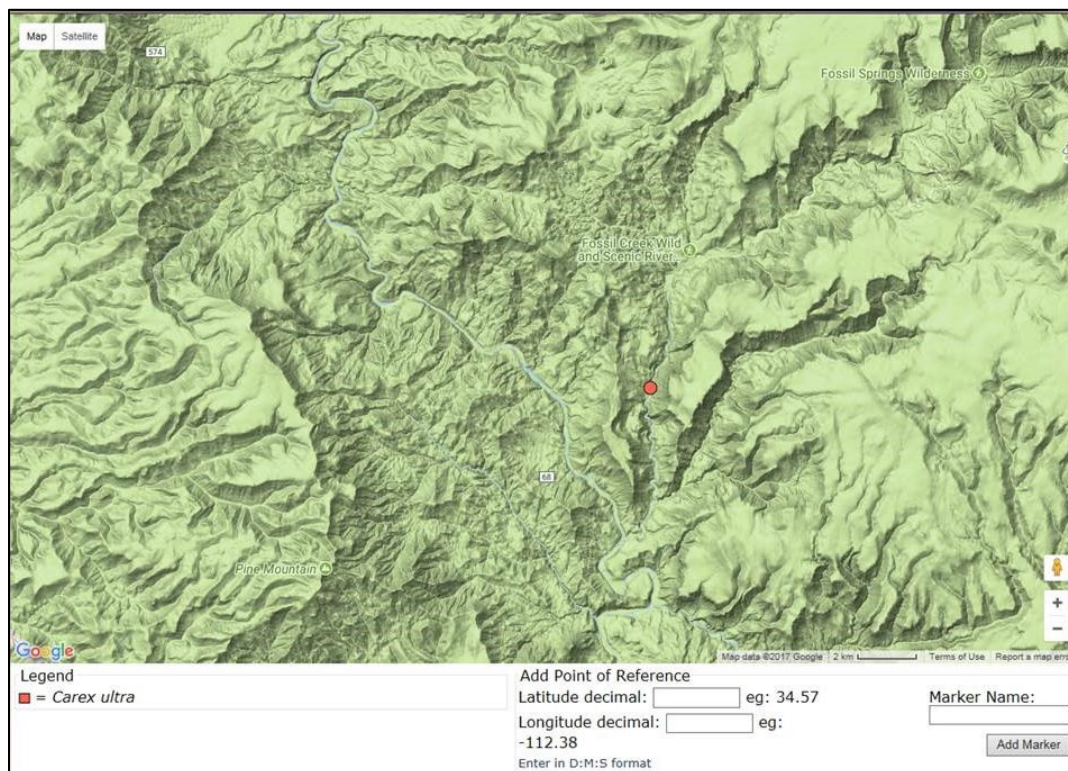


Figure 31: Known *Carex ultra* location in Fossil project area.

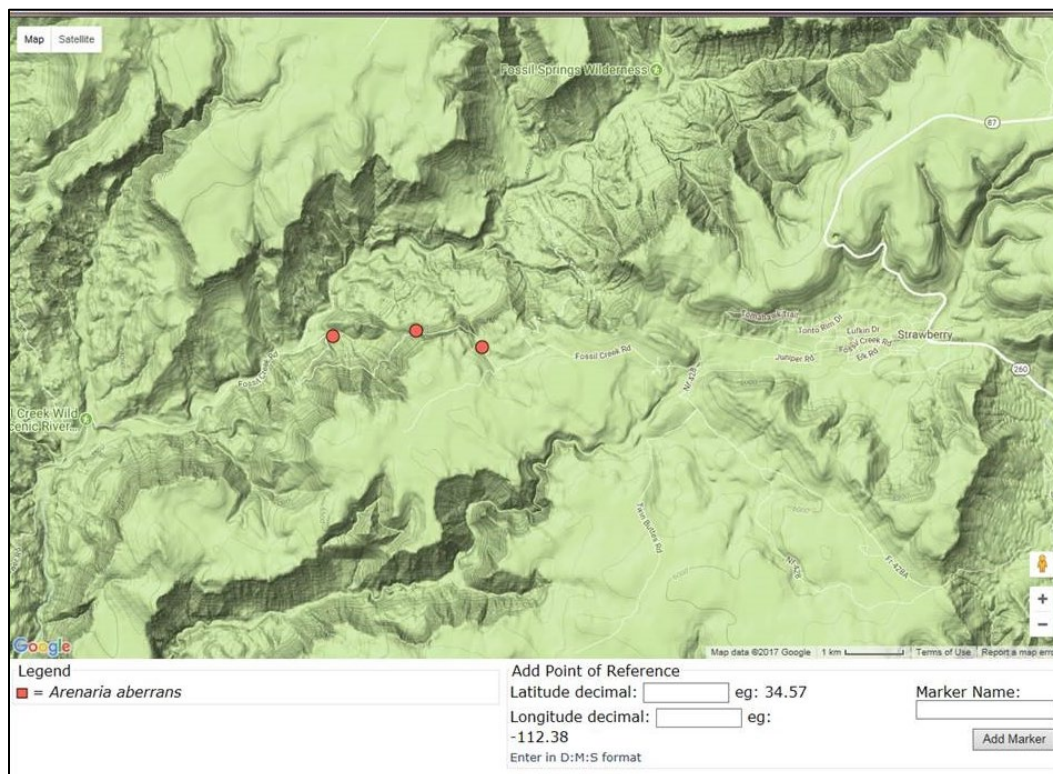


Figure 32: Known *Arenaria aberrans* location in Fossil project area.

Botanists and volunteers with the Arizona Rare Plant Task Force and Desert Botanical Garden (DBG) have been conducting plant inventories within the FC WSR corridor over the last several years. Recent plant collecting trips by Desert Botanical Garden botanists and volunteers have resulted in the collection of numerous endemic species: *Agave chrysantha*, *Perityle ciliate*, *Mentzelia longiloba* var. *yavapaiensis*, and *Echinocereus yavapaiensis*, and *Galiuim collomiae*. Another endemic, *Dudleya saxosa* ssp. *collomiae*, has not yet been located but is expected to occur in the Fossil area. DBG botanists provided a list of other plant species of interest that have been collected in Fossil Creek; *Desmodium metcalfei** (not yet confirmed), *Eriogonum microthecum* (need to key to subspecies), *Phlox tenuifolia*, *Salix bonplandiana*, *Epilobium canum* var. *latifolium*, and *Epipactis gigantea*. It is important to note that despite major inventory and collecting efforts by DBG botanists in recent years, plant surveys are still limited spatially (there are many areas with difficult access) and temporally (repeat entries across growing seasons are necessary for complete plant inventory) and there are likely numerous other species of interest that have yet to be documented in FC WSR corridor as well as additional locations of special status plant species already documented.

Professional input from DBG botanists (Ward and Hodgson, 2016) include the following points:

- Riparian areas in Arizona and the Southwest are rare.
- Fossil Creek sits between two predicted Arizona endemic hot spots, namely Verde Valley and base of Mogollon Rim.
- The riparian area associated with Fossil Creek is arguably unique.
- The Botanical Area has a high richness of species diversity.
- Even though no listed plant species and only a few sensitive species occur in the FC WSR corridor, the riparian plant community should be viewed in a more inclusive and holistic manner.
- Despite recent surveys, there is a lack of knowledge and understanding of the complexity of plant species and role they play in ecosystems.
- There is concern that lack of such knowledge may result in insufficient management proposals.
- Future needs include:
 - Increased collaboration, with potential for funding, between agency staff and botanists much experienced in Arizona/Southwest floristics, rare and invasive plants (including the Arizona Rare Plant Task Force) and plant systematics is encouraged.
 - Continued collaboration will result in a better understanding of plants and their role in the ecology of Fossil Creek.
 - Desert Botanical Garden staff, working with citizen scientists, continue to better document the flora of this region; population status of the more rare species, including possible new, previously unknown cryptic species may emerge.

In summary, there is a high diversity of plant species in the project area. This is supported by the known presence of four Forest Service Sensitive species, five endemic species, six other species of interest, and potential presence of a handful of other species. Since surveys are still limited spatially and temporally limited, there are likely additional locations of special status plant species already documented. Of what is known, only one sensitive species, Mt. Dellenbaugh Sandwort, occurs in close proximity to where moderate to high levels of human use occur.

Other Special Status Species

Golden and bald eagles are protected under the Bald and Golden Eagle Protection Act (Eagle Act). Existing condition for the golden eagle follows. Refer to the Sensitive Species section above, for existing condition for bald eagle.

Golden Eagle

Habitat requirements:

Golden eagles are found nesting in a wide variety of habitats from arid desert scrub to open conifer forests. No matter what habitat they choose in the state, topography features include tall cliffs or canyon in which to construct a nest and nearby large open areas to forage for prey (AGFD 2005). Most golden eagles nesting in Arizona are primarily residents, remaining within or near their home range throughout the year. In Arizona, cliff ledges are the most common nesting substrate used by golden eagles, but they will also use tall trees (esp. ponderosa pine), junipers, rock outcrops, and in rare cases, transmission towers (Glinski et.al. 1998 in AGDF 2005). Golden eagles often nest in areas of high rabbit populations. Golden eagles are well known for subduing large prey; however most of their diet consists of ground squirrels, rabbits, and prairie dogs. Abundant prey in the form of rabbits and ground squirrels occur throughout most of the Fossil CRMP corridor.

Habitat in the Analysis Area

Golden eagles may occur in all biotic communities as long as tall cliffs or canyons are present, prey (primarily rabbits) is abundant and there are relatively low levels of human activity. Habitat meeting these requirements occurs in the project area, particularly the upper portion just below Sandrock and Calf Pen Canyons and the lower portion of Fossil by the “Narrows”.

Surveys in the Analysis Area:

Prior to 2011, information on golden eagles was limited in Arizona (McCarty et. al 2015). AGFD has been conducting surveys annually since 2011. Based on the AGFD monitoring effort, there are currently no known, active breeding areas in the project area. However, there are two areas where golden eagles were observed and or nesting suspected and one active nest outside of the project area, but within the cumulative effects analysis area (personal communication, Tuk Jacobson - email 7/28/17):

- A 1999 report of a pair of golden eagles near Irving powerplant was reported to AZGFD. The pair was seen perched and flying together. Although AZGFD searched the area in 2014, no nests were found. AZGFD considers this sighting a species observation. There is high recreational use in this area.
- The second area is called Fossil Pocket (Boulder Canyon), where a large-sized nest was discovered in 2012. However, since no eagles were observed, AZGFD considers this to be a possible nesting location, but unconfirmed. This site is located in Boulder Canyon over 2 miles north of the project area and far from any recreational activities.
- The last site, Deadman Mesa is a single cliff nest that was discovered during the 2005 bald eagle surveys. The first time the nest was observed to be active (eggs laid) was in 2012. However the nest failed in 2012 and again in 2015. The nest is ~0.4 miles south of the Fossil Creek project area on the Fossil-facing cliffs associated with Deadman Mesa and far from recreational activities. Refer to Figure 33 for these three locations.

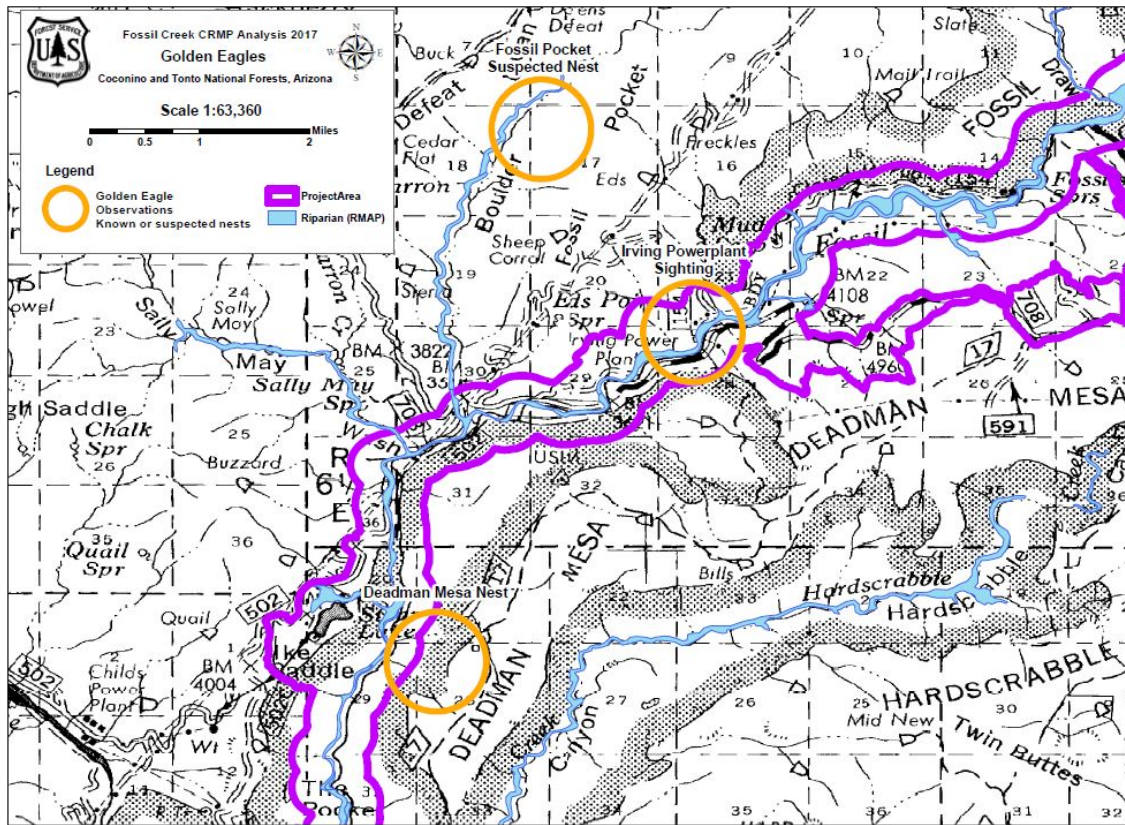


Figure 33: Golden eagle observations in the Fossil Creek area

Management Indicator Species

There are numerous MIS identified as indicators for habitats on the Coconino and Tonto National Forest. Macroinvertebrates are being addressed in the Fisheries Specialist's Report and will not be addressed further in this report. This report tiers to and summarizes forestwide habitat and population trends from each Forest's MIS status reports. The MIS analysis, as required, is broken out by forest.

Coconino National Forest MIS

Three MIS are designated on the Coconino National Forest: pronghorn, Mexican spotted owl, and pygmy nuthatch (Table 31).

Table 31: Coconino National Forest Management Indicator Species (MIS) and the habitat they were chosen to represent.

Species	Indicator Habitat
Pronghorn Antelope	• Great Basin Grassland • Montane/Subalpine Grassland • Semi-desert Grassland
Mexican Spotted Owl	• Ponderosa Pine – Gambel Oak • Mixed Conifer with Infrequent Fire • Mixed Conifer Frequent Fire
Pygmy Nuthatch	• Ponderosa Pine – Old Growth • Ponderosa Pine - Snags

Mexican spotted owl and Pygmy nuthatch are management indicators for vegetation types that do not occur in more than two percent of the project area (mixed conifer and ponderosa pine,) and therefore are excluded from this analysis.

Habitat features for pronghorn antelope occur within the Fossil CRMP corridor, so this species will be analyzed in this document. The habitat trend for pronghorn on the Coconino NF is considered to be stable to declining, and the population trend is considered to be stable. Approximately 497 acres of pronghorn habitat is present in the project area and approximately 206,199 acres of pronghorn habitat is present on the Coconino NF. Refer to Table 32 for both habitat and population trends as well as acres of indicator habitat within the project area.

Tonto National Forest MIS

Table 32: Tonto National Forest Management Indicator Species (MIS) and the habitat they were chosen to represent.

Species	Indicator Habitat (ERU code)	Acres of MIS Habitat in Project Area
Elk	• PJO • JUG • MEW • PJC • PJ Grass • PPE • PPF • MCD	• 2086 • 610 • 0 • 0 • 0 • 0 • 4 • 0
Turkey	• PJO • JUG • MEW • PJC • PJ GRASS • PPE • PPF • MCD	• 2086 • 610 • 0 • 0 • 0 • 0 • 4 • 0
Pygmy Nuthatch	• PPE • PPF • MCD	• 0 • 4 • 0
Violet-green Swallow	• PPF • MCD	• 4 • 0
Western Bluebird	• PPF • MCD	• 4 • 0
Hairy Woodpecker	• PPE • PPF	• 0 • 4
Northern Goshawk	• PPE • PPF • MCD	• 0 • 4 • 0
Abert Squirrel	• PPE • PPF • MCD	• 0 • 4 • 0
Ash-throated Flycatcher	• SDG • PJO • JUG • PJC • PJG	• 142 • 2086 • 610 • 0 • 0
Gray Vireo	• IC • PJO • MEW • PJC	• 0 • 2086 • 0 • 0
Townsend's Solitaire	• PJO • PJC	• 2086 • 0
Juniper Titmouse	• PJO • MEW • PJC • PPE	• 2086 • 0 • 0 • 0

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Species	Indicator Habitat (ERU code)	Acres of MIS Habitat in Project Area
Northern Flicker	• PJO • MEW • PJC • PPE	• 2086 • 0 • 0 • 0
Spotted Towhee	• MSDS (SOS) • IC • PJO • MEW • PJC	• 0 • 0 • 2086 • 0 • 0
Black-chinned Sparrow	• IC • PJC	• 0 • 0
Savannah Sparrow	• SDG • JUG • PJG	• 142 • 610 • 0
Horned Lark	• SDG • JUG • PJG	• 142 • 610 • 0
Black-throated Sparrow	• SDS • MSDS (CB) • MSDS (SOS) • MSDS (SP) • IC • SDG • JUG • PJG	• 0 • 0 • 0 • 0 • 0 • 0 • 610 • 0
Canyon Towhee	• SDS • MSDS (CB) • MSDS (SOS) • MSDS (SP) • IC • SDG • PJO • JUG • PJG	• 0 • 0 • 0 • 0 • 0 • 142 • 2086 • 610 • 0
Bald Eagle	• Riparian	• 175
Bell's Vireo	• Low elevation Riparian	• 175
Summer Tanager	• Low elevation Riparian	• 175
Hooded Oriole	• Low elevation Riparian	• 175
Hairy Woodpecker	• High elevation riparian	• 175
Arizona Gray Squirrel	• High elevation riparian	• 175
Warbling Vireo	• High elevation riparian	• 175
Western Wood Pewee	• High elevation riparian	• 175
Common Black-hawk	• Riparian streamside	• 175

Legend to ERU Codes:

SDS = Sonora-Mojave Creosote-Bursage Desert Scrub

MSDS = Mohave Sonoran Desert Scrub

MSDS(CB) = Sonora-Mohave Mixed Salt Desert Scrub

MSDS(SOS) – Sonoran Mid-Elevation Desert Scrub

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MSDS(SP) = Sonoran Paloverde-Mixed Cactus Desert Scrub

IC = Interior Chaparral

SDG = Semi-Desert Grassland

PJC = Pinyon-juniper Evergreen Shrub

PJO = Pinyon-juniper Woodland

JUG = Juniper Grass

MEW = Madrean Encinal Woodland

PJC = Pinyon-juniper Evergreen Shrub

PJG = Pinyon-juniper Grass

PPE = Ponderosa Pine – Evergreen Oak

PPF = Ponderosa Pine Forest

MCD = Mixed Conifer – Frequent Fire.

Pygmy nuthatch, violet-green swallow, western bluebird, hairy woodpecker, northern goshawk, and Abert squirrel are management indicators for vegetation types that do not occur in more than two percent of the project area (mixed conifer and ponderosa pine forests) and therefore are excluded from this analysis when those two habitats are the only habitats for which they are indicators.

The main habitat types observed in the Fossil Creek corridor include pinyon-juniper woodlands, grasslands, chaparral, desert scrub, and low elevation riparian. The corresponding ERU codes include: MSDS-SOS, SDG, PJO, JUG, MEW, PJC, and JJG. While a few acres of mixed conifer and ponderosa pine forest occur within the project area, the area where these two habitat types are found occur in the uplands, well away from any existing or proposed infrastructure and away from areas where recreation occurs.

Habitat features for Tonto National Forest MIS species in Table 33 occur within the Fossil CRMP corridor on the Tonto National Forest, so those species will be analyzed in this document. Refer to Table 33 for habitat trends for The Tonto National Forest as well as acres of indicator habitat within the project area.

Table 33: Tonto MIS Analyzed Within Fossil Project Area.

Species	Indicator Habitat	Departure from Reference Condition	Acres of MIS Habitat in Project Area	Acres of MIS Habitat on Forest
Elk	• PJO • JUG • MEW • PJC* • PJ Grass • PPE • PPF • MCD	• Low • Moderate • Moderate • High • Moderate • High • High • Moderate	• 2086 • 610 • 0 • 0 • 0 • 0 • 0 • 0	• 54,352 • 415,546 • 93,157 • 398,154 • 74,240 • 205,729 • 37,878 • 58,829
Turkey	• PJO • JUG • MEW • PJC* • PT GRASS • PPE • PPF • MCD	• Low • Moderate • Moderate • High • Moderate • High • High • Moderate	• 2086 • 610 • 0 • 0 • 0 • 0 • 0 • 0	• 54,352 • 415,546 • 93,157 • 398,154 • 74,240 • 205,729 • 37,878 • 58,829
Ash-throated Flycatcher	• SDG • PJO • JUG • PJC* • PJG	• High • Low • Moderate • Moderate • Moderate	• 142 • 2086 • 610 • 0 • 0	• 340,983 • 54,352 • 415,546 • 398,154 • 74,240
Gray Vireo	• IC • PJO • MEW • PJC	• Low • Low • Moderate • Moderate	• 0 • 2086 • 0 • 0	• 340,983 • 54,352 • 415,546 • 398,154

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Species	Indicator Habitat	Departure from Reference Condition	Acres of MIS Habitat in Project Area	Acres of MIS Habitat on Forest
Townsend's Solitaire	• PJO • PJC*	• Low • Moderate	• 2086 • 0	• 54,352 • 398,154
Juniper Titmouse	• PJO • MEW • PJC* • PPE	• Low • Moderate • Moderate • High	• 2086 • 0 • 0 • 0	• 54,352 • 93,157 • 398,154 • 205,729
Northern Flicker	• PJO • MEW • PJC* • PPE	• Low • Moderate • Moderate • High	• 2086 • 0 • 0 • 0	• 54,352 • 93,157 • 398,154 • 205,729
Spotted Towhee	• MSDS (SOS) • IC • PJO • MEW • PJC	• Moderate • Low • Low • Moderate • Moderate	• 0 • 0 • 2086 • 0 • 0	• 113,557 • 290,771 • 54,352 • 93,157 • 398,154
Black-chinned Sparrow	• IC • PJC*	• Low • Moderate	• 0 • 0*	• 290,771 • 398,154
Savannah Sparrow	• SDG • JUG • PJG	• High • Moderate • Moderate	• 142 • 610 • 0	• 340,983 • 415,546 • 74,240
Horned Lark	• SDG • JUG • PJG	• High • Moderate • Moderate	• 142 • 610 • 0	• 340,983 • 415,546 • 74,240
Black-throated Sparrow	• SDS • MSDS (CB) • MSDS (SOS) • MSDS (SP) • IC • SDG • JUG • PJG	• Low • Low • Moderate • Low • Low • High • Moderate • Moderate	• 0 • 0 • 0 • 0 • 0 • 0 • 610 • 0	• 21,095 • 54,423 • 113,557 • 602,209 • 290,771 • 340,983 • 415,546 • 74,240
Canyon Towhee	• SDS • MSDS (CB) • MSDS (SOS) • MSDS (SP) • IC • SDG • PJO • JUG • PJG	• Low • Low • Moderate • Low • Low • High • Moderate • Moderate • Moderate	• 0 • 0 • 0 • 0 • 0 • 142 • 2086 • 610 • 0	• 21,095 • 54,423 • 113,557 • 602,209 • 290,771 • 340,983 • 54,352 • 415,546 • 74,240
Bald Eagle	• Riparian	• Data not available	• 175	• 35,022
Bell's Vireo	• Low elevation Riparian	• Data not available	• 175	• 35,022
Summer Tanager	• Low elevation Riparian	• Data not available	• 175	• 35,022
Hooded Oriole	• Low elevation Riparian	• Data not available	• 175	• 35,022
Hairy Woodpecker	• High elevation riparian	• Data not available	• 175	• 35,022
Arizona Gray Squirrel	• High elevation riparian	• Data not available	• 175	• 35,022
Warbling Vireo	• High elevation riparian	• Data not available	• 175	• 35,022

Species	Indicator Habitat	Departure from Reference Condition	Acres of MIS Habitat in Project Area	Acres of MIS Habitat on Forest
Western Wood Pewee	• High elevation riparian	• Data not available	• 175	• 35,022
Common Black-hawk	• Riparian streamside	• Data not available	• 175	• 35,022

*Even though the query for vegetation types shows no acres for PJC in the project area or analysis area, this habitat type is present but it is included in other P/J veg types. So, black-chinned sparrow is included in this analysis and the acres for other P/J types are used as a proxy for PJC.

Migratory Birds

Three sources were used to identify priority species: (1) Partners in Flight Landbird Conservation Plan (Rosenberg et al. 2016), (2) Birds of Conservation Concern 2008 (U.S. Fish and Wildlife Service 2008), and (3) Arizona's State Wildlife Action Plan: 2012-2022 (Arizona Game and Fish Department 2012). Using these sources, a list of migratory birds that occur on the Forests was developed. In the Partners in Flight plan (PIF Plan), birds listed for the Intermountain West and Sonoran Joint Ventures were evaluated. Birds listed in Bird Conservation Regions (BCR) 16 and 34 were evaluated from the Birds of Conservation Concern (BCC 2008) plan, as were Tier 1a and 1b Species of Greatest Conservation Need (SGCN) from the Arizona State Wildlife Action Plan (SWAP).

From those lists, 31 priority bird species were identified. Of those, 25 breed on the Forests and the other six species (Cassin's finch, chestnut-collared longspur, grasshopper sparrow, savannah sparrow, ferruginous hawk, and lark bunting) are present in the winter. Federally-listed and Forest Service Sensitive species were not included, as projects evaluate effects under the ESA and as Sensitive species. Eagles are addressed in the Bald and Golden Eagle Act section.

A total of 13 species are excluded from further analysis because their preferred habitat type is either high elevation riparian which does not occur in the project area or is ponderosa pine and/or mixed conifer which only occurs within less than two percent of the project area and in relatively inaccessible areas where no infrastructure is proposed and recreation activities will be very infrequent. These birds include band-tailed pigeon, Brewer's blackbird, Cassin's finch, evening grosbeak, flammulated owl, Grace's warbler, Lewis's woodpecker, McGillivray's warbler, Mexican whip-poor-will, olive warbler, olive-sided flycatcher, and red-faced warbler. Within the project area, only 19 of the 31 priority bird species occur or have potential to occur (Table 34).

Table 34. Neotropical Migratory Birds Known to or May Occur within the Project Area

Common Name	Occurrence Type	Nest Type	Primary Ecological Response Units	Notes
Bell's Vireo	Known to breed in FWSRC	shrub, tree	Cottonwood Willow Riparian Forest	Nests in shrubs and trees at 1.5-10.8 ft.
Bendire's Thrasher	Possible breeding	shrub, tree	Semi-desert Grassland	Local nester N. of Mogollon Rim; some potential on Forest. ABBA, ebird. Nests in shrubs and trees at 1.9-9.8 ft.
Black-chinned Sparrow	Known to breed in FWSRC	shrub	Interior Chaparral	Probable breeder on the Forest below Mogollon Rim (ABBA). Nest height 1.2-6.8 ft.
Black-throated Gray Warbler	Known to breed in FWSRC	tree	Pinyon Juniper Woodland, Pinyon Juniper Evergreen Shrub	In P-J on the Forest (ABBA). Nests in oaks and junipers 1.6-16.1 ft, which is lower than reported elsewhere in AZ

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Common Name	Occurrence Type	Nest Type	Primary Ecological Response Units	Notes
Chestnut-collared Longspur	Possible wintering	n/a	Semidesert Grassland	Occasional; more often adjacent (e.g. Babbit Tank Buffalo Ranch road). Ebird winter detections at Mormon Lake and Doney Park.
Common Black-Hawk	Known to breed in FWSRC	tree	Montane Willow Riparian Forest, Mixed Broadleaf Riparian Forest, Cottonwood Willow Riparian Forest	
Common Nighthawk	Likely breeding, but no night surveys	ground	Ponderosa Pine (including P-O)Pinyon Juniper Woodland, Great Basin Grassland	
Elf Owl	Possible migration and breeding	tree	Cottonwood Willow Riparian Forest	Historical from Oak Creek and BBA atlas detection there. Several eBird detections in April and May. Nest cavities in saguaro, mesquite, cottonwood, willow, sycamore 10-59 ft
Ferruginous Hawk	Possible migration	n/a	Grasslands (all 3?)	In migration and breed off the Forest, but nearby. Spends at least early part of the winter on the Forest (Bald Eagle Midwinter Survey results).
Flammulated Owl	Possible breeding	cavities in Gambel's oak, ponderosa pine, aspen, AZ cypress, AZ sycamore, usually 10-40 ft	Ponderosa Pine	Probable breeder (ABBA); confirmed breeder Forest survey records.
Grace's Warbler	Possible breeding	usually in ponderosa pine 25-40 ft	Ponderosa Pine	
Gray Vireo	Known to breed in FWSRC	usually junipers from 3-17 ft	Pinyon Juniper Woodland, Pinyon Juniper Evergreen Shrub	
Lark Bunting	Possible migration and wintering	n/a	Semidesert Grassland, Desert Communities	Many eBird sightings; mostly scattered throughout Verde Valley.
Lucy's Warbler	Known to breed in FWSRC	tree	Cottonwood Willow Riparian Forest	Nest cavities from 2-36 ft.
Phainopepla	Known to breed in FWSRC	tree	Desert Communities	ABBA - desert washes, desertscrub. Nests in desert trees such as palo verde, mesquite, acacia, oaks from 3-33 ft.
Savannah Sparrow	Possible wintering	n/a	open habitats	Winter and migration detections scattered throughout forest
Virginia's Warbler	Known to breed in FWSRC	ground, shrub	many	Many habitat types; shrub or oak understory is key. Nests on the ground under grass clumps or in woody shrubs, often on slopes.
Wood Duck	Observed in Fossil Creek	tree	Cottonwood Willow Riparian Forest	cavity nester

Common Name	Occurrence Type	Nest Type	Primary Ecological Response Units	Notes
Yellow Warbler (<i>sonorana</i> ssp.)	Known to breed in FWSRC	tree	Cottonwood Willow Riparian Forest; Mixed Deciduous Riparian Forest	Nest heights 13-42 ft.

General Wildlife (Non-Special Status Species)

The Fossil Creek area provides a variety of habitat types that support an abundance of wildlife. The habitat types found in the area include ponderosa pine, pinyon/juniper, chaparral, desert scrub, desert grasslands, and riparian. This diversity supports hundreds of species of reptiles, amphibians, fish, birds, and mammals. Some SGCN species were not analyzed in the sections above where all SGCN Tier 1A and most SGCN Tier 1B species were included, so they are included in this section.

Mammals

Game species in the Fossil Creek area include elk, mule deer, white-tailed deer, bear, mountain lion, bobcat, gray fox, coyote, javelina, beaver, otter, cottontail and jackrabbits, squirrels, and raccoons. Elk are primarily found in mixed conifer and ponderosa pine woodlands during the spring, summer and fall months but move into pinyon-juniper woodlands during the winter, especially when deep snows preclude access to forage in the higher country. Deer, mountain lion, bobcat, coyote, fox, cottontails and jackrabbits occur throughout all biotic communities within the Fossil planning area. Javelina occur in desert scrub, grassland, riparian, and chaparral and pinyon/juniper slopes with abundant prickly pear cacti. Raccoons occur primarily within riparian and other vegetative zones within close proximity to riparian areas. Refer to Appendix C for a list of actual mammal observation in Fossil Creek as well as a list of species for which suitable habitat occurs.

Non-game mammal species include chipmunks, mice, rats, woodrats, skunks, ring-tailed cats, and numerous species of bats (some of which are analyzed in the sensitive species section). Spotted and striped skunks occur primarily within riparian and other vegetative zones within close proximity to riparian areas. Hog-nosed skunks may occur more in upland habitats. Cliff chipmunks, white-footed mouse, and white-throated woodrat are a few small mammal species that occur within the chaparral and pinyon-juniper habitats. Rock squirrel, Harris' antelope ground squirrel, harvest mouse, and brush mouse are other small mammals that likely occur in the planning area. Sinagua High School teachers have been conducting annual surveys for small mammals and macroinvertebrates in Fossil for well over a decade. Small mammals trapped included: a ring-tail cat, southern grasshopper mice, and pinyon mice.

Following is a summary of all known bat survey efforts in Fossil Creek. Bat species codes are the first two letters of the genus and species – refer to scientific names in Table 35. Detailed descriptions of the population status of and survey efforts for the western red bat, Allen's lappet-browed bat, plate Townsend's big-eared bat, and spotted bat are provided in an earlier section of this report.

Bat surveys on the Tonto National Forest in 1993 and 1994 detected Myau (1), Nyfe (1), Epfu (5) in Fossil near Flume Trailhead (now called the Lewis trailhead), and Epfu (1) at a tank on Hardscrabble Mesa in pinyon-juniper woodland. Refer to Table 35 for a crosswalk of bat names and species codes.

Table 35: Crosswalk of bat scientific name, common name, and species code

Common Name	Scientific Name	Species Code
Yuma Myotis	<i>Myotis yumanensis</i>	Myym
Cave Myotis	<i>Myotis velifer</i>	Myve
Arizona Myotis	<i>Myotis occultus</i>	Myoc
Long-eared Myotis	<i>Myotis evotis</i>	Myev
Southwestern Myotis	<i>Myotis auriculus</i>	Myau

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Common Name	Scientific Name	Species Code
Fringed Myotis	<i>Myotis thysanodes</i>	Myth
Long-legged Myotis	<i>Myotis volans</i>	Myvo
California Myotis	<i>Myotis californicus</i>	Myca
Small-footed Myotis	<i>Myotis ciliolabrum</i>	Myci
Silver-haired Bat	<i>Lasionycteris noctivagans</i>	Lano
Canyon Bat	<i>Parastrellus hesperus</i>	Pahe
Big Brown Bat	<i>Eptesicus fuscus</i>	Epfu
Allen's Lappet-browed Bat	<i>Idionycteris phyllotis</i>	Idph
Townsend's Big-eared Bat	<i>Corynorhinus townsendii</i>	Coto
Pallid Bat	<i>Antrozous pallidus</i>	Anpa
Red Bat	<i>Lasiurus borealis</i>	Labo
Hoary Bat	<i>Lasiurus cinereus</i>	Laci
Spotted Bat	<i>Euderma maculatum</i>	Euma
American Free-tailed Bat	<i>Tadarida brasiliensis</i>	Tabr
Big Free-tailed Bat	<i>Nyctinomops macrotis</i>	Nyma
Pocketed Free-tailed Bat	<i>Nyctinomops femorosaccus</i>	Nyfe
Mastiff Bat	<i>Eumops perotis</i>	Eupe
California leaf-nosed Bat	<i>Macrotus californicus</i>	Maca

In 2010, mist netting in May and June at three locations around Fossil Springs resulted in the detection of Myve (1), Epfu (5), Laci (4), Myca (1), and Myyu (1).

Also, in 2010, caves and a fissure near Fossil Springs were inspected during the day for roosting bats. While bats were not observed, one cave had staining and guano, two caves did not have bat sign but in one, that could have been due to the presence of an active bee hive. One set of caves were not seen until after hiking down; roost inspections there are needed. In addition a fissure (a wide near vertical crack) was inspected at the entrance; no bat sign was detected.

In June 2011, a multi-agency effort organized by NAU through a Forest Service contract resulted in hundreds of mist net hours. Over 35 biologists from various agencies across the state turned out for both nights. Janie led a crew each night and assisted Carol with logistics. As a result of this massive effort, agency and volunteer biologists mist netted six sites in Fossil the first night (including 3 crews hiking down the springs trail 4 miles, mist netting three sites until one, then hiking out 5 miles). The next night biologists mist netted three tanks in the uplands within 1/4 mile of Fossil Creek (so still within the CRMP boundary). Overall, 13 species of bat were mist netted. A few unusual species netted included one cave myotis, two red bats, two Townsend's big-eared bats, one Allen's lappet-browed bat, and the Coconino National Forest's first record of a big free-tail. Table 36 shows the species, number, and sex netted during efforts in 2011.

Table 36: 2011 Bat Mist Netting Results.

	Total	Female				Male		percent
		Pregnant	Lactating	Nonreproductive	Postlactating	Nonreproductive	Scrotal	
TABR	50	17	1	4	4	24	0	31.8
ANPA	36	1	23	1	2	3	6	22.9
MYCA	23	0	15	3	3	2	0	14.6
EPFU	12	3	2	0	2	5	0	7.6
PAHE	12	2	6	0	3	1	0	7.6
MYCI	8	1	3	0	2	2	0	5.1
MYAU	3	0	0	0	0	3	0	1.9
MYYU	3	0	0	0	0	2	1	1.9
LABL	2	0	2	0	0	0	0	1.3
MYVE	2	0	0	0	2	0	0	1.3
COTO	1	0	1	0	0	0	0	0.6
IDPH	1	0	0	0	0	1	0	0.6
LANO	1	0	0	0	0	1	0	0.6
MYVO	1	0	0	0	0	0	1	0.6
NYMA	1	0	0	1	0	0	0	0.6
UNKN	1	0	0	1	0	0	0	0.6

Additional surveys were conducted in 2013 by NAU through a contract with the Forest Service. Surveys at Purple Mountain, Fossil Creek bridge, and Boulder bridge resulted in the capture of 24 individuals (including a red bat that escaped) representing eight species: Anpa, Labl (1), Epfu, Coto (1), Myve, Myca, Pahe, and Epfu. In addition, one big brown bat was hand captured during an inspection of the Boulder Creek bridge and staining and guano indicated use by *Myotis* species.

When combining 2011 and 2013 data, 15 species of bats were captured. Mexican free tails, pallid bats, and California myotis were the most common species, comprising 68% of the 180 bats captured. Sixty-two percent were pregnant, lactating, or post lactating females (as compared to 90% in 2011). Twenty-seven percent of the captures were non-reproductive males.

On June 29, 2016, Forest Service inspected bridges along FR 708 and FR 502 within the Fossil corridor. While no bats were observed and use was not significant, there was evidence that the Boulder and Sally May bridges are being used at least as night roosts. Sally May bridge had a tiny amount of staining indicating light night use.

In 2017, volunteers mapped and scouted out the seven flume tunnels that were closed during the decommissioning phase. Nine of the tunnel entrances/exits were gated before closing the tunnels to the public. Five tunnels entrances/exits were buried and/or sealed and there was no obvious entrance or exit to these tunnels. Exit counts were conducted at a total of seven gated sites in 2017. While none of the tunnels supported large roosts, bats were using four of the seven gated sites; bats were not detected at three sites. Exit counts are still needed at Tunnel 3 entrance and exit. Table 37 displays the survey efforts in 2017 and future survey needs. Refer to Figure 34 for all the known and potential bat roosts in the Fossil corridor.

In the late summer of 2017, the district archeologist reported bats in a cave north of Fossil Springs. On September 27, a cave above Fossil Springs dam was checked for signs of bat use; none was detected.

Table 37: Fossil Flume Tunnels and 2017 Exit Count Survey Results.

Tunnel 1 Entrance	Tunnel is 36" wide and 66" high. Used by bats as a night roost.
Tunnel 1 Exit	Tunnel is 38" wide by 47" high. Used by bats as a night roost.
Tunnel 2 Entrance	No bats were detecting during an exit count.
Tunnel 2 Exit	Tunnel appears to be buried.

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Tunnel 3 Entrance	Tunnel is about 40" wide by 60" high, but part of that is below ground level, so only 28" of the gate is exposed above ground. There is a hole in the roof just behind the gate, about 16" in diameter. An exit count is needed.
Tunnel 3 Exit	The roof has collapsed on the tunnel exit, leaving a large opening for bats and/or people to enter. Tunnel is about 40" wide x 60" high. An exit count is needed.
Tunnel 4 Entrance	Only 45" wide by 46" high. Used by bats both as a day and a night roost.
Tunnel 4 Exit	Only 60" wide by 38" high. Used by bats as a day roost.
Tunnel 5 Entrance	Tunnel is 60" wide by 37" high. No bats were detected during an exit count.
Tunnel 5 Exit	Sealed; not suitable for bats.
Tunnel 6 Entrance	Tunnel is 36" wide by 60" high, but part of that is below ground. Only 18" of the gate is exposed above ground. No bats were detected during exit count.
Tunnel 6 Exit	Tunnel appears to be buried.
Tunnel 7 Entrance	Sealed; not suitable for bats.
Tunnel 7 Exit	Tunnel appears to be buried.

Approximately 22 species of bats may occur in the Fossil Creek area based on species' ranges and habitat preferences (Table 38). When looking at survey data across all years and efforts, 17 bat species have been detected in the greater Fossil Creek area, making this area unique for its high diversity of bat species. The high numbers captured in 2011 and 2013 likely indicate sizeable roosts within the local area. The lower portion of Fossil Creek has been unsurveyed (due to inaccessibility) but has Sonoran desert species such as blue palo verde, indicating the possibility that some low elevation species such as California leaf-nosed bat may occur in the lower portion of Fossil Creek corridor. Roost inspections and exit counts have resulted in the detection of bats or signs of use at 9 sites in the corridor (see figure 34).

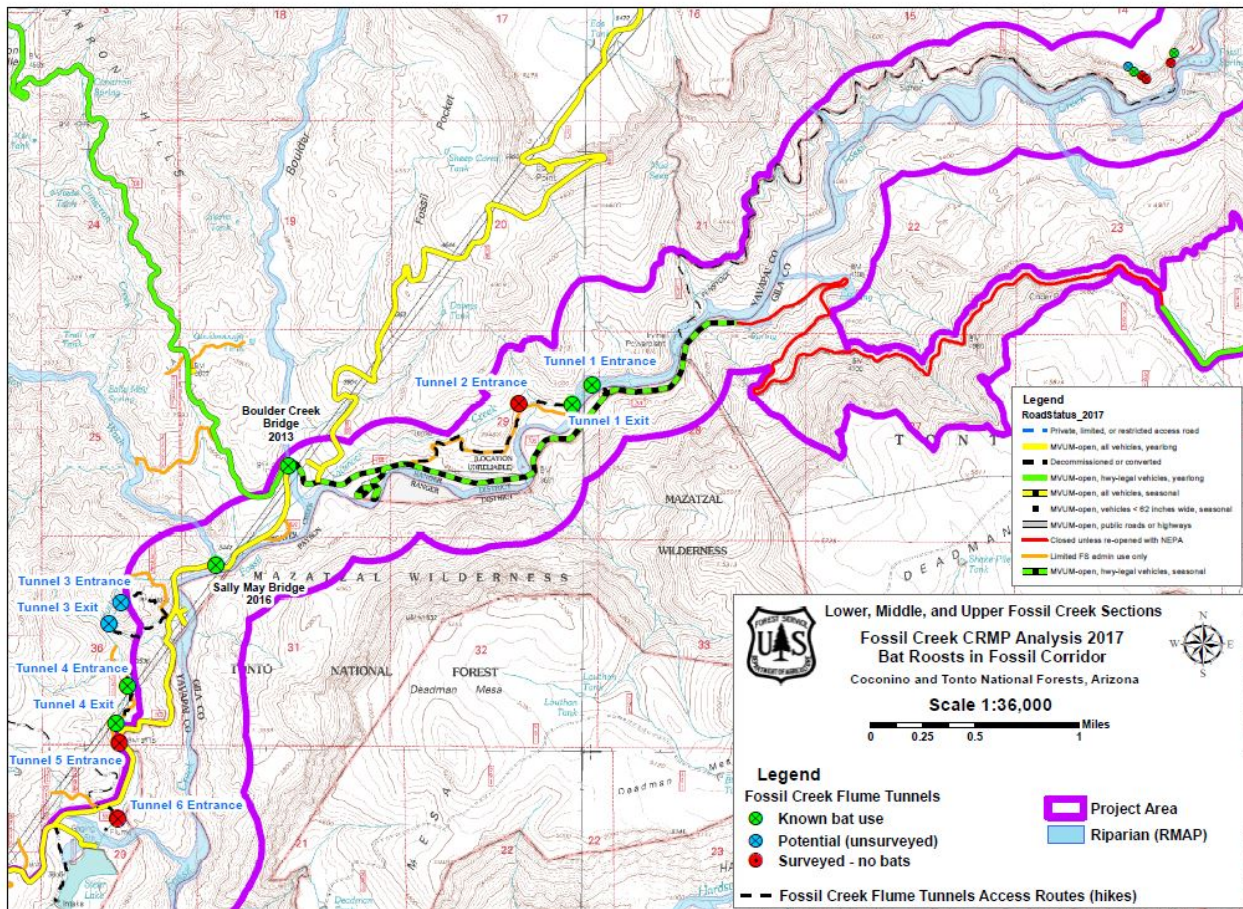


Figure 34: Known and Potential Roost Sites in Fossil WSR Corridor

Table 38: Bat Species and their Habitat Requirements.

Common Name	Scientific Name	Roost Requirements					Habitat						
		S	R	C	T	F	MC	PP	PJ	C	DS	G	R
California leaf-nosed bat	<i>Macrotus californicus</i>			X					X		X		
Yuma myotis*	<i>Myotis yumanensis</i>	X	X	X				X	X		X	X	X
Cave myotis*	<i>Myotis velifer</i>	X		X							X		
Occult little brown bat	<i>Myotis lucifugus occultus</i>	X		X	X			X					
Long-eared myotis	<i>Myotis evotis</i>	X	X	X	X		X	X	X	X			
Southwestern myotis*	<i>Myotis auriculus</i>							X	X	X	X		
Fringed myotis	<i>Myotis thysanodes</i>	X		X	X		X	X	X	X	X	X	
Long legged myotis*	<i>Myotis volans</i>	X	X	X				X	X		X		
California myotis*	<i>Myotis californicus</i>			X				X			X		
Western small-footed myotis*	<i>Myotis ciliolabrum</i>		X	X				X	X	X			X
Pallid bat*	<i>Antrozous pallidus</i>							X	X				
Allen's big-eared bat*	<i>Idionycteris phyllotis</i>		X	X	X		X	X	X				X
Townsend's big-eared bat*	<i>Corynorhynchus townsendii</i>	X		X			X	X	X		X		
Spotted bat	<i>Euderma maculatum</i>		X					X	X	X	X		X
Silver-haired bat*	<i>Lasionycteris noctivagans</i>						X	X	X				
Canyon pipistrelle*	<i>Parastrellus hesperus</i>		X	X			X	X	X		X		X
Big brown bat*	<i>Eptesicus fuscus</i>			X			X	X	X	X	X	X	X
Red bat*	<i>Lasiurus blossevillii</i>					X							X
Hoary Bat*	<i>Lasiurus cinereus</i>					X	X	X	X				
Mexican free-tailed bat*	<i>Tadarida brasiliensis</i>			X				X	X	X	X	X	
Pocketed free-tailed bat*	<i>Nyctinomops ferrosaccus</i>		X								X		
Big free-tailed bat*	<i>Nyctinomops macrotis</i>			X							X		X

Legend**S** = Structures such as buildings, barns, bridges**R** = Cracks and crevices in cliffs, and under rocks**C** = Caves, cliff dwellings, mines, tunnels**T** = Hollow trees, snags, underneath loose tree bark**F** = Among foliage of trees and leafy shrubs**MC** = Mixed Conifer**PP** = Ponderosa Pine**PJ** = Pinyon Juniper**C** = Chaparral**DS** = Desert Scrub**G** = Grassland**R** = Riparian

* Denotes species that have been detected in Fossil Creek during survey efforts.

Few roost inspections have been conducted for bats in the planning area but several occupied bat roosts are known to occur in cliff dwellings and sealed and gated flume tunnels along Fossil Creek. Other roosts likely occur in natural structures such as underneath loose bark on snags, in tree and snag cavities, under rocks, in the cracks and crevices of cliffs, and in man-made structures such as bridges, buildings, and gated flume tunnels. All of the bat species occurring or potentially occurring in the area are insectivorous. Water sources such as earthen stock tanks, springs, seeps, and streams are important for bat foraging due to the abundance of insects found flying above the water. Refer to Table 38 for Bat Species potentially occurring in Fossil corridor and their habitat types.

Birds

There are many species of birds that occur in the Fossil CRMP corridor. A query of the Fossil Creek database (Appendix C) for actual bird observations reveals that numerous species have been documented as occurring in the Fossil Creek area. The majority of these birds are passerines but other groups of birds include waterfowl,

wading birds, fowl-like birds, raptors, and various non-passerine birds such as kingfishers, doves, hummingbirds, and woodpeckers. Of particular note (and that haven't already been analyzed) are zone-tail hawks, American dipper, brown-crested flycatcher, bridled titmouse, yellow warbler, Bullock's oriole and Abert's towhees, Gila woodpeckers, pinyon jay, gray flycatcher, and Lazuli bunting. Other SGCN bird species not recorded but that could occur based on their range and habitat requirements include black-tailed gnatcatcher and common poorwill.

Reptiles & Amphibians

Amphibian and reptiles in the Fossil Creek corridor include several species of toads, frogs, lizards, snakes, and turtle. Amphibians include canyon treefrogs and red spotted toads. Further up in the watershed, striped chorus frogs and tiger salamanders occur. Mountain tree-frogs may occur at the very head of the corridor and likely in the wooded portions of the upper watershed. Numerous species of lizards occur throughout the uplands (non-riparian areas); Gila monster, collared, fence, earless, side-blotched, tree, Gila spotted whiptail, and Madrean alligator. Snake species that occur in the area include: black-necked gartersnake; Sonoran whip snake; Sonoran mountain king snake; gopher (bull) snake; and Arizona black, black-tailed and Western diamondback rattlesnakes. The Sonora mud turtle is also observed all along Fossil Creek. Refer to Appendix C for a list of actual reptile and amphibian observations in Fossil Creek as well as a list of species for which suitable habitat occurs.

Terrestrial Invertebrates

Invertebrate surveys in Fossil Creek have been numerous but have almost exclusively focused on aquatic macro invertebrates (see Fisheries specialist report). Some terrestrial invertebrates that have been observed and documented in the Fossil corridor include tarantula, wolf spider, various beetles (alder leaf flea beetle, tiger, two dot click, green fluorescent, glorious scarab, ten-lined June bug,), cicadas, tarantula hawk, moths (tiger, Virginia and yellow sphinxes, glover silkmoth, Io, Polyphemous), butterflies (Southern dogface, pipevine swallowtail, mourning cloak, painted lady, Arizona sister, Queen, common buckeye, yellow sulphur, Sarah's orangetip, cabbage white, skipper), antlion, katydid, and centipede. Semi terrestrial invertebrates include six-spotted fishing spider, and numerous species of damselflies, skimmers, dragonflies, dobsonflies.

Environmental Consequences for Wildlife and Vegetation.

The entire environmental consequences section starts with a general discussion on how proposed activities can result in direct and indirect effects to special status species and their habitat. More in-depth analysis of effects for individual special status species occur later in this section.

General Effects Common to All Action Alternatives

All action alternatives have both programmatic and site-specific components.

Programmatic actions *common to all action alternatives* include comprehensive river management plan (CRMP) management direction and adjustment of the Fossil Springs botanical area. The CRMP lays out desired conditions, standards, guidelines, objectives, and management approaches for Fossil Creek WSR river values and other resources and uses occurring in the area. This management direction is to ensure that the river's outstandingly remarkable values, including biological habitat and populations are protected or enhanced.

Wildlife and vegetation-specific desired conditions outlined in the CRMP strive towards protecting and maintaining a diversity of wildlife and plant species, improving the status of special status species and contributing to recovery of these species, providing abundant and accessible refugia where species are largely unimpacted from recreation activities, educating visitors about the consequences of introducing and/or spreading non-native species (plants, fish, crayfish, mussels, and diseases). Wildlife and vegetation-specific standards outline in the CRMP ensure: the control and spread of invasive plants, removal of non-native fish should they be introduced in the native fishery. Guidelines provide protection to special status birds during their breeding season, restoration of springs interrupted by manmade features, discouraging visitation to bat roosts, continuing treatment of invasive species, ensuring the permanent fish barrier is functioning properly, limiting mesquite bosque fragmentation and minimizing human use in refugia areas. An objective of obtaining baseline inventory for the

major taxa groups will give a clear picture of diversity and will highlight species that may need special management actions. Management approaches mainly involve close coordination with other agencies and species specialists but also allows for the construction of temporary fish barriers and calls for restoring impacted habitat outside of recreation sites. Enlarging the botanical area, ensuring the integrity of native species and natural ecological processes are maintained, ensuring vegetation communities and soil productivity are largely free of impact from human activities, staggering invasive plant treatments to avoid erosion, and prohibiting horse camping in the botanical area, will all protect the botanical area and this will benefit vegetation as well as riparian and terrestrial wildlife. In summary, the guidance specific to wildlife and vegetation will provide a long-term benefit to regionally important populations and special status species, as well as the unique and exceptionally high quality habitat. As a result, CRMP guidance will result in the protection and enhancement of the diversity of species as well and ensure diverse and contiguous habitat; all of which are criteria for the Biological ORV.

Following in Table 39 is a summary of the effects of programmatic guidance for other program areas on vegetation, wildlife and special status species.

Table 39: Summary of program level effects of the CRMP on vegetation, wildlife, special status species, and their habitat.

Program Area	Anticipated Effects to Riparian Species and Habitat
Free Flow, Water Quantity, and Water Quality	Free flow conditions, a federally reserved water right for stream flows, meeting water quality standards, protecting ecological processes and biodiversity of groundwater-dependent species, restoring springs to proper function, rehabilitate and recover bare soil areas outside of recreation sites, all contribute to long term benefits to species and their habitat.
Riparian Function	Benefits to riparian obligate and aquatic species and their habitat from implementing management direction for proper function riparian areas, ensuring stream channel and banks are stable, and maintaining aquatic management zones.
Vegetation	See discussion above.
Soil Condition	Minimizing human-created bare areas particularly outside of recreation sites and within AMZ and implementing BMPs, site re-design, or restoration to reduce erosion and sedimentation into Fossil Creek will result in long-term benefits to wildlife and their habitat.
Geology	Protection of travertine formations and the unique structural and vegetative habitat they create will protect species particularly in the high-formation reach.
Wildlife, Fish and Aquatic Species	See discussion above.
Traditional Cultural Practices	Discouraging visitation to cliff dwellings, caves, and cliffs and limiting use of banks in Fossil Springs to day use will benefit riparian and aquatic wildlife species and their habitat. Access for traditional practitioners for ceremonies could result in short term noise disturbance to wildlife.
Heritage Resources	The protection and preservation of prehistoric, historic, and traditional/sacred places will also benefit wildlife species and their habitat.
Recreation	When appropriate infrastructure is in place, capacities are appropriately set, entry is managed, developed camping is limited to outside the 100 year floodplain and AMZ, and dispersed camping in limited, impacts to species and their habitat will be reduced. In addition, there will be no: new trails across springs or paralleling Fossil Creek to connect recreation sites; no roadside parking; no motorized watercraft; no campfires; no glass containers, and no rope swings. Trails should be located on soils with low erosion hazard, outside of the AMZ, and away from areas with special-status species concerns. Helicopter landings are restricted to emergency and limited administrative purposes. Recreation fees and partnerships will ensure resources to implement the CRMP, monitoring, and adaptive management. Overall, recreation guidelines strive to ensure visitors are satisfied with their recreation experience. As a result their behavior supports protection of river values, most visitors will recreate responsibly, and the majority of visitors will stay within the designated areas. As a result, the refugia in between recreation sites will be largely free of human disturbance and this will benefit riparian vegetation, riparian and aquatic species, and species' habitat. The developed recreation sites where infrastructure will be constructed, will result in the long-term loss of a small area of wildlife habitat. The recreation use areas will have less effect, but there will be some bare soil areas through the uplands and along the creek banks as a result of recreational activities.
Recreation/Lands Special Uses	The continued use and maintenance of existing utility infrastructure results in a long term loss of wildlife habitat and disturbance to wildlife during maintenance activities. Vegetation under powerlines is kept mainly free of tree canopy and this result in a long-term loss of specific structure required by tree-dependent species. Lands special use guidance that benefits wildlife and their habitat include requiring powerlines comply with avian protection guidelines, not allowing new aerial utilities to be constructed in the Fossil corridor, and not widening existing utility corridors. There will be no commercial filming using

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Program Area	Anticipated Effects to Riparian Species and Habitat
	helicopters or unmanned aerial vehicles. Commercial filming/photography and commercial special-use recreation events will be prohibited during the high-use season; these activities will have minimal impact to species outside of the high use season. Permit holders should provide an education component to their programs and filming should have the primary objective of disseminating information about wild and scenic rivers and their values. In general, recreation special uses permits facilitate resource protection and protect or enhance river values. While outfitter/guided activities can result in visual and aural disturbance to wildlife and impacts to their habitat, impacts will be less than unguided recreation because guides are limited in group size, have a responsibility to educate their customers, and their activities can be closely regulated through a tailored special use permit. Research activities, likewise are screened, tailored to reduce impacts to wildlife and habitat, and contribute data needed to make informed management changes.
Roads and Facilities	The existence of roads and infrastructure equates to the loss of wildlife habitat. Maintenance of roads will include adequate drainage and will implement BMPs, design features; all of which will minimize resource impacts. Unauthorized roads will be decommissioned, obliterated or closed, with priority to roads that intersect stream courses or springs or those that result indirect delivery of sediment to Fossil creek. This will benefit wildlife species and their habitat. In addition, guidance calls for locating recreation infrastructure outside of areas with special status species concerns.
Scenery Resources	There are no negative effects from scenery guidance on wildlife and habitat. Using native vegetation buffers to soften views of infrastructure and rehabilitation of unplanned bare soil areas outside of recreation sites, trails and roads will benefit wildlife and their habitat.
Special Areas	Act-driven restrictions in special areas indirectly benefit wildlife species and their habitat through minimizing the use of motorized equipment and mechanized travel as well as maintaining free flow and protecting and enhancing river values. Expanding the Fossil Springs Botanical Area would increase the area in which the protection and maintenance of physical and biological processes unique to the Fossil Springs area is emphasized. This would benefit wildlife and vegetation by supporting protection of the vegetation and habitat in the vicinity of Fossil Springs.
Interpretation and Education	Interpretation and education will mainly result in indirect benefits to wildlife species and their habitat. In addition interpretation infrastructure and organized activities in the uplands will aid in reducing the amount of people recreating along the creek and in the water. I&E events in the corridor, however, can result in similar visual and aural disturbance to wildlife and impacts to their habitat as described above for recreation.

Effects of the Forest Plan amendments to correct the Fossil Creek Designated Wild and Scenic River Special Area boundary on the Coconino National Forest, incorporate the CRMP's management direction into the Coconino and Tonto forest plans, establish a Fossil Creek Wild and Scenic River Designated Area on the Tonto National Forest, and recommend additions to the Fossil Springs Botanical Area are the same as those effects of the programmatic management direction discussed above.

Site-specific actions common to all action alternatives include: development of recreation sites including construction of infrastructure and delineation of parking; restoration activities; construction and repair of roads and trails; withdrawal of the recreation segment from locatable mineral entry; obtaining federally reserved water rights for streamflows; maintaining access to Stehr Lake, Childs, and Deadman Mesa Road; infrastructure at east and west welcome stations; repair and extension of existing gabion; construction of a new vehicle bridge adjacent to existing Fossil Creek bridge; day use opportunities; access for dispersed backcountry camping; camping for administrative activities and special events; camping at Stehr Lake; possibility of outfitter/guiding activities after a separate needs assessment and prospectus is completed; Mail trail (length and location), maintenance of roads (grading, new drainage improvements, vegetation maintenance and utility maintenance); road hazard mitigation activities (including rock scaling); facilities maintenance; restoration of closed roads, unauthorized roads and trails, and bare soil areas (but amount differ by alternatives); armoring recreation sites and trails; and installation of barriers to delineate sites and installation of runoff retention basins, and other drainage features. Refer to the alternative descriptions for details on these actions that are common to all action alternatives.

Important assumptions, adaptive management measures, and implementation strategies common to all action alternatives include:

- If future changes to CRMP management direction are needed to ensure protection or enhancement of river values, the management direction would be updated and, if necessary, would include the current forest plan amendment process.

- Elements of the monitoring plan may be modified to improve assessment and protection of river values or incorporate new methodologies and the best available science.
- Upon completion of the CRMP, existing infrastructure that supports education and interpretation would be utilized, with materials updated as needed to support CRMP implementation. Over time, additional infrastructure such as kiosks, displays, welcome centers, and group facilities would be built if resources to do so are available and river values are protected.
- Areas outside of recreation sites, construction footprints, and designated roads and trails would serve as relatively undisturbed habitat (refugia) for wildlife, fish, and plants. In refugia areas, the effects from visitor use are anticipated to be so minor as to be negligible and there would be no use of heavy machinery or development of infrastructure.
- If human disturbance that may adversely impact the structure or function of refugia areas is detected, educational messaging could be focused on the importance of refugia, or restoration activities or temporary closures may be used to aid recovery of these areas. Physical barriers such as rocks, vegetative material, or fencing may be used to prevent access to these areas.
- A permit system may be used if needed to accommodate increasing use, administrative considerations or to protect river values, the length of the permit season could be expanded up to the point that it includes the entire year. Likewise, the area for which permits are required for parking or camping may be expanded to include additional locations such as Stehr Lake. The number of daily permits available on a weekly or seasonal basis could be adjusted if needed to provide temporal refugia for fish or wildlife. The permit system could also be adjusted to redistribute the timing, location, and/or type of use as need to protect river values.
- Actual visitor use is anticipated to continue to differ on a seasonal basis. From April through September, recreational uses is highest. From October through March, recreational use is substantially lower and focused more around activities such as hiking, fishing, and hunting. During this low use period, visitor access would not be subject to the permit system unless use increases to the point that it risks exceeding established capacities or adversely affecting river values.
- The precise location and arrangement of amenities within recreation sites would be determined after approval of the CRMP through a separate site design process. However, this analysis assumes that within any portion of developed recreation footprints, disturbance could occur from machinery, the building of infrastructure, the presence of vehicles, and use by visitors. Within the recreation dispersal footprint, the effects of visitors (ground disturbance, noise disturbance, trash, et.) will be analyzed but the assumption is that no major machinery or infrastructure will be used or built in these areas. Minor infrastructure or actions in the recreation dispersal area could include signage, hardened trails, armored creek access, fencing, and restoration activities.
- If monitoring indicates recreation activities or conditions at recreation sites may be adversely impacting river values, a variety of actions may be taken including implementing resource protection measures, modifying the type or arrangement of facilities provided within recreation sites, targeted restoration activities, increased management presence, education efforts targeted at addressing observed impacts, permit system changes to adjust use patterns, or temporary or long-term closures or prohibitions of specific recreation activities.
- Motor vehicle access into the corridor may be temporarily restricted to protect public safety or to protect resources.
- Restoration activities would be prioritized in areas where there is direct connectivity with Fossil creek or where sensitive cultural or natural resources occur.

Administrative activities include area and permit operations, routine maintenance and servicing of facilities, construction activities, survey efforts by other agencies and researchers, and occasional tribal ceremonies. The majority of activity in Fossil Creek is from recreation. Recreational activities occurring within the Fossil Creek

planning area under all alternatives include: swimming, non-motorized boating, snorkeling, picnicking, hiking, biking and equestrian use on certain trails, wilderness exploration, learning about history and contemporary uses associated with the corridor, off-road vehicle use, camping, hunting, fishing, and viewing scenery, wildlife, fish, and plants/wildflowers.

Direct and Indirect Effects to Wildlife

The presence of people (visitors, agency personnel, tribes, researchers, volunteers, law enforcement, emergency responders, and special use permit holders) and pets, and the use of vehicles (personal and administrative, including equipment needed for servicing, maintenance and construction) can result in direct and indirect effects to wildlife and their habitat. Because people would be more concentrated at recreation sites in Fossil Creek, these effects are expected to occur at developed recreation sites which mostly occur in Middle Fossil Creek as well as the Fossil Springs area. However, these impacts would not be expected in the refugia areas (riparian and uplands outside of developed recreation sites, recreation dispersal areas, and roads and trails).

Humans can directly affect wildlife by intentional activities such as handling or collecting, especially reptiles and amphibians and to a lesser extent, invertebrates (Maxell and Hokit, 1999). However, most of direct effects are unintentional consequences including: trampling smaller animals (e.g. invertebrates or tadpoles); physically disturbing frog and toad eggs masses; trampling larvae attached to substrate and/or vegetation; stepping on or knocking over nests; and spilling contents of nests (Hamann et al. 1999). Handling, harassing, or translocating reptiles or amphibians can result in increased risk of mortality, especially certain species more susceptible to stress from human handling (Maxell and Hokit 1999). It is anticipated that most of these types of disturbances will occur from visitors and their pets as they recreate along Fossil Creek in the developed recreation sites. Vehicular activities, including construction and restoration activities can result in collisions that injure or killed individuals, particularly reptiles, small mammals, passerine birds, and invertebrates.

Activities in Fossil Creek under all alternatives can directly affect wildlife species when people, pets, vehicles and equipment cause aural and visual disturbance to wildlife present in the planning area. Aural disturbance occurs when noises (such as that from people, pets, vehicles, equipment, and music) occurs within close enough proximity to wildlife. Visual and aural disturbance results in reduced health and fitness, reduced reproduction rates, and increased mortality/decreased reproductive success (Leung and Marion, 2000). Proposed activities that can result in direct disturbance to wildlife include: day use at developed recreation sites, camping in designated campsites and in wilderness, and dispersed back country recreation such as canyoneering in Fossil Springs and Mazatzal wildernesses; repair and extension of the gabion along FR502; construction of a new vehicle bridge on FR 708; road hazard mitigation activities; and construction of infrastructure when it results in new ground disturbance. Other proposed activities that have a short term impact but long term benefit to wildlife include maintenance of roads and trails, maintenance of facilities, construction of infrastructure that contains recreation impacts (parking area delineation) and mitigates effects (runoff retention basins that reduce contaminants from reaching Fossil creek), and restoration activities.

Most bird, mammal, reptile, and aerial invertebrate species are mobile and are capable of dispersing from disturbance. However disturbance that is frequent, or of long duration, or during critical periods (such as visitor use of designated recreation sites in Middle Fossil and up at Fossil Springs) can result in: disrupted wildlife movement; abandonment of nests, dens or roosts; nest failure; and even abandonment of young (Knight and Cole 1991). Individuals incapable of dispersal (eggs, larvae, non-aerial individuals such as invertebrates or tadpoles, dependent young, and egg masses attached to aquatic vegetation or substrate) or individuals unwilling to disperse (adults with immobile young) can experience negative effects including: death or injury from trampling, crushing, and collection; increased physiological stress; flushing of birds from incubating eggs thus increasing potential for eggs to become unviable; premature fledging of young from nests; and exposing nests resulting in an increased potential for predation, nest parasitism, and exposure to elements. Response to humans include altered behavior, changes in spatial distribution, and changes in the use of habitats (Hamann et al. 1999). Monitoring data shows that when recreation numbers drastically increased at both the waterfall and the historic Fossil Springs dam, black-hawks nesting at those sites disappeared after 2007 and before 2009; as of 2011 neither of those two

territories have been reoccupied. Proposed activities that may result in disturbance to wildlife over the long term include; day use, camping, and dispersed back country recreation; use along roads and trails; and construction of infrastructure when it results in new ground disturbance. Again, these impacts to wildlife would not be expected in the refugia areas (riparian and uplands outside of developed recreation sites, recreation dispersal areas, and roads and trails).

Disturbance to bats may occur when activities in the corridor result in noise within close enough proximity to bat roost (particularly maternity roosts) and hibernacula locations. Noise disturbance at certain intensities can disturb bats in their roosts and result in premature exiting or unnecessary arousal from hibernation. Since hibernating bats often have only enough fat reserve to bring them out of hibernation once, disturbance during the winter can trigger bats to arouse from hibernation, only to go resume hibernation without enough fat reserves to come back out in the spring. Noise disturbance of long duration can cause temporary or permanent roost abandonment. Recreation-caused changes to vegetation can result in reduced plants that are hosts to insects that insectivorous bats eat. Only a handful of bat roosts are known and except for the bridges, the flume tunnels and most cliff dwelling roosts occur mainly in areas away from or relatively inaccessible to visitors. However there are many unknown roost locations including, trees, snags, crevices in cliffs, caves, rocks on talus slopes, etc. Bats that roost among foliage of deciduous trees are also likely to be disturbed in recreation sites. As for hibernating bats, activities in Fossil are fairly limited during that season and is mainly from hunting and fishing and then administrative activities such as maintenance, construction, and restoration. Construction, maintenance, and restoration activities would have the most potential for disturbing hibernating bats, especially since hibernacula locations are unknown.

More specifically, proposed administrative activities that may affect species and their habitat, either temporarily or long-term, include construction (new infrastructure such as the 708 bridge) and certain maintenance activities (such as the failing gabions). Construction activities may directly affect wildlife (through visual and aural disturbance) and their habitat. However, since most construction activities are likely to occur outside of the high-use recreation season and critical breeding season for birds, most construction will not disturb nesting birds. Likewise, restoration activities are most likely to occur before or after the high use season. Overall construction and restoration activities should have minimal impact to wildlife species and their habitat.

Forest Service employees have observed over the years of interim management, an increase in the number of ants and skunks in high-recreation-use areas of the Fossil corridor. Wild predators (ravens, skunks, raccoons, coyotes, and foxes) are supported at artificially higher numbers where high human activity generates more trash and displace native species, and can have higher predation rates on reptiles and amphibians (Maxell and Hokit 1999).

There is always potential that visitors to Fossil Creek illegally or unintentionally introduce non-native species (such as non-native sport fish; invasive plants) or move non-natives around within the corridor (such as crayfish). Nonnative species directly affect wildlife through competition, predation, reduced diversity of prey, and increased risk of introducing or spreading disease or pathogens (Maxell and Hokit 1999). Non-native fish introduced into Fossil would not only put native fish at risk, but also native amphibians (such as lowland leopard frogs) which would in turn affect predators such as gartersnakes and black-hawks.

Administrative (area management, construction, and restoration activities) and recreation activities can directly affect wildlife habitat when activities in the corridor disturb, alter, or destroy their habitat. Activities and infrastructure that support these activities can act as barriers to, and displace wildlife from, food, water and shelter (Leung and Marion 2000). Recreational use at designated sites and along roads and trails also contribute to introduction and spread of invasive species, both plant and animal (Leung and Marion 2000).

Pronounced ground-disturbing activities alter the characteristics of soil, vegetation, and water which affect the quality and amount of food, water, cover, and nest substrate and concealment, for wildlife resulting in a decline in the diversity and species richness of wildlife species (Cole and Landres, 1995 and Leung and Marion, 2000). Impacts from visitation on vegetation include a reduction in the amount and types of herbaceous ground cover; decline in plant vigor, reduction and even elimination of tree seedlings and saplings, mechanical injury to mature

trees which encourages diseases and parasites, shift in species diversity to those more tolerant of impacts, and establishment and spread of invasive species (Johnson and Carothers, 1982 and Cole and Landres, 1995). Impacts from proposed activities on soils can include: compaction, reduction in plant ground cover, reduced infiltration, and reduced organic debris (Johnson and Carothers, 1982 and Cole and Landres, 1995). Compacted soil hinders burrow excavation and affects fossorial wildlife species (such as ground squirrels) and species that prey on them (such as Gila monsters).

Activities within the riparian zone result in: loss of soil-stabilizing ground cover; exposed and eroding stream banks, soil compaction; direct damage to riparian plants from trampling of riparian vegetation; exposure of the root system of woody riparian plants; decreased amount of grasses, forbs, shrubs, and recruitment trees; increased potential for establishment and spread of invasive weeds; decreased infiltration of water during rain events; decreased soil moisture availability to plants; increase rates of run off; increased sedimentation into streams; increase of trash and contaminants (human waste, vehicle fluids) into streams; decreased water quality (higher levels of turbidity and *E.coli*, altered pH levels), and exacerbated flooding.

Unauthorized trails from day use and camp sites lead directly down to Fossil Creek and act as conduits facilitating sediment input into Fossil Creek. When these activities occur in the uplands, they cause degraded upland conditions which subsequently cause increased water runoff, increased soil deposition, decreased water quality; further contributing to decreased quality of riparian habitat. Excessive sedimentation into Fossil Creek can result in the stream substrate becoming embedded with soil. This reduces the surface area for macroinvertebrates to attach. Macroinvertebrates are the food source for many aquatic and riparian obligate species; when macroinvertebrate populations decline, the effects carries over to predator species as well. These impacts are mostly likely to occur at Fossil Springs and the Middle Fossil area (Waterfall downstream to Mazatzal), but are not expected to occur above the springs nor below the Mazatzal recreation site.

Following in Figures 35- 38 are pictures demonstrating denuded and compacted soil at high use recreation sites in Fossil in the years following restoration of full flows.



Figure 35. Denuded area at Fossil Creek Bridge (left) and Purple Mountain (right), 2006



Figure 36. Denuded area at unknown Fossil Creek location, 2013



Figure 37. Denuded area at Sally May (left) and the waterfall (right), 2016



Figure 38. Denuded area along the Waterfall Trail, 2017

Poor road and trail drainage causes erosion and sediment delivery which can result in: altered channel morphology, loss of fish spawning and rearing habitat, and changes in the macroinvertebrate assemblage (Lisle 1989; Miller and Benda 2000; Wood and Armitage 1997). When sediment from unmaintained roads indirectly affect fish and macroinvertebrates, there is a subsequent affect to those species that forage on fish and macroinvertebrates. Frogs, toads, and some birds (such as the American dipper) depend on aquatic invertebrates

for food. Garter snakes depend at least partly on fish, frogs, toads, tadpoles, and salamanders for food. Insectivorous birds (flycatchers, warblers, and others) and bats depend at least partly on the aerial life forms of aquatic macroinvertebrates for food. Birds such as black-hawks, herons and kingfishers depend on fish and other aquatic organisms for their food. Mammals such as raccoons and river otters depend at least partly on fish and aquatic invertebrates for their food.

Proposed activities such as improved drainage along designated roads and trails, withdrawal from mineral entry, repair of the gabion, restoration of closed roads and unauthorized roads and trails, delineation of creek access trails that lead to armored areas, barriers to delineate sites, installation of runoff retention basins all contribute to reducing the amount of sediment that gets into Fossil Creek. Monitoring bare area will ensure timely closure and restoration of unauthorized trails. All these activities will minimize effects to aquatic species and those species they depend on aquatic species for food.

Trails, roads, and recreation sites, especially within the riparian corridor, fragment habitat and reduce the amount of unaltered habitat. Fragmentation of limited and linear habitats, such as riparian areas, causes greater effects to songbirds when compared to fragmentation of uplands adjacent to riparian (Hamann et al. 1999). Trails, roads, and recreation sites fragment habitat, reduce hiding cover, and disrupt wildlife movement, all of which increase the potential for predation and loss of nesting, roosting, and hiding areas. The cumulative decrease in the quality and quantity of suitable nesting, roosting, and foraging habitat from all activities in the project area can cause site abandonment ultimately reducing the composition and diversity of wildlife species over the next several decades. The concept of refugia – protecting the areas outside of roads, trails and the recreation sites, along with mostly day use, will reduce the potential for fragmentation.

Vehicle use on roads and parking at recreation sites may contribute to pollutants (oils, fuels, radiator fluids) that can affect macroinvertebrates, amphibians, and aquatic reptiles as well as their habitat when these vehicle-related pollutants enter streams (Maxell and Hokit 1999). The proposed sediment retention basins to be constructed in the parking lots will reduce this potential.

Use of helicopters for search and rescue may occur anywhere within the Fossil corridor and could result in short term disturbance to wildlife resulting in individuals fleeing from the vicinity of a land zone. However, this disturbance will be very infrequent and of short duration and is not expected to cause abandonment for a long enough duration to result in mortality.

Indirect Effects to Habitat

Ground disturbing activities, such that occur in areas where people concentrate at recreation sites in Middle Fossil Creek and the Fossil Springs area, result in the removal of organic material on the soil surface. Removal of vegetation cover, in addition to compaction, decreases infiltration of the soil, which enhances surface runoff (U.S. Fish and Wildlife Service 1993b). Increased runoff in turn then results in increased silt loads, increased turbidity, decreased water quality, increased scouring during high flows, and altered pH levels. At the lowest level sedimentation increases embeddedness which decreased habitat availability for macroinvertebrates which are the base of the food chain.

While monitoring will show where impacts are occurring and adaptive management will result in the on-the-ground action to reduce those impacts, there may be a temporal delay in implementation. For example, unauthorized trails are more likely to become established in the summer months during the high use period. Monitoring in the off season would not detect the impact of unauthorized trails until fall/winter. Closure of unauthorized trails should occur before the next high use season. This temporal delay will result in short-term impacts such as trampled vegetation, bare soil soils, potential sediment source for Fossil, and visual/aural disturbance to special status wildlife species.

Invasive plant species affect wildlife and wildlife habitat in numerous ways. Vehicles, people and pets can bring in seed as well as spread it throughout the corridor. Infestations of invasive non-native plant species: reduce the diversity of plants in an area, even resulting in monostands; reduce ground cover; reduce forage for wildlife;

deteriorate wildlife habitat; out-compete native vegetation, and in some cases can be toxic to wildlife. In Fossil Creek, non-native plants such as Himalayan blackberry, giant reed, and tall fescue are well established in some areas. Where these invasive species occur, they result in dense stands where no native vegetation can persist. Moreover, endophytes in fescue causes the plants to produce an alkaloid toxin that makes the plant unsuitable for animals and allows fescue to outcompete other plant species. Birds that eat large portions of infected seed are subject to substantial weight loss (Madej 1991). Fungal endophyte-infected fescue is toxic when consumed by mammalian herbivores (Clay et al 1984). Not all fescue is infected with endophytes, however, and it is unknown whether tall fescue in Fossil contains endophytes. Even without endophytes, this non-native grass overtakes the wetted soil within riparian areas, forms a dense stand that out-competes native herbaceous vegetation, reduces vegetative diversity, and is considered an inferior source of food for animals when compared to a native assemblage of plants.

Beneficial Effects

Many of the measures common to all action alternatives will have a positive effect in moving current vegetation and wildlife resource towards the desired future conditions. In general, a river management plan along with monitoring and adaptive management will, in the long term, reduce: bare soil areas; erosion, soil runoff and sedimentation in the stream; trash, human waste, and vehicle pollutants; creek access to areas with soft, unarmored banks; the creation and long-term use of unauthorized trails and roads; and uninformed and/or improperly behaved visitors. Benefits are also expected from: obtaining federally reserved water rights; withdrawal from locatable mineral entry; use of sustainable materials and energy sources; more and focused education, interpretation, and research; more restoration and maintenance to reduce erosion and sediment; more appropriate infrastructure that harden sites, improves visitor distribution, and reduces visitor impacts; more and better quality refugia areas; potential for future outfitter/guide activities which can help manage recreation; and consistent management of the Fossil Springs Botanical Area.

The healthier and more diverse a habitat, the less likely it is to have invasive species establish and flourish, partly due to a reduced chance of introducing new species as well as a reduced chance of establishment. All of the management actions listed above that benefit general vegetation composition, structure and resiliency will lead to these areas being less susceptible to invasion by weeds as well as minimizing spread of current populations. Invasive species are introduced to an area by humans and their equipment.

Effects Unique to Each Action Alternative

The best way to demonstrate the differences in amount of habitat altered/destroyed by alternative is through a table. The following table summarizes various categories of disturbance and restoration miles and acres by alternative by vegetative community.

Table 40: Summary of Disturbed Acres in the Project Area by Veg Type and Alternative

Vegetation Type	No Action	Alt B	Alt C	Alt D	Alt E	Alt F
Alligator/Utah juniper Savanna	4.6	4.6	4.6	4.6	5.3	4.6
Juniper Woodland – Semi Desert Grassland Transition	15.6	13.8	16.6	12.9	17.4	21.4
Lake (No longer lake – now PJ/Semi Desert Grassland)	0.1	0.03	0.03	0	0.03	0.03
Pinyon-juniper Woodland	57.3	47.0	48.2	45.6	50.7	48.8
Ponderosa Pine Forest	1.9	1.9	1.9	1.9	1.9	0.8
Riparian Streamside Vegetation + RMAP = Total Riparian Veg	0.2+26.4 = 26.5	0.2+9.1 = 9.3	0.2+8.4 = 8.6	0.2 + 13.4 = 13.6	0.2+21.4 = 21.6	12.6 + 7.8 = 20.4
Semi-desert Grassland	20.3	17.3	17.3	17.3	17.5	17.0
Total Veg Acres disturbed ¹	126.3	94.0	97.1	95.9	114.7	114.3
Total Veg Acres Restored	0	41.2	43.7	46.4	40.6	41.6

¹Total Veg Acres Disturbed for the No Action alternative includes disturbed areas that would be restored in the action alternatives.

The no action has the most acres of disturbed habitat (upland and riparian) of all alternatives, followed by Alt E, Alt F, and Alt C. Alt B has the least followed by Alt D. For restoration, Alternative D calls for the most at 46.4 acres, followed by alternative C (43.7), then F (41.6), then B (41.2), then E (40.6) and least, Alt A (0).

In addition, the differences between alternatives in regard to the various riparian habitat categories is displayed in Table 41. Since most special status species in the corridor are riparian obligates, this data was important to consider in the effects analysis.

Table 41: Summary of Riparian Acres by Category and Alternative

	No Action	Alt B	Alt C	Alt D	Alt E	Alt F
Total Riparian Acres	652.2	652.2	652.2	652.2	652.2	652.2
Riparian Acres Disturbed	26.5	9.3	8.6	13.6	21.6	14.6
Undisturbed Riparian Refugia (rip tot – rip disturbed)	625.6	642.9	643.6	638.6	630.4	637.7
Riparian Acres Restored	0	20.5	21.8	22.3	20.5	20.4
Full Potential for Riparian Refugia (undisturbed rip refugia + riparian acres restored)	625.6	663.4	665.4	661.0	651.0	657.9
Total Number of Recreation Sites with Access to Fossil Creek	9	10	8	4	11	11
Total PAOTs	810	640	720	905	1510	2580

Most of the special status species in the Fossil Creek corridor are either riparian obligates or depend on water and riparian areas for a portion of the life history requirements. In one publication, the authors recommend that no new roads, trails, or campgrounds be established within 600 meters of a stream or riparian forest (Hamann et al. 1999). All action alternatives have recreation sites, roads, and trails within 600 meters of riparian, however the amount of disturbance in riparian habitat differs among alternatives. Acres of riparian habitat disturbed is highest in the no action (26.5 ac), followed by Alt E (21.6 ac), Alt F (14.6), Alt D (13.6 ac) and Alt B (9.3 ac). Alt C has the least impact to riparian veg at 8.6 acres. Riparian acres to be restored is most in alternative D (22.3), followed by C (21.8). Alternatives B and E both call for the restoration of 20.5 acres of riparian areas. Alternative F would restore 20.4 acres. No restoration would be able to occur under the no action alternative until further NEPA was completed. When the riparian acres to be restored is added to undisturbed riparian refugia, the full potential for riparian refugia is most in alternative C (665.4), followed by alternative B (663.4), then D (661.0), then F (657.9) then E (651.0) and last, the no action (625.6).

Alternative F eventually would allow the most PAOTs (2,580), followed by E (1,510), D (905), the no action (810), C (720) and then B (640). If Alternatives B or C were selected, PAOTs would be decreased. If alternatives D, E, or F were selected, PAOTs would not be incrementally increased until infrastructure is in place and monitoring shows there are no effects from current capacities.

Under alternatives A, B, E, and F, roughly 1.65 miles of perennial Fossil Creek would be within recreation sites. This constitutes about 11.3% of the total perennial stream length within the WSR corridor. This means that around 12% of the stream length within the WSR corridor would be within existing or proposed recreation sites. The number and length of recreation sites vary by alternative; consequently the stream length immediately adjacent to recreation sites varies from about 2826 feet (Alt D) to over 8700 feet (Alts E and F) (Table 42). Alternative D is likely to be most protective of stream bank stability since the linear distance of recreation sites immediately adjacent to Fossil Creek is less than that for all the other alternatives whereas alternatives E and F have the most linear distance of recreation sites adjacent to Fossil Creek.

Because most special status species depend on Fossil Creek for all or a part of their needs, another important consideration was to look at PAOTs, linear stream miles within recreation sites, and the potential for crowding resulting in impacts to refugia. The higher the number of visitors, the more crowded visitors may feel within

recreation sites. The higher potential for crowding results in an increased potential for impacts to refugia (i.e. creation of social trails and bare area). Table 42 displays the step-down calculations for arriving at crowding (see Fisheries Specialist Report for full description of table including assumptions and caveats). To facilitate comparison between alternatives of potential recreation impacts and the likelihood of intact refugia, we calculate the potential visitor density. The potential for crowding is most in alt F and D, followed by E and C. The potential for crowding is least under action alternative B. . These values are useful in comparing the potential for impacts between alternatives. For example, visitors using recreation sites in Alternative F are estimated at a density of just over 3 feet/person (3 feet between visitors), whereas visitors in the same area in Alternative B are nearly 12 feet/person. Based on the relative crowding of people in each alternative, it is reasonable to predict that in order to escape the high density of recreation some visitors in Alternative F will be more likely to move away from the dispersed recreation site than in Alternative B (Hall and Shelby 2000; Manning and Valliere 2001).

Table 42: Stream lengths designated for impact from recreation.

	Alt A	Alt B	Alt C	Alt D	Alt E	Alt F
Number of Dispersed Recreation Sites with Creek Access	10	10	7	4	10	10
Stream length with recreation access (ft)	7,511	7511	4642	2826	8195	8021
People at one time (PAOT)	810	640	720	905 total 475 at rec sites	1,510	2,580
Feet of stream per person if every visitor stays within Recreation Sites	10.2	13.4	7.0	4.4	6.1	3.2

While monitoring and adaptive management will prevent long-term effects, such as crowding and impacts to refugia, from occurring, there is potential that these effects occur for a season (or a year) before monitoring is conducted and adaptive management is implemented, or even for several seasons (or years) if adaptive management techniques are not effective the first year.

Alternative B

Direct and Indirect Effects

The total disturbed acres (open roads and trails, unauthorized roads and trails, bare soil area, developed recreation footprint, and admin sites) is 94 acres; of which, 9.3 acres occur in riparian and 84.7 acres occurs in the uplands.

In general, construction activities will result in direct removal of vegetation (habitat) and disturbance to wildlife. Construction activities may directly affect wildlife (through visual and aural disturbance) and their habitat. However, since most construction activities are likely to occur outside of the high-use recreation season and critical breeding season for birds, most construction will not disturb nesting birds. Likewise, restoration activities are most likely to occur before or after the high use season. Overall construction and restoration activities should have minimal impact to wildlife species and their habitat. In alternative B, new construction would occur at Heinrich and could include a welcome center with 15 parking spaces, indoor/outdoor interpretive displays, short interpretive trail and/or canopy walk, toilet, trash receptacles, one-way loop road, host/administrative site with toilet. Habitat at this site is completely upland vegetation with no mesquite bosque and therefore will not affect riparian obligate species. Habitat loss for upland species will occur. In addition, toilets may be installed at the end of the Lewis trail and in the Fossil Springs area. While there could be some minor loss of habitat from toilet placement, there would be an overall benefit to improved water quality.

Camping, especially in or near riparian habitat, can result in trampling and denuding vegetation, compacting vegetation, increased bare area, an increase in sediment into the stream, and a higher potential for trash and

human waste issues. Camping can also result in visual and aural disturbance to wildlife from camping activities, especially birds during their nesting period and roosting bats. Allowing 3 dispersed campsites near Fossil Springs year round and up to 10 campsites at developed rec sites outside of the high use season can result in an increase in the direct and indirect effects to water quality, vegetation, wildlife, and their habitat.

The corridor-wide capacity of 640 PAOT is lowest PAOT of all action alts and 170 PAOT less than current management. Monitoring and adaptive management will ensure that the overall PAOT is appropriate and doesn't result in degradation of river values, including the habitat and population portion of the Biological ORV. Crowding that could lead to visitors dispersing from designated recreation sites into refugia is least likely to occur in action alternative B.

In general, recreation site expansions or development of new amenities would be phased in over time and only if: funding is available for construction and future maintenance; monitoring indicates river values are protected so there's no adverse effect to river values; additional infrastructure is needed to support existing or potential visitor capacities. Priority infrastructure would be toilets, armored creek access routes, designated parking areas with sediment retention features and kiosks.

Beneficial Effects

Refer to the detailed discussion of beneficial effects in the Common to All Action Alternatives section above. Additional benefits unique to this alternative follow. A total of 41.2 acres of bare areas outside of open recreation sites would be restored using a variety of methods, such as soft closures to encourage natural revegetation or hard closures involving ripping, seeding, and temporary barriers. 1.9 acres of unauthorized trails would be restored using above methods. 3.7 acres of unauthorized roads restored and system roads decommissioned. A total of 35.6 acres of bare area not associated with roads and trails would be restored as well. The total acres restored in riparian is 20.5 and uplands is 20.7. When the acres of undisturbed riparian refugia is combined with acres of riparian acres to be restored, a full potential of 663.4 acres of riparian refugia could be realized.

A total of 57 parking spaces at recreation sites would be reduced from the permit season following finalization of the CRMP to bring recreation sites capacities to prescribed levels. This is a reduction of 5 spots at Homestead, 17 spots at Tonto Bench, 3 spots at Irving, 16 spots at Lewis, and 15 spots at Bear Trailhead.

Roads and vehicle access – The currently closed 4.1 mile section of FR 708 would remain closed to motor vehicles (but available for non-motorized travel). Road maintenance would occur to improve drainage and reduce sediment runoff.

If human impacts are detected in the Fossil Springs Botanical Area that affect the physical and biological processes inherent to the area, temporary access restrictions or other means to limit access to the area may be implemented.

Alternative C

Direct and Indirect Effects

The total disturbed acres (open roads and trails, unauthorized roads and trails, bare soil area, developed recreation footprint, and admin sites) is 97.2 acres, of which, 8.6 acres occurs in riparian and 88.6 acres occurs in the uplands.

In general, construction activities will result in direct disturbance to vegetation and wildlife habitat. Construction activities may directly affect wildlife (through visual and aural disturbance) and their habitat. However, since most construction activities are likely to occur outside of the high-use recreation season and critical breeding season for birds, most construction will not disturb nesting birds. Likewise, restoration activities are most likely to occur before or after the high use season. Overall construction and restoration activities should have minimal impact to wildlife species and their habitat. In alternative C, new construction would include the Cactus Flat parking area and visitor center, the Creek View trailhead and trail along with two connectors, a host/admin facility

at Heinrich, the Rim trail and connector, and the new Bear Trailhead. Habitat at these sites is completely upland vegetation with no mesquite bosque and therefore will not affect riparian obligate species. Habitat loss for upland species will occur. The west and east welcome centers could involve new facilities and additional ground disturbance; this would be of upland vegetation and would not affect riparian obligate species.

Allowing three designated campsites at Cactus Flat and four at Rim Trailhead can affect upland species. Camping in the uplands would result in trampling and denuding vegetation, compacting vegetation, increased bare area, and a higher potential for trash and human waste issues. Camping would also cause visual and aural disturbance to wildlife, especially birds during their nesting period and roosting bats. This alternative calls for not allowing any camping in riparian habitat; therefore there will be no direct effects to riparian obligate species and their habitat.

The corridor-wide capacity of 720 PAOT is second lowest PAOT of all action alts and 90 PAOT less than current management. Monitoring and adaptive management will ensure that the overall PAOT is appropriate and doesn't result in degradation of river values, including the habitat and population portion of the Biological ORV. Crowding that could lead to visitors dispersing from designated recreation sites into refugia is more likely to occur in action alternative C compared to action alternatives B and less likely to occur when compared to action alternatives D, E, and F.

In general, recreation site expansions or development of new amenities would be phased in over time and only if: funding is available for construction and future maintenance; monitoring indicates river values are protected so there's no adverse effect to river values; additional infrastructure is needed to support existing or potential visitor capacities. Priority infrastructure would be toilets, armored creek access routes, designated parking areas with sediment retention features and kiosks.

Beneficial Effects

Refer to the detailed discussion of beneficial effects in the Common to All Action Alternatives section above. Although the Rim Trail will require new acres of disturbance, the presence of this trail would provide an opportunity for diverting recreation from riparian areas. Additional benefits unique to this alternative follow. A total of 43.7 acres of bare areas outside of open recreation sites would be restored using a variety of methods, such as soft closures to encourage natural revegetation or hard closures involving ripping, seeding, and temporary barriers. 2.7 acres of unauthorized trails would be restored using above methods. 3.8 acres of unauthorized roads restored and system roads decommissioned. A total of 37.2 acres of bare area not associated with roads and trails would be restore as well. The total acres restored in riparian is 21.8 and uplands is 21.9. When the acres of undisturbed riparian refugia is combined with acres of riparian acres to be restored, a full potential of 665.4 acres of riparian refugia could be realized.

A total of 86 existing parking spaces at recreation sites would be reduced. This is a reduction of 6 spots at Purple Mountain and 10 spots at Sally May with the closure and restoration of those two sites. Because there would be no motorized access beyond Homestead other parking spots to be closed include 10 spots at Fossil Creek bridge, 21 spots at Tonto Bench, and 18 spots at Irving, and 21 spots at Lewis Trailhead.

A 6.1 mile portion of FR 708 would remain closed to motor vehicles (but available for non-motorized travel). Road maintenance would occur to improve drainage and reduce sediment runoff.

In alternative C there would be no access to the Fossil Springs, botanical area, and historic Fossil Springs dam area in order to maximize refugia for wildlife, fish, and vegetation in this area. If adverse effects from human use in the Fossil Springs Botanical Area are detected, measures would be taken to eliminate this use.

Even though Cactus Flat parking area is new construction, parking here and at Homestead will keep motorized vehicles (except for admin use) out of the corridor beyond Homestead. Access to the remaining upstream recreation sites in middle Fossil would be by foot, bicycle and horseback.

Alternative D

Direct and Indirect Effects

The total disturbed acres (open roads and trails, unauthorized roads and trails, bare soil area, developed recreation footprint, and admin sites) is 95.9 acres, of which, 13.6 acres occurs in riparian and 82.3 acres occurs in the uplands.

In general, construction activities will result in direct disturbance to vegetation and wildlife habitat. Construction activities may directly affect wildlife (through visual and aural disturbance) and their habitat. However, since most construction activities are likely to occur outside of the high-use recreation season and critical breeding season for birds, most construction will not disturb nesting birds. Likewise, restoration activities are most likely to occur before or after the high use season. In alternative D, new construction includes additional parking spaces at Irving with a new bridge over Fossil to access new shade ramadas and group use sites. There would also be a boardwalk on the south side of the creek and trail to wildlife blind at Irving. There would be a new one mile Rim Trail loop constructed in the vicinity of the existing Bear Trailhead. New construction at Heinrich includes a small welcome center with 10 parking spaces, short interpretive trail and/or canopy walk, toilet, trash receptacles, as well as host/administrative site with toilet. A 4.1 mile section of 708 would be opened after major repairs (including rock scaling) are completed. Habitat at these site is primarily upland vegetation with no mesquite bosque and therefore will not affect riparian obligate species. Some habitat loss for upland species will occur. The board walk may occur in the riparian corridor, but its intent is to provide armored access. ‘

Motorized use will occur under this alternative. As a result, there would be a slight increase in sedimentation from motorized use along roads. Proper engineering of roads, along with routine road maintenance would make delivery of sediment into Fossil Creek minimal. In addition, increased motorized use would increase noise disturbance to wildlife.

The corridor-wide capacity of 905 PAOT is 95 PAOT more than current management. The presence of more people in the river corridor has the potential to result in a greater magnitude and intensity of effects described in the direct and indirect effects common to all action alternatives section at the beginning of this analysis. However, monitoring and adaptive management will ensure that the overall PAOT is appropriate and doesn’t result in degradation of river values, including the habitat and population portion of the Biological ORV.

In general, recreation site expansions or development of new amenities would be phased in over time and only if: funding is available for construction and future maintenance; monitoring indicates river values are protected so there’s no adverse effect to river values; additional infrastructure is needed to support existing or potential visitor capacities. Priority infrastructure would be toilets, armored creek access routes, designated parking areas with sediment retention features and kiosks. Crowding that could lead to visitors dispersing from designated recreation sites into refugia is more likely to occur in action alternative D compared to action alternatives B, C, and E and less likely to occur when compared to action alternative F.

Beneficial Effects

Refer to the detailed discussion of beneficial effects in the Common to All Action Alternatives section above. Additional benefits unique to this alternative follow. A total of 46.4 acres of bare areas outside of open recreation sites would be restored using a variety of methods, such as soft closures to encourage natural revegetation or hard closures involving ripping, seeding, and temporary barriers. 4.5 miles of unauthorized trails would be restored using above methods. 3.8 miles of unauthorized roads restored and system roads decommissioned. A total of 38.1 acres of bare area not associated with roads and trails would be restore as well. The total acres restored in riparian is 22.3 and uplands is 24.1. When the acres of undisturbed riparian refugia is combined with acres of riparian acres to be restored, a full potential of 661 acres of riparian refugia could be realized. Although the Rim Trail will require new acres of disturbance, the presence of this trail would provide an opportunity for diverting recreation from riparian areas. Scenic driving also diverts some use from riparian.

A total of 73 existing parking spaces at recreation sites would be closed. This is a reduction of 6 spots at Purple Mountain, 10 spots at Sally May, 5 spots at Homestead, 5 spots at Homestead, 21 spots at Tonto Bench, and 21 spots at Lewis.

The Purple Mountain, Sally May, Tonto Bench, and Lewis sites would be closed and rehabilitated. The Lewis and Bear trails would be closed and rehabilitated. A 1.25 mile portion of the Flume trail would be closed and there would be no access to the historic Fossil Springs dam, Fossil Springs, or the botanical area. There would be no camping in Middle Fossil, the east side trailheads, nor the Fossil Springs and botanical area, and this would eliminate the direct and indirect effects associated with camping to wildlife and their habitat.

In alternative D there would be no access to the Fossil Springs, botanical area, and historic Fossil Springs dam area in order to maximize refugia for wildlife, fish, and vegetation in this area. If adverse effects from human use in the Fossil Springs Botanical Area are detected, measures would be taken to eliminate this use.

Alternative E

Direct and Indirect Effects

The total disturbed acres (open roads and trails, unauthorized roads and trails, bare soil area, developed recreation footprint, and admin sites) is 114.4 acres, of which, 21.6 acres occurs in riparian and 92.8 acres occurs in the uplands.

In general, construction activities will result in direct disturbance to vegetation and wildlife habitat. Construction activities may directly affect wildlife (through visual and aural disturbance) and their habitat. However, since most construction activities are likely to occur outside of the high-use recreation season and critical breeding season for birds, most construction will not disturb nesting birds. Likewise, restoration activities are most likely to occur before or after the high use season.

In alternative E, new construction would include: a new welcome center, parking area, and trailhead at Cactus Flat with trails leading from the trailhead; new facilities at Heinrich; additional build-out at Irving including a new bridge across the creek, boardwalk and wildlife blind; a new toilet at the end of the Lewis trail; a new Bear trailhead with a new trail; alternative toilet at Fossil Springs; and a new Rim Trail loop and connector trail. A 4.1 mile section of 708 would be opened after major repairs (including rock scaling) are completed. As a result of motorized use on the 4.1 mile section of FR 708, there would be a slight increase in sedimentation from motorized use along the road. Proper engineering of the road, along with routine road maintenance would make delivery of sediment from FR 708 into Fossil Creek minimal. In addition, there would be increased noise from motorized use along the 4.1 miles that could result in aural disturbance to wildlife.

Habitat at these site is primarily upland vegetation with no mesquite bosque and therefore will not affect riparian obligate species. Some habitat loss for upland species will occur. The board walk may occur in the riparian corridor, but its intent is to provide armored access and reduce compaction of soil, erosion, and sedimentation into the stream.

Camping, especially in or near riparian habitat, can increase the effects to water quality, soil, vegetation, and increase the amount of visual and aural disturbance to wildlife, designating camping. Allowing 3 dispersed campsites near Fossil Springs year round and up to 10 campsites year round at developed rec sites can result in an increase in the direct and indirect effects to water quality, vegetation, wildlife, and their habitat. Camping in the uplands at Cactus Flat and Rim Trailhead can result in direct disturbance to upland wildlife and their habitat.

The corridor-wide capacity of 1,510 PAOT is 700 PAOT more than current management. The presence of more people in the river corridor has the potential to result in a greater magnitude and intensity of effects described in the direct and indirect effects common to all action alternatives section at the beginning of this analysis. However, monitoring and adaptive management will ensure that the overall PAOT is appropriate and doesn't result in degradation of river values, including the habitat and population portion of the Biological ORV. Crowding that

could lead to visitors dispersing from designated recreation sites into refugia is more likely to occur in action alternative E compared to action alternatives B and C, and less likely to occur when compared to action alternatives D and F.

In general, recreation site expansions or development of new amenities would be phased in over time and only if: funding is available for construction and future maintenance; monitoring indicates river values are protected so there's no adverse effect to river values; additional infrastructure is needed to support existing or potential visitor capacities. Priority infrastructure would be toilets, armored creek access routes, designated parking areas with sediment retention features and kiosks.

Beneficial Effects

Refer to the detailed discussion of beneficial effects in the Common to All Action Alternatives section above. Additional benefits unique to this alternative follow. A total of 40.6 acres of bare areas outside of open recreation sites would be restored using a variety of methods, such as soft closures to encourage natural revegetation or hard closures involving ripping, seeding, and temporary barriers. 2.1 miles of unauthorized trails would be restored using above methods. 3.7 miles of unauthorized roads restored and system roads decommissioned. A total of 38.1 acres of bare area not associated with roads and trails would be restore as well. The total acres restored in riparian is 20.5 and uplands is 20.11. When the acres of undisturbed riparian refugia is combined with acres of riparian acres to be restored, a full potential of 651 acres of riparian refugia could be realized.

A total of 6 existing parking spaces at recreation sites would be closed. This is a reduction of 6 spots at Tonto Bench.

If human impacts are detected in the Fossil Springs Botanical Area that affect the physical and biological processes inherent to the area, temporary access restrictions or other means to limit access to the area may be implemented.

Alternative F

Direct and Indirect Effects

The total disturbed acres (open roads and trails, unauthorized roads and trails, bare soil area, developed recreation footprint, and admin sites) is 113.0 acres, of which, 20.4 acres occurs in riparian and 92.6 acres occurs in the uplands.

Upon implementation, 400 parking spaces would be constructed at Cactus Flat with potential for another 100 spaces in the future. This would be an increase of 352 from the current situation. The construction of this parking lot is included in the acres of disturbed area, above. Loss of upland habitat would occur at this location.

In general, construction activities will result in direct disturbance to vegetation and wildlife habitat. Construction activities may directly affect wildlife (through visual and aural disturbance) and their habitat. However, since most construction activities are likely to occur outside of the high-use recreation season and critical breeding season for birds, most construction will not disturb nesting birds. Likewise, restoration activities are most likely to occur before or after the high use season. Overall construction and restoration activities should have minimal impact to wildlife species and their habitat. In alternative F, new construction would include the Cactus Flat parking area and visitor center, additional parking and infrastructure at Homestead, a host/admin site and facilities at Heinrich, the Creek View trailhead and trail along with two connectors, the Rim trail and connector and new bridges installed on the Flume trail across two side canyons (to provide for limited administrative OHV access to the historic dam). Habitat at these construction sites is mostly upland vegetation. Habitat loss for upland species will occur. The only affect to riparian obligate species would be 1) those that also use mesquite bosque (such as yellow-billed cuckoos, Lucy's warbler, and Bell's vireo) and 2) possibly springsnails where they may occur in seeps that flow across the Flume trail. At Homestead, a small amount of mesquite trees may be removed slightly reducing the overall mesquite bosque habitat important to cuckoos for foraging and to other passerine birds for nesting. In order to reduce effects of OHV crossing riparian habitat where seeps cross the Flume trail, structures

will be installed to avoid OHVs from touching wetted soil. Should these seeps be occupied by Fossil springsnails, these structures will ensure that snails are not crushed by OHV vehicles.

Camping, especially in or near riparian habitat, can result in trampling and denuding vegetation, compacting vegetation, increased bare area, an increase in sediment into the stream, and a higher potential for trash and human waste issues. Camping can also result in visual and aural disturbance to wildlife from camping activities, especially birds during their nesting period and roosting bats. Allowing dispersed camping at up to 10 designated walk-in campsites at Homestead year round can result in an increase in the direct and indirect effects to water quality, vegetation, wildlife, and their habitat.

The corridor-wide capacity of 2,580 PAOT is 1,700 PAOT more than current management. The presence of more people in the river corridor has the potential to result in a greater magnitude and intensity of effects described in the direct and indirect effects common to all action alternatives section at the beginning of this analysis. However, monitoring and adaptive management will ensure that the overall PAOT is appropriate and doesn't result in degradation of river values, including the habitat and population portion of the Biological ORV. Crowding that could lead to visitors dispersing from designated recreation sites into refugia is more likely to occur in action alternative F compared to all other action alternatives.

Beneficial Effects

Refer to the detailed discussion of beneficial effects in the Common to All Action Alternatives section above. Closing the Bear trail may result in reduced pressure on riparian habitat, species habitat and to wildlife at Fossil Springs, even though the Fossil Springs area would be accessible via the Flume trail. Although the Rim Trail will require new acres of disturbance, the presence of this trail would provide an opportunity for diverting recreation from riparian areas reducing disturbance to wildlife and habitat. Additional benefits unique to this alternative follow. A total of 40.1 acres of bare areas outside of open recreation sites would be restored using a variety of methods, such as soft closures to encourage natural revegetation or hard closures involving ripping, seeding, and temporary barriers. Two acres of unauthorized trails would be restored using above methods. A total of 3.9 acres of unauthorized roads restored and system roads would be decommissioned. A total of 34.7 acres of bare area not associated with roads and trails would be restore as well. The total acres restored in riparian is 20.4 and uplands is 20.9. When the acres of undisturbed riparian refugia is combined with acres of riparian acres to be restored, a full potential of 657.9 acres of riparian refugia could be realized.

A 4.1 mile portion of FR 708 would remain closed to motor vehicles year round between the Waterfall trailhead and gate on the Strawberry side. This would result in less noise to disturbance to wildlife near that section of road and would reduce the amount of sediment that would make its way to Fossil Creek.

Even though Cactus Flat parking area is new construction, parking there and at Homestead will keep motorized vehicles (except for admin use) out of the corridor beyond Homestead, reducing noise disturbance, collisions, and sedimentation. Access to the remaining upstream recreation sites in middle Fossil would be by foot, bicycle and horseback.

Effects of Not Implementing the Project Actions (No Action)

Programmatic Actions:

Under the no action alternative, there would be no formal monitoring plan and therefore no consistent or effective way to determine when changes in management (adaptive management) are needed in order to minimize adverse effects to species and their habitat. Education and interpretive materials would be provided to support current management system but would not be a focus like they are in the action alternatives. As a result, visitors would have less understanding and be less supportive of river values resulting in more adverse effects to species and their habitat. The no action alternative does not articulate the concept of refugia and therefore, unauthorized trailing and compacted dispersed recreation sites in between the designated recreation sites would not be targeted for closure and rehabilitation. Locatable mineral entry would be possible in the recreation segment and this may result in more direct and indirect effects to species and their habitat.

Without a comprehensive river management plan the river's outstandingly remarkable values, including habitat and population components of the biological ORV, may not be protected or enhanced, even with continued implementation of interim management measures. Since NEPA will not have been completed for on-the-ground actions, implementation of needed actions would be delayed during the time NEPA is completed. In addition, neither forest plan currently has sufficient guidance that would protect the biological ORV, and there would be no forest plan amendments that would incorporate management direction that would protect the biological ORV under the no action alternative. Another programmatic component is the botanical area. The Fossil Springs botanical area would continue to be inconsistent between the two forest plans. Uncertainty about the size and location of the botanical area would contribute to inconsistent management. The botanical area would be smaller (anywhere from 12 to 26 acres) compared to the action alternatives (33 acres) so fewer plants (species and individuals) would be protected. The effects of the plan amendment are the same as the programmatic direction discussed above.

Site Specific Actions:

Under the no action alternative, no permit would be required for camping use so unlimited camping outside of the permit season would be allowed downstream of Fossil Creek bridge and upstream of the historic Fossil Springs dam. Unlimited dispersed camping would be allowed year-round outside of permit area in wild segments. Camping at Stehr Lake area would be allowed year-round. Camping allowed under the no action alternative would result in trampling and denuding vegetation, compacting vegetation, increased bare area, an increase in sediment into the stream, and a higher potential for trash and human waste issues. Camping can also result in visual and aural disturbance to wildlife from camping activities, especially birds during their nesting period and roosting bats. In the wild segments, where camping would be allowed during the summer months, impacts to soil and vegetation would likely be minimal but there would be visual and aural disturbance to wildlife from camping activities, especially birds during their nesting period and roosting bats.

The no action alternative calls for more total parking spots than alts D and E and more rec sites with parking than alts B and D. In addition, the no action alternative does not call for better delineation, surfacing, and installing water retention basins at any of the parking areas. This can result in creep and enlarging of the parking areas, as well as more run off contributing more sediment and vehicle fluids into Fossil Creek. While some of the action alternatives call for more parking spots than the no action, the action alternatives also provide for more infrastructure and site hardening to accommodate those higher numbers.

Overall capacity in the corridor would be 810 persons at one time (PAOT), including administrative use. While this is less than Alternative D, E, and F, the no action alternative would allow more PAOT than Alternatives B and C and wouldn't have NEPA completed on any new infrastructure that would accommodate and absorb the impact of 810 PAOT. Because there would be no refugia concept, repeat visitor use and resulting impacts to streamside vegetation would occur along a much greater length of Fossil Creek than with the action alternatives.

There would be no specific scenic driving permits. This likely results in more visitors spending time along the creek, contributing more impacts to riparian and aquatic species and their habitat. There would be no motorized trail use permits which means that the 708 road would remain closed. But since this section of road would be closed but not rehabbed, erosion and sedimentation coming off the road would be worse in this alternative than any of the action alternatives. Sedimentation into Fossil Creek will contribute to negative impacts to aquatic systems, riparian habitat, and their associated biota.

Under the no action alternative, outfitter/guide use in WSR corridor is minimal. Fewer visitors would be guided and more likely to act irresponsibly, resulting in more resource degradation than guided visitors.

The Creek View Trail, Rim trail, Bear trailhead, and various interpretive trails would not exist. Without these upland trails, dispersal of visitors in the corridor is reduced and more visitors recreated in fewer and more concentrated areas along the creek. This would result in more direct and indirect effects to riparian and aquatic species and habitat.

Any new infrastructure construction would be subject to separate analysis resulting in slower response time in implementing measures to better manage recreation activities in Fossil Creek. Without infrastructure, direct and indirect impacts to aquatic and riparian habitat will be higher than the action alternatives.

Bare areas, unauthorized trails, and unauthorized roads would be restored on an as-needed basis. There would be less restoration of bare areas and unauthorized roads and trails without the management direction provided in a CRMP. Changing the status of system roads would be subject to separate analysis delaying the implementation of restoration activities.

Cumulative Effects Analysis

The spatial boundaries for analyzing the cumulative effects to wildlife and plants is comprised of four sixth code watersheds: Upper Fossil Creek, Lower Fossil Creek, Mud Tanks Draw, and Hardscrabble Creek, and Gap Creek-Verde River, but the portion of Gap Creek is so little that activities in that watershed are negligible in the cumulative effects (see figure 39). These watersheds were selected because there may be downstream indirect effects such as sedimentation and movement of non-native species that result in direct and indirect effects to vegetation, wildlife, and their habitat. In addition, canyoneering, cross country travel, and use of the Mail Trail connect activities in the uplands outside of the corridor to the Fossil Creek corridor. The temporal boundaries for analyzing the cumulative effects are 10 years because we anticipate we will have implemented the majority of the proposed action elements with resulting direct effects from these actions within 10 years.

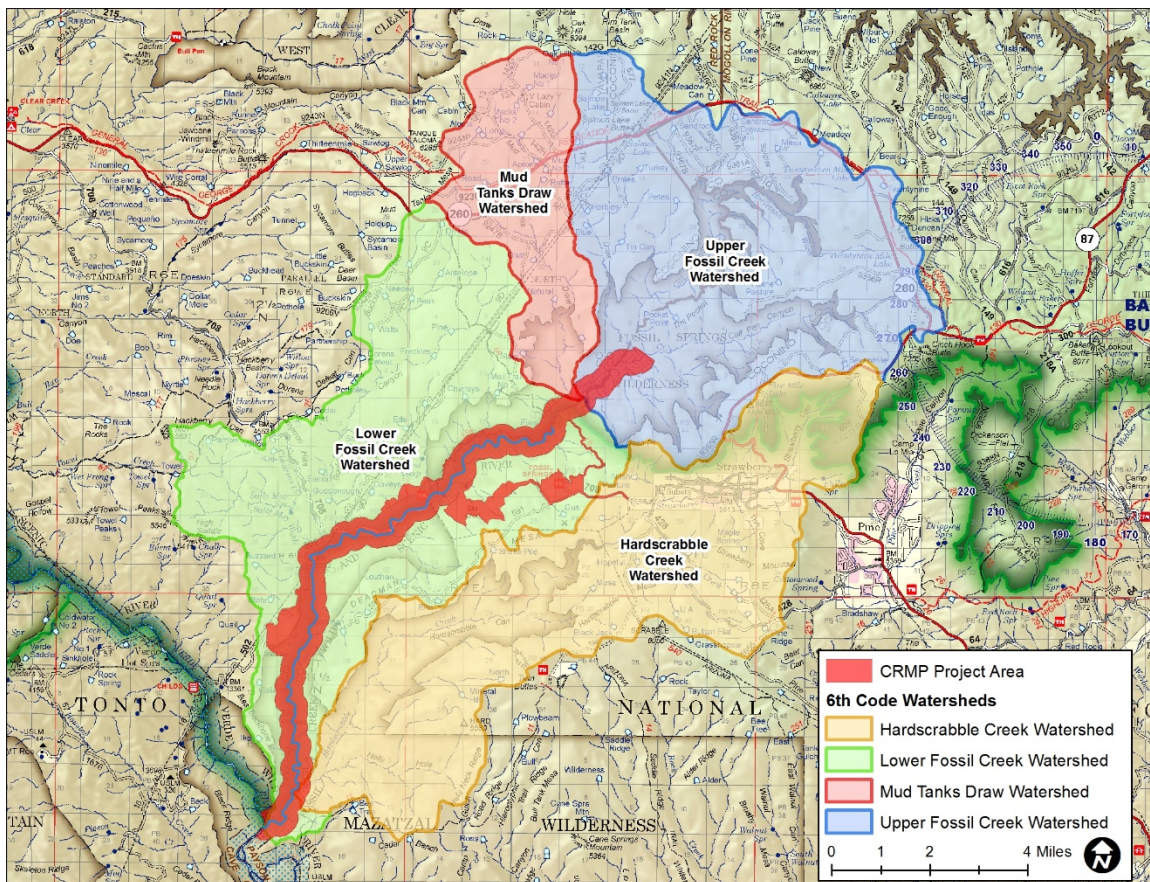


Figure 39: Cumulative Effects Analysis Boundary

The following is a general list of past, present, and reasonably foreseeable future actions within the four 6th Code watersheds (Upper Fossil Creek, Lower Fossil Creek, Mud Tanks Draw, and Hardscrabble Creek) of the Coconino and Tonto national forests considered in the cumulative effects analysis for the Fossil Creek Wild and Scenic River Comprehensive River Management Plan. For more details on these projects, refer to the project file or **Appendix X** of the EIS.

Land Management Activities:

- decommissioning of the hydropower facilities;
- interim management activities including springsnail habitat protection;
- road and trail maintenance;
- vegetation management such as juniper thinning to improve ground cover;
- native fish restoration in Fossil Creek, monitoring, and stocking/repatriation;
- Chiricahua leopard frog habitat protection and enhancement efforts;
- prescribed burning, fuels reduction, and managed wildfires (Pine/Strawberry WUI);
- invasive plant treatments;
- quarrying and mineral storage activities;
- implementation of Travel Management Rule;
- Heinrich land acquisition - 19 acres along Fossil Creek; and
- addition of 1,739 acres in Davey's Recommended Wilderness Area (upon completion of the revised forest plan) Recreation management including roads and trails maintenance;

Public and Permitted Activities:

- livestock grazing;
- repair and maintenance of utility lines -
 - APS lines
 - WAPA lines
 - fiber/optic cable
 - water pipelines in Pine Strawberry area and local communication lines
 - UGSG Stream Gage at Fossil Creek
 - 5 Mile communication site (towers and buildings maintenance and vegetation management (east side of Hwy 87 on the edge of watershed boundary);
- motor vehicle use;
- various temporary recreation seasonal permits for hiking/trail riders around the corridor;
- Research permits of various kinds in the past which are usually require access and minimal ground-disturbing activities; and
- Personal Uses: Firewood permits, personal-use collection, and research-and-education permits.

Activities on Private Lands:

- Urban development and interface growth; and
- Increased groundwater withdrawal.

Cumulative Effects to Riparian Habitat and Species

In general, past, present, and reasonably foreseeable activities may affect wildlife and plant habitat through the loss, destruction, or modification of riparian vegetation. More specifically, activities within the riparian area result in: loss of soil-stabilizing ground cover; soil compaction; decreased amount of grasses, forbs, shrubs, and recruitment trees; increased potential for invasion of exotic weeds; decreased infiltration of water during rain events; increase rates of run off; increased sedimentation into streams; increase of contaminants into streams; and

decreased water quality (Cole and Landres, 1995; Johnson and Carothers, 1982; and Leung and Marion, 2000). All of these activities impact riparian conditions, which consequently degrade wildlife and plant habitat. Some actions can provide benefits to habitat by increasing water flow, reducing impacts from human activities, etc.

Activities within the riparian zone may result in direct aural and visual disturbance to wildlife species, particularly during critical periods such as breeding, roosting, and feeding. Disturbance can result in increased physiological stress, nest, roost, or site abandonment, flushing of birds from eggs, premature fledging of young from nests, and reduction in the amount of suitable nesting and foraging areas.

Past Activities with No or Beneficial Effect

Past activities occurring in riparian areas within the Fossil Creek Watershed include: recreation, hydropower decommissioning, the Heinrich land acquisition, the native fish restoration effort, invasive plant treatments, Fossil interim management activities, maintenance of utility lines, road and trail maintenance, and research and education permits. All activities except for recreation, maintenance of utilities, and research and education permits have benefited wildlife habitat in various ways. The restoration of 43 cfs of spring flows back into Fossil Creek greatly improved aquatic habitat, allowed for native frog colonization downstream of Fossil Springs, and increased the amount and diversity of riparian and aquatic habitat. The decommissioning also restored habitat when infrastructure and man-made structures were deconstructed. The Heinrich acquisition increased the amount of riparian and aquatic habitat within the NFS system and since this site will not allow creek access, there will be an increase in riparian that is off-limits to recreation. The restoration of the native fisheries removed non-native fish species, increased native aquatic species that were previously declining, and provide native prey sources for other riparian obligate species such as the common black-hawk. Treatment of invasive plant species has eliminated some species from the project area and reduced the spread of other species in the corridor. Interim management activities, especially capacity control, since 2005 have incrementally reduced the effects of recreation on natural resources, including fish, wildlife and rare plants. For example interim management resulted in the rerouting of a trail and construction of footbridges to protect the endemic Fossil springsnail at three springs along the waterfall trail. Proper maintenance of roads and trails has contributed to reduced erosion and sedimentation into Fossil Creek and improved water quality and habitat condition for aquatic species, especially macroinvertebrates. Research proposals are carefully screened to avoid adverse effects and typically result in useful information that support and drive future land management decisions resulting in better resource protection. The Fossil stream gage has minimal impact to the stream since operation of the stream gauge is wireless and does not involve any access to the creek beyond the existing pipe and transducer which is fixed to the bedrock channel bottom. The benefits from having stream flow data for research, management, and effects analyses outweighs the short-term effects during the initial installation period.

Past Activities with Adverse Effects

Past activities that may have adversely affected wildlife and their habitat along Fossil Creek include recreation; maintenance of utilities (such as APS and WAPA power lines, fiber/optic line, 5 mile communication site, USGS stream gage, water pipelines and local communication lines in Strawberry); road and trail maintenance; research and education permits; short-term effects from maintenance of the native fisheries; hydropower decommissioning activities; development on private land; and water withdrawal.

Recreation occurring along Fossil Creek increased dramatically after restoration of full flows in 2005. Visitation during the high use season in 2006 was around 20,000 people but by 2011 had increased to 95,000 people. Recreational activities in Fossil Creek, particularly before camping was restricted and capacity controls were implemented starting in 2011, resulted in resource damage including bare soil and compacted soils both adjacent to the creek as well as in the uplands, an increase in trash and human waste, damage to trees, small wildfires, etc (Adams et al. 2015). In addition, the large number of recreationists in a relatively unmanaged recreation setting resulted in direct disturbance to wildlife in Fossil Creek. For example two black-hawk nests were abandoned by the historic Fossil Springs dam and by the waterfall when recreation numbers increased from 37,000 people/high use season to 81,000 people per high use season. Beginning in 2012 capacities were controlled by closing entrances when parking areas filled up. When the permit system was implemented in 2014, recreation use and the

resulting impacts were decreased to a great extent considered so that recreational effects were limited to the most sustainable areas in the project area. Fishing in the uplands is known to occur at stock tanks because non-native fish have been detected in various locations. These non-native fish are a source, that when floods carry them downstream, can become established in Fossil Creek, compromising the entire native fisheries there.

Maintenance of permitted utility sites and lines causes visual, aural, and physical disturbance when done during critical periods for various species (bird nesting, bat roosting, etc.). In addition, maintenance of power lines allows for some removal of riparian trees which reduces habitat. Road and trail maintenance likewise can cause visual and aural disturbance if conducted during critical periods. The Forest Service had to close the section of FR 708 road between the Waterfall and Fossil Springs Trailheads due to the deteriorating condition of the 708 road, the extreme cost to properly repair the road to safety standards, and then to maintain it frequently. As a result, rock falls, rilling, undermining has occurred and has contributed soil and sediment runoff; some of which has likely ended up in Fossil Creek contributing to water quality issues.

Without proper screening or detailed permits, research and educational activities can disturb species as well as impact habitat.

Maintenance of the native fishery, required when non-native fish appeared in the native section, required building a temporary fish barrier, treating 3 miles of stream with a piscicide, repair of the native fish barrier, and having many people in the riparian corridor and along the stream for weeks in 2012. Non-native fish made it over the compromised fish barrier requiring the construction of a temporary fish barrier at Sally May and a piscicide re-treatment along three miles of Fossil Creek. These short-term adverse effects were outweighed by the long-term effects of a non-native free portion of Fossil Creek. Short-term impacts to aquatic species occurred when the historic Fossil Creek Dam was lowered 14 feet in 2009. A subsequent winter storm resulted in severe shearing of banks in the unstable sections above the dam, resulting in scoured habitat above and downstream for several miles. In addition the unstable nature of the channel and the high velocity flows from the winter flood damaged the fish barrier about 10 miles downstream. Fortunately, with phased decommissioning (where frog populations were given four years to colonize in restored flows downstream of the historic Fossil Springs dam), frog populations survived the flood and have rebounded.

Existing wells drilled in the Strawberry have resulted in an increase in groundwater withdrawal. In general throughout the southwest, there is concern with reduced instream flows as a result of groundwater withdrawal.

Ongoing and Future Activities

Ongoing and future activities in the riparian corridor include maintaining the native fisheries which may require similar actions as in the past, invasive plant treatments, repair and maintenance of utilities, and research and educational events. The ongoing and future effects would be the same as described above. In addition, should future drilling of wells on private land result in decreased instream flow in Fossil Creek, further well drilling can have direct effects to aquatic species in Fossil Creek even though private land is miles away from Fossil Creek.

Cumulative Effects to Upland Species and Habitat

The presence of people, vehicles, and equipment in the cumulative effects area can result in aural and visual disturbance to wildlife species, particularly during critical periods such as breeding, roosting, and feeding. Disturbance that occurs frequently and over a period of time can result in increased physiological stress, nest, roost, or site abandonment, flushing of birds from eggs, premature fledging of young from nests, and reduction in the amount of suitable nesting and foraging areas. In addition to direct disturbance to wildlife species, adverse effects to wildlife habitat can occur when activities reduce the amount of soil-stabilizing ground cover, compact soil, reduce the amount of grasses, forbs, shrubs, and recruitment trees; increase the potential for invasion of exotic weeds; all of which contributes to decreased infiltration of water during rain events and increase rates of water and soil runoff. The additive decrease in the quality and quantity of wildlife habitat from all activities in the Fossil Creek cumulative effects area can cause site abandonment ultimately reducing the distribution of wildlife species.

Other past, present, and reasonably foreseeable activities that occur in the uplands of Fossil Creek and contribute to cumulative effects to species and their habitat include: recreation; addition of the Davey's Recommended Wilderness Area, hydropower decommissioning; Heinrich land acquisition; vegetation management; wildlife habitat improvement efforts; prescribed burning; fuels reduction and managed wildfires; invasive plant treatments; quarrying and mineral storage activities; interim management activities; livestock grazing; repair and maintenance of utilities; motor vehicle use; temporary permits for hikers/trail riders; research; personal uses; urban development and interface growth; and increased groundwater withdrawal.

As described above, recreation in Fossil Creek increased from 20,000 to 95,000 people during the high use season before capacity control measures were taken during interim management. While most of the recreational use occurred in the riparian areas, dispersed camping occurred in the uplands until camping restrictions were implemented. Dispersed camping resulted in resource damage including bare soil and compacted soils, an increase in trash and human waste, and increase in nuisance wildlife such as skunks and ants, damage to trees, small wildfires, etc. Other recreation in the cumulative effects area includes hunting and fishing. Hunting, a necessary tool for managing game populations, occurs mostly outside of the critical season for most wildlife species. Fishing in the uplands is known to occur at stock tanks because non-native fish have been detected in various locations. These non-native fish are a source, that when floods carry them downstream, can become established in Fossil Creek, compromising the entire native fisheries there.

Hydropower decommissioning may have had short-term adverse effects to wildlife and habitat in the area through visual and aural disturbance and ground disturbing activities. Stehr Lake was a wetland surrounded by mature deciduous trees. But with decommissioning and restoration of full flows, Stehr Lake dried up and was returned to natural contour. Ultimately, decommissioning benefited species by removing man-made structures and restoring previous developed lands back to natural habitat. During decommissioning, flume tunnels were closed to the public but were fitted with bat gates that have allowed use by bats for roosting structure.

The Heinrich acquisition increased the amount of upland habitat within the NFS system and allows for improved consistency of management of the acquired acres, possibly decreasing fragmentation.

Past, present and continuation of vegetation management involves removing encroached junipers in areas with a natural low (<10%) canopy cover. These types of activities have occurred in Sycamore Basin, and 1,800 acres are planned for treatment on the Fossil Creek Allotment in the upper Fossil Creek watershed. Removal of encroached junipers allows for increased herbaceous cover, reduced erosion and sedimentation into stream channels and stock tanks, and overall improves watershed condition.

Other vegetation management activities include prescribed burning, fuels reduction and managed wildfires. These activities are aimed at moving vegetative condition closer to historic conditions, to reduce overstocked fuels that contribute to catastrophic wildfires, and improving watershed condition. Besides short term disturbance to special status wildlife and plants, as well as their habitat, the overall benefit of restored ecosystem function outweighs the short-term effects from on-the-ground implementation.

Invasive plant treatments have been conducted and will continue to be conducted. There are possible short term disturbances to wildlife, but overall, the control of spreading weeds protects habitat in that vegetative diversity and abundance is preserved. Treatments for woody invasive species occur in the fall and winter months, out of the most critical periods for most wildlife species.

The addition of 1,739 acres in Davey's Recommended Wilderness Area should have slight beneficial effects. This area is already remote and few activities besides livestock grazing and hunting occurs in this area. The designation would provide protection from future proposals such as the designation of new roads for motor vehicle use or proposals that might require installation of range infrastructure that may cause disturbance to wildlife or fragmentation of their habitat.

Chiricahua leopard frog habitat improvement efforts such as the repair and maintenance of stock tanks which are used by this species, habitat fencing, erosion control sock installation, and juniper thinning treatments, have

occurred in portions of the watershed above the rim. These activities have been focused around occupied sites and were deemed necessary by multiple agencies to reduce sedimentation into stock tanks which causes the stock tanks to become shallower, putting frogs at risk of desiccation during drought years. Habitat fencing was constructed around portions of five occupied stock tanks to exclude livestock from a portion of each tanks' perimeter in order to protect vegetation needed by frogs for hiding cover, basking platforms, tadpole food, and egg mass structure. Habitat fencing was later retrofitted to an improved standard (from sucker rod to pipe toprail and cable railings) to reduce the potential for fence failure, access by unauthorized livestock, and reduced maintenance. These activities will continue into the future.

The Ike's Backbone Allotment has recently been closed within the Fossil Creek analysis area resulting in beneficial effects to wildlife and their habitat over the coming decades. In addition, the Deadman Mesa Allotment on the Tonto National Forest, which occurs along the majority of the perennial section of Fossil Creek on the Tonto side, has been vacant for 19 years and there are no foreseeable plans to reauthorize livestock grazing at this time. Five other allotments occur in the cumulative effects boundary. Standard structural range maintenance has occurred within the past, present and will continue into the future, including cleaning tanks to their original depth, cleaning out sediment traps, repairing berms, fixing fences, and converting electric fences to more reliable wire fences. Livestock grazing is managed and monitored to ensure livestock use levels stay within allowable intensities and utilizations so there are no adverse effects to vegetative communities and the wildlife species that depend on them. Livestock may have access to habitat occupied by the sensitive Arizona phlox (*Phlox amabilis*) and Mt. Dellenbaugh sandwort (*Arenaria aberrans*), which only occur within Arizona, resulting in possible grazing and trampling. Because there are no riparian pastures along Fossil Creek, grazing will not have direct effects to riparian and aquatic plants and animals. Great effort has been made to ensure riparian areas are protected, for example livestock on the Fossil Creek allotment are trailed through the Stehr Lake pasture because livestock fencing, to keep livestock out of the riparian, would hinder recreational access.

Repair and maintenance of utilities can have direct visual and aural effects as well as direct effects to habitat (such as when vegetation under powerlines is cleared to prevent arcing and wildfires).

Motor vehicle use can have direct visual and aural effects to wildlife and occasionally vehicles run over or hit individuals causing injury or death. The prohibition of cross-country travel and the closure of roads through the Travel Management Rule have reduced effects to wildlife and habitat. Maintenance of highways, roads, and trails general protect habitat by properly designed water drainage features.

Use by individuals such as recreationists, hunters, temporary permitted hikers/trail riders and those collecting forest products, can result in short-term effects to wildlife and their habitat. Use occurring in a concentrated area over a long period of time can result in alteration of wildlife movement and even site abandonment.

Research activities sometime occur in the uplands but proposals are carefully screened to avoid adverse effects and typically result in useful information that support and drive future land management decisions resulting in better resource protection.

Activities on private lands, including urban development and interface growth, can not only affect wildlife habitat, but can affect wildlife movement through large tracts of private land.

Cumulative Effects Related to Climate Change in the Southwest

Current climate change in the southwest has been already been observed and documented. The southwest's recent warming is among the most rapid in the nation and in some areas, significantly greater than the global average (Karl et al, 2009). There has been a near 2°F increase in temperatures in the last century, with 110 years of records showing the 2001-2010 decade being the warmest (EPA website, accessed 2016). August in 2015 was the hottest August ever for Phoenix. The length of the frost-free season has increased by 19 days in recent decades (EPA website, accessed 2016). Declines in spring snowpack have been observed in recent decades (Garfin et al 2013 and EPA website, accessed 2016). The highest streamflows occur earlier in the year and there's been a

decrease in the total yearly streamflow over the last decade (EPA website, accessed 2016). Changes in phenology (the timing of biological events) has also been observed. Spring is progressively earlier since the 60's.

Observed changes to flora in the Southwest include changes in phenology such as earlier shooting of plants, earlier first flowering, earlier tree budburst, and plants growing in a longer season (Garfin et al 2013). With increasing temps, habitat for many North American species are moving north and to higher elevations. Alligator juniper occur 1000' higher in elevation since the 1960s and may eventually no longer occur in the Fossil Corridor (Brusca et al, 2013). In recent decades plants and animals have moved to higher latitudes at a rate of 10.5 miles per decade and to higher elevations at a rate of 36 feet per decade and (EPA website, accessed 2016). In the Fossil corridor, this could mean a range expansion for some species but for others a move into less hospitable habitat. In addition, drought has led to a substantial die off of pinon trees (90%) across 4,600 square miles of the Four Corners region (EPA website, accessed 2016; Defenders of Wildlife, accessed 2018; and Karl et al, 2009). The loss of pinyon removes an important food source for bears, birds, small mammals, and humans (especially tribes) and applies to the Fossil Corridor. Other examples of observed effects include: changes in the distribution of evergreen increases in forest pest populations and increases in the size and severity of wildfires.

Predicted changes in Southwest weather include increase temperatures. Temperatures in the southwest are projected to rise 4-6 degrees Fahrenheit under the lowest emission scenarios (by up to 10F under highest emission scenarios) by the end of the century (Defenders of Wildlife website, accessed 2018). Average annual temperatures are projected to rise an additional 3.5°F to 9.5°F by the end of this century, with the greatest temperature increases expected in the summer and fall. The southwest will experience hotter heat waves (Garfin et al 2013). Winters in the southwest will also be altered by having fewer frost days, shortened snow season, less snowpack, more frequently extremely dry and extremely wet winters, increase precipitation outside of summer seasons (Garfin et al 2013; Karl et al, 2009).

The Southwest will experience changes in water availability with more frequent, intense and longer droughts, reduced river flow and soil moisture, increasingly scarce water supplies, increased frequency of floods, and altered timing of floods. Drought conditions are already common in the Southwest and drought periods are expected to become more frequent, intense, and longer. Drought will affect important water sources. Combined with expected population growth, climate change will exacerbate existing stresses.

Finch (2012) sites numerous predictions for changes in Southwest landscapes due to climate change and those pertinent to the Fossil Corridor follow. By 2099, 55% of western landscapes will have climates incompatible with current vegetation types. Pinyon juniper woodlands move northward and upslope. Semi desert grassland expands northward and occupies an area four times that of the present. Great basin shrub/grassland decreases by 40% and becomes fragmented. Great Basin montane scrub declines (69%) and displacement through time. There will be a northward shift of key plant species including saguaro, and creosote bush. Species with small distributions (AZ cypress) experience complete climate disequilibrium early in the century. There will be an increase in and expansion of invasive plant species and invasive cheatgrass shifts northward. It is likely that grass species such as lovegrass, yellow bluestem and cheatgrass increase in the Fossil Corridor.

Phenology—the timing of seasonal activities of animals and plants—is perhaps the simplest process in which to track changes in the ecology of species in response to climate change. Birds, butterflies and wild plants, in particular, include popular and easily identifiable species and thus have received considerable attention from the public. As a result many long-term phenological data sets have been collected. Common changes in phenology include: earlier bird nesting, earlier arrival of migrant birds, earlier choruses and spawning of amphibians, earlier appearance of butterflies, and earlier insect hatching (EPA website, accessed 2016). These may not always match with all of species' life history requirements. Some species may not have advanced their timing of breeding sufficiently to continue reproducing optimally relative to the occurrence of peak food availability, thus becoming mismatched compared with their food sources (EPA website, accessed 2016).

12% of local populations of 48 lizard species in Mexico have already disappeared because of warmer temperatures.

Climate change will present both challenges and opportunities for adaptations for amphibians. Highly aquatic frog species will be challenged as they lose habitat from diminished flows and toad size has been observed to be smaller in temporary pools versus perennial waters (Regan et al 2014). Frogs and toads occupying temporary pools in the intermittent portion of Fossil Creek, along with other Fossil tributaries such as Boulder Creek may experience similar challenges. Tadpoles (great basin spadefoot tadpoles and other species) in warmed pools opportunistically reached metamorphosis 15-17 days earlier with little cost to size (Regan et al 2014) and so amphibians in Fossil Corridor may be able to similarly adapt. A New Mexico study did not find evidence that shrub encroachment has had negative impacts on the toad community and may even have had positive effects on anurans, especially Great Plains toad and Plain's spadefoot toad, both of which are more common in mesquite habitat (Boeing et al. 2014). This is because: mesquite's ability to provide shelter (small mammal burrows found under mesquite – roots prevent burrow collapse), increase surface moisture and humidity, and lowering temperature from shading, and increased abundance of food resources within this habitat (Boeing et al. 2014). There are upland mesquite (versus bosque mesquite) in the Fossil Corridor that may provide shelter for upland toad species in the Fossil corridor.

Audubon's Breeding Bird Survey and Christmas Bird Count's huge and longest-running data sets were used to model climate change effects on North American bird species. An Audubon website (accessed 2015) reveals the following. In the last 50 years, greater than 60% of 305 bird species shift their winter ranges northward by an average of 35 miles (American robin is an example and occurs in the Fossil Corridor)(Audubon website accessed 2015). Of 588 species modeled, 314 bird species will lose more than 50 percent of current range by 2080. Some will adapt, others will have nowhere to go. One species modeled that occurs in the Fossil Corridor is the green-tailed towhee. Audubon modeling predicts an 82% decrease in its summer range by 2080 (Audubon website accessed 2015).

Aquatic habitats in the Southwest will also experience changes due to climate change. A 17% increase in the frequency of stream drying events is expected. Spring and early summer flows in rivers will diminish between 8 and 20% (Jaeger et al. 2014). More frequent and severe droughts will result in altered flows and connectivity in SW streams (Jaeger et al, 2014). Water will become more isolated due to longer stretches of dry channel (Jaeger et al. 2014). Altered flows and reduced connectivity will make aquatic species especially vulnerable. This may be the case in the future for Fossil Corridor's intermittent tributaries.

Water tables are lowering as a result of ground water pumping and rising temperatures are causing lower flows in major rivers (Karl et al, 2009). At this time, groundwater use from the portion of the regional limestone aquifer that supports perennial flow in Fossil Creek is extremely limited or absent. However, development of a production well in the vicinity of a deep exploratory borehole that was drilled would likely impact discharge at Fossil Springs since groundwater would be withdrawn from the same regional limestone aquifer that supports springs discharge and groundwater extraction would be in close proximity to Fossil Springs.

Overall, the anticipated effects of climate change to species habitat (e.g. diminished spring flows in intermittent reaches, fewer and shorter-term pools for amphibians, northward shift in species habitat and die off of pinyon trees and possibly oak trees, declines in summer ranges for migrants) combined with the direct and indirect effects of implementing the CRMP alternatives, would result in additional effects to certain groups of wildlife (toads, non-ranid frogs, some migrant birds) and some species of vegetation (such as Alligator juniper, pinyons, and possibly evergreen oaks).

Summary

Cumulatively, the implementation of the different action alternatives when combined with past, present and future actions in the adjacent watershed, will not result in adverse effects to the outstandingly remarkable values associated with Fossil Wild and Scenic River. Overall, various management actions (removal of non-native fish in upland tanks, maintenance of the native fisheries in Fossil, vegetation management and watershed improvement projects, Chiricahua leopard frog habitat protection measures, Fossil interim management including capacity management, implementation of Travel Management Rule, closure of Ike's Backbone allotment) have contributed to improving vegetative conditions, wildlife habitat, and watershed function in the cumulative effects analysis

area. These efforts are expected to counteract the cumulative stressors and disturbance caused by climate change, rec use, invasive species establishment and spread, and recurring drought and wildfire risk.

Additional Analysis for Federally-listed and ORV-specific species

The purpose of this section is to evaluate the potential effects of this action on listed and ORV-specific species. This assessment is based on the current geographic range of species on the Coconino and Tonto National Forests and the area affected by the project. This assessment considers, as appropriate for the species and area, factors that may affect the current trend for the species population. Additionally, this assessment will display findings under the various management alternatives considered for the project (FSM 2621.2).

Birds

Mexican Spotted Owl

Effects from Programmatic Components of All Action Alternatives

In all action alternatives, there would be a CRMP that provides management direction to ensure the river's outstandingly remarkable values are protected or enhanced, including riparian recovery habitat for the Mexican spotted owl. An increase in the size of the botanical area will provide protection to more recovery habitat for the Mexican Spotted owl.

In the no action alternative and in regards to riparian recovery habitat, there would be no management guidance from a comprehensive management plan, limited monitoring, and no adaptive management. Restoration activities would be subject to further NEPA and therefore implementation would be delayed for one to three years once impacts are identified. The effects of the plan amendment are the same as the programmatic direction discussed above.

Direct and Indirect Site-Specific Effects of All Action Alternatives

There are no protected activity centers in the CRMP project area, only within the broader analysis area. A small amount of critical habitat occurs at the very northern end of the corridor. The only activities in that may occur in protected or critical habitat would be backpacking and/or canyoneering activities, but due to the location, access is very challenging. From the Fossil Springs Trailhead, this habitat is located nearly four miles upstream of Fossil Springs (which is a four mile hike from the trailhead) along an intermittent section of Fossil Creek that doesn't appeal to most visitors due to the lack of water and riparian vegetation. Access into MSO protected and critical habitat is equally difficult from Hwy 260, requiring canyoneering skills including rappelling. However, some determined and skilled backpackers and canyoneers may occur within MSO protected habitat during the breeding season and this may result in direct aural and visual disturbance to owls. Since backpackers and canyoneers tend to travel in small groups and are more likely to practice leave no trace principles when compared to the average visitor to Fossil, visual and aural disturbance is expected to be of low intensity. Due to the remoteness, disturbance is expected to be limited. Due to the nature of backpackers and canyoneers, they tend to stay one or just a few nights in one location, so the impacts are expected to be of short duration.

The majority of recreation occurs in Fossil riparian habitat from just above Fossil Springs down through the middle section to below Mazatzal. The riparian habitat in this area is considered recovery habitat for the Mexican spotted owl. Owl use of the perennial portion of Fossil Creek is expected to be limited (due to the distance from occupied habitat) and likely only used by wintering and and/or dispersing owls. In all alternatives, the presence of people and their vehicles (visitors as well as administrative personnel), the operation of machinery for new construction (such as the new FR 708 bridge), maintenance/repair existing infrastructure (e.g. gabion baskets) and restoration activities, could cause visual and/or aural disturbance to individuals, should they occur in this portion of Fossil Creek.

Proposed actions common to all action alternatives include road improvements (repair of gabions, energy dissipaters, improve drainage), obliteration of unneeded roads and trails, rehabilitation of bare soil areas

previously used for dispersed recreation, weed treatments, designating creek access trails, delineation and surfacing of parking lots, prohibiting road side parking, and implementing capacity control (such as reservation and permit systems, limits on group sizes, camping limitations, various prohibitions and restrictions). While some of these actions (parking areas), and new infrastructure (708 bridge and Irving bridge) will result in long-term disturbances to vegetation, BMPs and improvements (in drainages, closures and rehabilitation will overall improve upland watershed conditions and reduce indirect effects of erosion and sedimentation in Fossil Creek over the next decade.

Overall and across all action alternatives, activities that will improve riparian recovery habitat include better management through a comprehensive river management plan, monitoring, and adaptive management. The project area is expected to see a long-term reduction in bare soil area, better delineated creek access via hardened areas and less area dominated by invasive plants. Benefits are expected from increased restoration efforts, improved visitor distribution, reduced visitor impacts, and better quality refugia areas in between recreation sites.

Differences Among All Alternatives

Alternative A results in the most riparian habitat alteration at 26.54 acres. Alternatives, E, F, D, and B follow with 21.6, 14.6, 13.6 and 9.3 acres, respectively. Alternative C has the least amount of riparian recovery habitat disturbed at 8.6 acres. Acres of riparian restoration is most in alternative D (22.3) and then followed by alternative C (21.8). Alternatives E and B restore the same amount of riparian acres (20.5). Alternative F would restore 20.37 acres. There would be no restoration acres under the no action alternative. When the riparian acres to be restored are added to undisturbed riparian refugia, the full potential for riparian refugia is most in alternative C (665.4), followed by alternative B (663.4), then D (661.0), then F (657.94), then E (651.0) and last, the no action (625.6).

The no action alternative results in the most alteration to owl riparian recovery habitat. In considering both the amount of riparian habitat alteration, combined with the different implementation strategies, the alternative with the most effects to habitat is alternative F, followed by alternatives E, B, D, and C.

Cumulative Effects for Action Alternatives

Refer to the general cumulative effects analysis for all species, above.

Southwestern Willow Flycatcher

Effects from Programmatic Components of All Action Alternatives

Under the no action alternative, there would be no management guidance from a comprehensive management plan, no monitoring, and no adaptive management. Restoration activities would not occur without completion of NEPA and therefore implementation would be delayed for one to three years after impacts are identified

In all action alternatives, there would be a CRMP that provides management direction to ensure the river's outstandingly remarkable values are protected or enhanced, including riparian habitat that is suitable for the southwestern willow flycatcher. The effects of the plan amendment are the same as the programmatic direction discussed above.

Direct and Indirect Site-Specific Effects of All Action Alternatives

There have been no detections of flycatchers where surveys were conducted in marginal habitat occurring in wider pockets of riparian along Middle Fossil Creek. However, not all pockets of marginal habitat have been surveyed including between the waterfall and the dam, at Purple Mountain recreation site, and various pockets between the permanent fish barrier and the confluence. Activities in the CRMP corridor that may occur in marginal habitat would include recreation, restoration, restoration, new construction, maintenance/repair of existing infrastructures, and road and trail maintenance. Recreation activities in the riparian area could directly affect willow flycatchers through visual and/or aural disturbance, should they be present in the Fossil corridor. Recreation activities can result in indirect effects to flycatchers when activities degrade habitat conditions and

increase the amount of trash that attracts parasitic brown-headed cowbirds (Airola, D.A., 1986). Restoration activities, new construction (such as the FR 708 bridge), maintenance/repair of existing infrastructure (such as the gabion baskets), and road and trail maintenance are unlikely to disturb flycatchers, should they be present, because these activities would occur during the low use season which is outside of the flycatcher's breeding season. Restoration activities will benefit willow flycatchers by increasing the amount of riparian habitat over the next decade

Because even the best habitat within Fossil Creek is marginal and surveys have been negative, it is the determination that there is a very low possibility that southwestern willow flycatchers nest in the FC WSR boundary. Even though marginal habitat is present, it is rationalized that the chance of southwestern willow flycatchers occurring in middle Fossil are slim for several reasons.

One, the best habitat in Fossil Creek is marginal. Two, all surveys to date have been negative. Three, the overall population is greatly diminished, known nesting areas are limited, and the nearest nesting occurs in the broad valley floodplain of the Verde Valley. Four, this species has high site fidelity and therefore returning birds generally come back to the area they were fledged; not new areas miles from where they fledged. Five, the colonial nature of this species reduces the chance that a male finds a female this far from known nesting sites. Given all these factors, there is very little likelihood that there will be southwestern willow flycatchers present in the project area over the next ten year.

Proposed actions common to all action alternatives include road improvements (repair of gabions, energy dissipaters, improve drainage), obliteration of unneeded roads and trails, rehabilitation of bare soil areas previously used for dispersed recreation, weed treatments, designating creek access trails, delineation and surfacing of parking lots, prohibiting road side parking, and implementing capacity control (such as reservation and permit systems, limits on group sizes, camping limitations, various prohibitions and restrictions). While some of these actions (parking areas), and new infrastructure (708 bridge and Irving bridge) will result in long-term disturbances to vegetation, BMPs and improvements (in drainages), closures and rehabilitation will overall improve upland watershed conditions and reduce indirect effects of erosion and sedimentation in Fossil Creek.

Overall and across all action alternatives, activities that will improve riparian habitat and thus possibly benefit the southwestern willow flycatcher, include better management through a comprehensive river management plan, monitoring, and adaptive management. It is expected to see a long-term reduction in bare soil area, better delineated creek access to hardened areas and fewer populations of invasive plants. Benefits are expected from increased restoration efforts, improved visitor distribution, reduced visitor impacts, and better quality refugia areas in between recreation sites.

Differences in Effects Among All Alternatives

Alternative A results in the most willow flycatcher habitat alteration at 26.54 acres. Alternatives, E, F, D, and B follow with 21.6, 14.6, 13.6 and 9.3 acres, respectively. Alternative C has the least amount of riparian acres disturbed at 8.6 acres. Acres of riparian restoration is most in alternative D (22.3) and then followed by alternative C (21.8). Alternatives E and B restore the same amount of riparian acres (20.5). Alternative F would restore 20.37 acres. There would be no restoration acres under the no action alternative. When the riparian acres to be restored is added to undisturbed riparian refugia, the full potential for riparian refugia is most in alternative C (665.4), followed by alternative B (663.4), then D (661.0), then F (657.94), then E (651.0) and last, the no action (625.6).

Because of the differences in implementation strategies, monitoring would be conducted before capacity changes in Alts B-E and capacity changes would only be implemented if monitoring show the riparian condition could support the change. However, Alternative F may have short term impacts to riparian from an initial increase to up to 2,580 PAOTs prior to when monitoring is conducted. These impacts would be short term (1-2 years) because management changes would be implemented if monitoring shows an impacted resource.

The no action alternative results in the most alteration to willow flycatcher habitat with no decision to allow for habitat restoration. In considering both the amount of willow flycatcher habitat alteration, combined with the different implementation strategies, the action alternative with the most effects to willow flycatcher habitat is alternative F, followed by alternatives E, B, D, and C.

Cumulative Effects for Action Alternatives

Refer to the general cumulative effects analysis for all species, above.

Western Yellow-billed Cuckoo

Effects from Programmatic Components of All Action Alternatives

Under the no action alternative, there would be no management guidance from a comprehensive management plan, no monitoring, and no adaptive management. Restoration activities would not occur without completion of NEPA and therefore implementation would be delayed.

In all action alternatives, there would be a CRMP that provides management direction to ensure the river's outstandingly remarkable values are protected or enhanced, including riparian habitat that is suitable for the southwestern willow flycatcher. The effects of the plan amendment are the same as the programmatic direction discussed above.

Direct and Indirect Site-Specific Effects of All Action Alternatives

There have been no detections of yellow-billed cuckoos in Fossil Creek, however, suitable habitat occurs in wider pockets of riparian, especially where there are mesquite bosque vegetation adjacent to the riparian that provide foraging habitat. Even though the Fossil riparian area contains all the components of cuckoo habitat, repeat surveys have been negative. While it is unknown why Fossil doesn't support nesting cuckoos, it is the determination that there is a slim possibility that cuckoos nest in the FC WSR boundary. This is because, with low populations there are not enough yellow-billed cuckoos to disperse into all the suitable habitat (Johnson et al. 2011). However, protection of all suitable habitat is important, because improved management across the species range will allow for an increase in the cuckoo population leaving future potential for cuckoos to resettle into suitable habitat such as that along Fossil Creek (Johnson et al. 2011).

Activities in the CRMP corridor that may occur in suitable habitat would include recreation, restoration, new construction, maintenance/repair of existing infrastructures, and road and trail maintenance. Recreation effects to yellow-billed cuckoo are best described in the report 2009 Common Black-Hawk and Yellow-Billed Cuckoo Distribution and Abundance in the Upper Reach of Fossil Creek, AZ (Johnson et al. 2009):

“Some experts believe the primary natural resource management issue for this century will revolve around conflicts between recreation and wildlife (Gutzwiller 1995). Recreation use of river corridors (e.g., boating, hiking, biking and camping) in Arizona alone is projected to double over the next 15 years. This increase has the potential of impacting Common Black-Hawk, yellow-billed cuckoo, and other riparian bird species, by degrading riparian habitat. Taylor (1986) found a possible correlation between recreational activities and decreased riparian bird abundance. Blakesley and Reese (1988) reported seven species negatively associated with campgrounds in riparian areas in northern Utah. Therefore, there is evidence that recreational activities can impact riparian species, especially if black-hawks and cuckoos select breeding sites in riparian areas near popular camping sites in Fossil Creek.

Recreation can impact wildlife through: 1) direct mortality, 2) indirect mortality, 3) lowered productivity, 4) reduced use of habitat, 5) reduced use of preferred habitat, and 6) aberrant behavior or stress that results in reduced productivity or survival rates (Gutzwiller 1995). These impacts are not easily measured and different species may not react to them in the same way. The following are brief summaries of potential recreation risks and impacts on Common Black-Hawk and Yellow-billed Cuckoo habitat:

1. Fire Risk – As the number of recreation users increases, so does the probability of an accidental fire. If recreation use is to persist and fire continues to be a risk on black-hawk and cuckoo habitat, fire can be

reduced by confining campfires to certain locations, using fire boxes, restricting campfires during high fire danger conditions and/or prohibiting campfires.

2. Habitat Impacts – Direct impacts on soils and vegetation from recreational use are easier to measure and are well documented unlike direct recreation impacts on wildlife. Changes in structure, density and composition of vegetation can occur from recreation-induced soil compaction and erosion (Webb 1983, Briggs 1996, Monz 1998). Activities contributing to these changes include hiking, horseback riding, camping and day use (Briggs 1996, Cole and Spildie 1998). Trails, campgrounds and facilities can fragment habitat to the point where it cannot develop into suitable breeding habitat. Where vegetation is sparse, even light use can prevent further development of dense lower strata, an important component to black-hawks and cuckoos. Increased water turbidity, bank erosion, water pollution, noise disturbance and over-water movement resulting from waters sports like swimming, fishing, and boating can also reduce suitability of habitat (Tellman et al. 1997).

Ultimately recreation can reduce habitat structure and complexity, causing declines in species diversity and richness (Hammit and Cole 1987). Vegetation changes in and near camping areas can cause bird species diversity to shift to more common and generalist species, while rarer and specialist species such as Common Black-Hawks and Yellow-billed Cuckoos decline (Aitchison 1977). Reduced shrub and tree densities, woody debris and litter depth in campgrounds cause ground, shrub and small tree nesters to also decline (Blakesley and Reese 1988).

3. Predators, Scavengers and Nest Parasites - Where human activities occur, animal disturbance will soon follow. Food and garbage left behind by recreation users attracts predators and nest parasites, including jays, Common Ravens (*Corvus corax*), Great-tailed Grackles (*Quiscalus mexicanus*), Brown-headed Cowbirds, skunks, ringtails (*Bassariscus astutus*), lizards, rodents and squirrels (Aitchison 1977, Carothers et al. 1979). An increase in predators can significantly reduce black-hawk and cuckoo nest success directly (i.e. Common Ravens) and indirectly (food base such as lizards).

Recreation activities in the riparian area could directly affect yellow-billed cuckoos through visual and/or aural disturbance, should they occur in the area in the future. Restoration activities, new construction (such as the FR 708 bridge), maintenance/repair of existing infrastructure (such as the gabion baskets), and road and trail maintenance are unlikely to disturb cuckoos, should they be present, because these activities would occur during the low use season which is outside of the cuckoo's breeding season. Restoration activities will benefit yellow-billed cuckoos by increasing the amount of riparian habitat.

Poor watershed conditions in the uplands can have adverse indirect effects on cuckoo nesting and foraging habitat. Disturbance associated with recreational activities can contribute to poor watershed conditions and can occur directly in foraging habitat. Activities in the uplands can result in the removal of organic material on the soil surface. Removal of vegetation cover, in addition to compaction, decreases infiltration of the soil, which enhances surface runoff (U.S. Fish and Wildlife Service 1993b). Increased runoff in turn then results in increased silt loads, increased turbidity, decreased water quality, increased scouring during high flows, and altered pH levels. All of these impacts can have an indirect impacts to riparian areas, including cuckoo habitat. While some of these actions (parking areas) will result in long-term disturbances to upland vegetation including some cuckoo foraging habitat, BMPs, road and trail improvements, and restoration areas will overall improve upland watershed conditions and reduce indirect effects of erosion and sedimentation in cuckoo habitat.

Proposed actions common to all alternatives include road improvements (repair of gabions, energy dissipaters, improve drainage), obliteration of unneeded roads and trails, rehabilitation of bare soil areas previously used for dispersed recreation, weed treatments, designating creek access trails, delineation and surfacing of parking lots, prohibiting road side parking, and implementing capacity control (such as reservation and permit systems, limits on group sizes, camping limitations, various prohibitions and restrictions). While some of these actions (parking areas), and new infrastructure (708 bridge and Irving bridge) will result in long-term loss of vegetation, BMPs and

improvements (in drainages), closures and rehabilitation will overall improve upland watershed conditions and reduce indirect effects of erosion and sedimentation in Fossil Creek.

Overall and across all action alternatives, activities that will improve riparian habitat and thus benefit the yellow-billed cuckoo, include better management through a comprehensive river management plan, monitoring, and adaptive management. It is expected to see a long-term reduction in bare soil area, better delineated creek access to hardened areas and fewer populations of invasive plants. Benefits are expected from increased restoration efforts, improved visitor distribution, reduced visitor impacts, and better quality refugia areas in between recreation sites.

Differences in Effects Among All Alternatives

Alternative A results in the most suitable cuckoo nesting habitat alteration at 26.54 acres. Alternatives, E, F, D, and B follow with 21.6, 14.6, 13.6 and 9.3 acres, respectively. Alternative C has the least amount of riparian acres disturbed at 8.6 acres. Acres of riparian restoration is most in alternative D (22.3) and then followed by alternative C (21.8). Alternatives E and B restore the same amount of riparian acres (20.5). Alternative F would restore 20.37 acres. There would be no restoration acres under the no action alternative. When the riparian acres to be restored is added to undisturbed riparian refugia, the full potential for riparian refugia is most in alternative C (665.4), followed by alternative B (663.4), then D (661.0), then F (657.94), then E (651.0) and last, the no action (625.6).

Because of the differences in implementation strategies, monitoring would be conducted before capacity changes in Alts B-E and capacity changes would only be implemented if monitoring show the riparian condition could support the change. However, Alternative F may have short term impacts to riparian from an initial increase to up to 2,580 PAOTs prior to when monitoring is conducted. These impacts would be short term (1-2 years) because management changes would be implemented if monitoring shows an impacted resource.

The no action alternative results in the most alteration to cuckoo habitat with no decision to allow for habitat restoration. In considering both the amount of cuckoo habitat alteration, combined with the different implementation strategies, the action alternative with the most effects to habitat is alternative F, followed by alternatives E, B, D, and C.

Cumulative Effects for Action Alternatives

Refer to the general cumulative effects analysis for all species, above.

Common Black-hawk

Direct and Indirect Effects

Recreation effects to black-hawks are best described in the report 2009 Common Black-Hawk and Yellow-Billed Cuckoo Distribution and Abundance in the Upper Reach of Fossil Creek, AZ (Johnson et al. 2009):

“Some experts believe the primary natural resource management issue for this century will revolve around conflicts between recreation and wildlife (Gutzwiller 1995). Recreation use of river corridors (e.g., boating, hiking, biking and camping) in Arizona alone is projected to double over the next 15 years. This increase has the potential of impacting Common Black-Hawk, yellow-billed cuckoo, and other riparian bird species, by degrading riparian habitat. Taylor (1986) found a possible correlation between recreational activities and decreased riparian bird abundance. Blakesley and Reese (1988) reported seven species negatively associated with campgrounds in riparian areas in northern Utah. Therefore, there is evidence that recreational activities can impact riparian species, especially if black-hawks and cuckoos select breeding sites in riparian areas near popular camping sites in Fossil Creek.

Recreation can impact wildlife through: 1) direct mortality, 2) indirect mortality, 3) lowered productivity, 4) reduced use of habitat, 5) reduced use of preferred habitat, and 6) aberrant behavior or stress that results in reduced productivity or survival rates (Gutzwiller 1995). These impacts are not easily measured and different species may

not react to them in the same way. The following are brief summaries of potential recreation risks and impacts on Common Black-Hawk and Yellow-billed Cuckoo habitat:

1. Fire Risk – As the number of recreation users increases, so does the probability of an accidental fire. If recreation use is to persist and fire continues to be a risk on black-hawk and cuckoo habitat, fire can be reduced by confining campfires to certain locations, using fire boxes, restricting campfires during high fire danger conditions and/or prohibiting campfires.

2. Habitat Impacts – Direct impacts on soils and vegetation from recreational use are easier to measure and are well documented unlike direct recreation impacts on wildlife. Changes in structure, density and composition of vegetation can occur from recreation-induced soil compaction and erosion (Webb 1983, Briggs 1996, Monz 1998). Activities contributing to these changes include hiking, horseback riding, camping and day use (Briggs 1996, Cole and Spildie 1998). Trails, campgrounds and facilities can fragment habitat to the point where it cannot develop into suitable breeding habitat. Where vegetation is sparse, even light use can prevent further development of dense lower strata, an important component to black-hawks and cuckoos. Increased water turbidity, bank erosion, water pollution, noise disturbance and over-water movement resulting from waters sports like swimming, fishing, and boating can also reduce suitability of habitat (Tellman et al. 1997).

Ultimately recreation can reduce habitat structure and complexity, causing declines in species diversity and richness (Hammit and Cole 1987). Vegetation changes in and near camping areas can cause bird species diversity to shift to more common and generalist species, while rarer and specialist species such as Common Black-Hawks and Yellow-billed Cuckoos decline (Aitchison 1977). Reduced shrub and tree densities, woody debris and litter depth in campgrounds cause ground, shrub and small tree nesters to also decline (Blakesley and Reese 1988).

3. Predators, Scavengers and Nest Parasites - Where human activities occur, animal disturbance will soon follow. Food and garbage left behind by recreation users attracts predators and nest parasites, including jays, Common Ravens (*Corvus corax*), Great-tailed Grackles (*Quiscalus mexicanus*), Brown-headed Cowbirds, skunks, ringtails (*Bassariscus astutus*), lizards, rodents and squirrels (Aitchison 1977, Carothers et al. 1979). An increase in predators can significantly reduce black-hawk and cuckoo nest success directly (i.e. Common Ravens) and indirectly (food base such as lizards).

There is a strong correlation between the location of black-hawk nests in Fossil Creek and areas with high recreational use. Once restoration of full flows occurred and recreation increased, black-hawks abandoned their nest near the waterfall. In addition, increased recreation levels at the Springs, combined with decommissioning activity in 2008, resulted in abandonment of the nest just downstream of the historic Fossil Springs dam. This is a shift from three nests to just one nest from the Springs down to Irving. Results from visitor and bare area monitoring document increases between 2009 and 2011 at both the waterfall and Fossil Springs:

- A 31% increase in the number of vehicles parked at the Fossil Springs Trailhead occurred between 2009 and 2011.
- Areas denuded from camping in the Fossil Springs area more than doubled between 2005 and 2011 (0.41 acres to 0.88 acres).
- Areas denuded from camping at the waterfall increased by 406% (0.17 to 0.86) from 2005 to 2011.

To further strengthen the correlation between nesting and recreation, in areas where recreation use is fairly low black-hawk nest much closer together; from just upstream of the Mazatzal site, there were 3 active nests in 2011 within a little over a mile reach. Compare this to only one black-hawk nest in 2011 between Fossil Springs and Irving and this is an approximate 3.5 mile reach.

Another concerning factor is that the reach with the highest nesting densities (from below Purple Mountain downstream of the Mazatzal site) also has the highest abundance of crayfish. So, although black-hawks may

choose to nest there in higher densities based on lower recreation levels, prey composition there is not the most optimal. Crayfish are non-native and take more energy for birds (adults and nestlings) to consume due to the hard exoskeleton. Unfortunately the portion of Fossil Creek where most black-hawk nest displacement has occurred (from the historic Fossil Springs dam downstream to the waterfall) is largely crayfish-free. If it were not for the abundant native fish in Fossil (above the fish barrier), black-hawk nesting success would likely be lower in this reach with abundant crayfish. Should the native fishery ever be compromised and not maintained, nesting black-hawks would eventually have to switch to feeding their young crayfish and therefore nesting success would very likely decline (as indicated by nest success rates in other Verde Valley streams dominated by crayfish).

As indicated by past levels of recreation, recreation activities in the riparian area could directly affect common black-hawk through visual and/or aural disturbance (see full discussion under the baseline and existing condition sections of the black-hawk in the affected environment section). A serious indirect effect to black-hawks could occur if non-native fish were introduced into Fossil Creek. Currently, above the permanent fish barrier, there are over ten miles of exceptional foraging conditions due to the lack of non-native fish and a minimal number of crayfish. Introduction of non-native species could reverse this condition and consequently affect black-hawk health and reproductive success. Restoration activities, new construction (such as the FR 708 bridge), maintenance/repair of existing infrastructure (such as the gabion baskets), and road and trail maintenance could affect black-hawks because even if these activities occur during the low use season, black-hawks begin courtship in March and often stay on-site even into December. In the long-term, restoration activities will benefit common black-hawks by increasing the amount of riparian habitat and the prey base on which this species depends.

Proposed actions common to all alternatives include road improvements (repair of gabions, energy dissipaters, improve drainage), obliteration of unneeded roads and trails, rehabilitation of bare soil areas previously used for dispersed recreation, weed treatments, designating creek access trails, delineation and surfacing of parking lots, prohibiting road side parking, and implementing capacity control (such as reservation and permit systems, limits on group sizes, camping limitations, various prohibitions and restrictions). While some of these actions (parking areas), and new infrastructure (708 bridge and Irving bridge) will result in long-term disturbances to vegetation, BMPs and improvements (in drainage, closures and rehabilitation will overall improve upland watershed conditions and reduce indirect effects of erosion and sedimentation in Fossil Creek.

Overall and across all action alternatives (especially B-E), activities that will improve riparian habitat and thus benefit the black-hawk, include better management through a comprehensive river management plan, monitoring, and adaptive management. It is expected to see a long-term reduction in bare soil area, better delineated creek access to hardened areas and fewer populations of invasive plants. Benefits are expected from increased restoration efforts, improved visitor distribution, reduced visitor impacts, and better quality refugia areas in between recreation sites.

Differences in Effects Among All Alternatives

Alternative A results in the most alteration black-hawk nesting habitat at 26.54 acres. Alternatives, E, F, D, and B follow with 21.6, 14.6, 13.6 and 9.3 acres, respectively. Alternative C has the least amount of black-hawk nesting habitat disturbed at 8.6 acres. Acres of riparian restoration is most in alternative D (22.3) and then followed by alternative C (21.8). Alternatives E and B restore the same amount of riparian acres (20.5). Alternative F would restore 20.37 acres. There would be no restoration acres under the no action alternative. When the riparian acres to be restored is added to undisturbed riparian refugia, the full potential for riparian refugia is most in alternative C (665.4), followed by alternative B (663.4), then D (661.0), then F (657.94), then E (651.0) and last, the no action (625.6).

During the seven years of black-hawk monitoring in Fossil Creek a decline in nesting activity and detections has been observed in the upper reach of Fossil Creek. Between 2007 and 2009, black-hawks breeding areas between the Springs and just downstream of Irving decreased by 50% with black-hawks no longer nesting at the dam or the waterfall site. A likely explanation is the increase in recreational activity in Fossil Creek from the Springs downstream through middle Fossil Creek. Since restoration of full flows in 2005, the median number of people per weekend day increased from 180 in 2006, 233 in 2007, 327 in 2008, 551 in 2009, 537 in 2010, and 630 in

2011 (Rotert 2012). Holiday weekends experienced peaks in visitation as demonstrated by 2011 capacity data: 1900 people/day during Memorial Day weekend, 2400 people/day during 4th of July weekend, and 1700 people/day during Labor Day weekend (Rotert, 2012). There is concern that increased levels of recreation may further affect black-nesting in areas where recreation activity is high, especially since all alternatives have higher PAOTs than the median number of visitors per weekend day in the years 2006-2011 (Table 43).

Table 43: Comparison of Median # Visitors per Weekend Day per Year and PAOTs by Each Alternative.

2006	2007	2008	2009	2010	2011	Alt A	Alt B	Alt C	Alt D	Alt E	Alt F
180	233	327	551	537	630	810	640	720	905	1510	2580

In alternative C and F, visitors would have to park at Cactus Flat and walk to recreation sites. There is concern that instead of visitors walking along the road or a new trail paralleling the road (such as from Cactus Flat across Boulder Canyon), visitors will instead want to walk directly to the closest riparian. That shortest route would place visitors right where black-hawks nest downstream of Homestead. Through adaptive management and education these impacts could be mitigated once they are detected.

Camping in or near riparian habitat can increase the effects to water quality, soil, vegetation, and impacts to black-hawk habitat. Camping increases the duration of disturbance to nesting black-hawks, increasing the amount of visual and aural disturbance to black-hawks. Alternatives that allow for camping in/near riparian during the nesting season (B,E, F) would have more affect to black-hawks than alternatives that don't allow for riparian camping during the breeding season (A) or at all (C and D).

A consideration of crowding is an important social effect that may affect nesting black-hawks. Under alternatives A, B, E, and F, roughly 1.65 miles of perennial Fossil Creek would be within recreation sites. This constitutes about 11.3% of the total perennial stream length within the WSR corridor. This means that around 12% of the stream length within the WSR corridor would be within existing or proposed recreation sites. The number and length of recreation sites vary by alternative; consequently the stream length immediately adjacent to recreation sites varies from about 2826 feet (Alt D) to over 8700 feet (Alts E and F). Alternative D is likely to be most protective of stream bank stability since the linear distance of recreation sites immediately adjacent to Fossil Creek is less than that for all the other alternatives whereas alternatives E and F have the most linear distance of recreation sites adjacent to Fossil Creek.

The higher the number of visitors, the more crowded visitors may feel within recreation sites. The higher potential for crowding results in an increased potential for impacts to refugia (i.e. creation of social trails and bare area) and to places black-hawks may select for neting. The potential for crowding is most in alt F and D, followed by E and C. The potential for crowding is least under action alternative B. These values are useful in comparing the potential for impacts between alternatives. For example, visitors using recreation sites in Alternative F are estimated at a density of just over 3 feet/person (3 feet between visitors), whereas visitors in the same area in Alternative B are nearly 12 feet/person. Based on the relative crowding of people in each alternative, it is reasonable to predict that in order to escape the high density of recreation some visitors in Alternative F will be more likely to move away from the dispersed recreation site and into areas black-hawks choose for nesting than in Alternative B (Hall and Shelby 2000; Manning and Valliere 2001).

There is potential for short-term effects to species and habitat before monitoring occurs (bare area monitoring occurs in the fall at the end of the high use season) and before adaptive management is implemented. In some cases, adaptive management measure may not be enough to ensure those effects aren't carried over into the next high use recreation season. Repeat visual and aural disturbance to nesting black-hawks could result in increased physiological stress and reduced reproductive success (e.g. by causing adults to flush off of eggs for too long, young to pre-fledge, abandonment of nest sites). Re-occupancy can take more than one year to occur, based on past monitoring results.

To summarize the combined effect to nesting black-hawks, the alternatives are ranked for each of the factors discussed above. Based on that ranking (see Table 44) the alternatives that have most impact to nesting black-

hawks, are E, F, and A. The alternatives that have the least impact to nesting black-hawks are C, followed by B and then D.

Table 44: Ranked Comparison of Factors Affecting Nesting Black-hawks by Alternatives

	No Action	B	C	D	E	F
Impact to Habitat	1	5	6	4	2	3
Acres of Riparian Restoration	1	5	6	4	2	3
Full Potential for Riparian Restoration	1	5	6	4	2	3
# PAOTS	6	5	4	3	2	1
Camping Impacts	2	4	5	6	2	2
Weighted Score	11	24	27	21	10	12

Best = 6, worst = 1

Cumulative Effects for Action Alternatives

Refer to the general cumulative effects analysis for all species, above.

Amphibians

Chiricahua Leopard Frog

Effects of Not Implementing the Project Actions (No Action)

There are no effects of implementing the no action alternative since the Chiricahua leopard frog does not occur in wild and scenic river corridor but rather further in the uplands of the Fossil watershed west of the Mail Trail and trailhead.

Effects from Programmatic Components Common to All Action Alternatives

Not applicable since the CRMP and forest plan amendment covers only the wild and scenic corridor where Chiricahua leopard frogs and critical habitat do not occur.

Direct and Indirect Site-Specific Effects Common to All Action Alternatives

There will be no direct or indirect effects to the Chiricahua leopard frog because they do not occur in the Wild and Scenic Corridor. Indirect impacts to the Chiricahua leopard frog from the use of the Mail Trail may occur if trail users detour off the trail and travel to area tanks. There is a potential for visitors who visit tanks, especially equestrians, to inadvertently dislodge egg masses or crush tadpoles. In addition, when people or stock carry wet mud from one tank to another, there is potential to spread diseases and pathogens such as the chytrid fungus, which has been detected on Chiricahua leopard frogs in the Buckskin Hills population. Additionally, an increase in visitation at area tanks increases the threat of introduction/relocation of exotic fish and crayfish; all of which prey on the Chiricahua leopard frog. These effects were disclosed in a separate ESA section 7 consultation for the Mail Trail.

Differences Among the Action Alternatives

There is no difference among alternatives.

Cumulative Effects

Cumulative effects to Chiricahua leopard frog include livestock grazing, past and present watershed treatments (juniper cutting, filtersox installation), fire management, and personal use fuelwood gathering. Livestock grazing from the Hackberry/Pivot Rock and Fossil Creek allotments occur in occupied, suitable, dispersal, and critical habitat. Livestock grazing on other allotments occur in historical habitat. Various watershed treatments have occurred including lop and scatter of juniper on small acreages and installation of erosion control filter sox around erosive soils. There have been various wildfires within the Fossil watershed. In addition to concerns with erosion and sedimentation that occurs after wildfire and planned fires reduces vegetative cover, suppression

activities are also of concern. Withdrawing water from occupied sites and flying over suitable sites with contaminated water, are several concerns with suppression activities.

Lowland Leopard Frog

Effects from Programmatic Components of All Alternatives

Under the no action alternative, there would be no management guidance from a comprehensive management plan, no monitoring, and no adaptive management. Restoration activities would not occur without completion of NEPA and therefore implementation would be delayed.

In all action alternatives, there would be a CRMP that provides management direction to ensure the river's outstandingly remarkable values are protected or enhanced, including riparian and aquatic habitat that is occupied by lowland leopard frogs. The effects of the plan amendment are the same as the programmatic direction discussed above.

Direct and Indirect Site-Specific Effects of All Alternatives

Recreational activities within the riparian area can directly affect frogs by collecting and handling and trampling of egg masses, tadpoles, and subadult frogs. Recreational activities can cause habitat degradation by: trampling aquatic and streamside vegetation in which this species uses for hiding cover, temperature regulation, and substrate to support eggs masses; spreading predaceous, exotic organisms such as crayfish, bullfrogs, and non-native fish species; and increasing sediments in and turbidity of the water channel thereby decreasing water quality for these species and their prey base. Recreation activities in the riparian area can destroy leopard frog habitat over time by denuding stream banks and point bars, compacting soil thereby eliminating re-growth of riparian vegetation, and affecting water quality directly through human wastes and indirectly by facilitating erosion and sediment runoff. Recreational activities and infrastructure in the uplands near riparian can direct affect leopard frogs as they use the uplands for dispersal. Visitors can potentially (intentionally or accidentally) introduce and/or move nonnative aquatic organisms into occupied habitat; thereby increasing predation upon lowland leopard frogs.

Poor watershed conditions in the uplands can have adverse indirect effects on aquatic systems and frog habitat. Disturbance associated with recreational activities (parking areas, camping areas, unauthorized roads and trails) can contribute to poor watershed conditions. Such activities result in the removal of organic material on the soil surface. Removal of vegetation cover, in addition to compaction, decreases infiltration of the soil, which enhances surface runoff. Increased runoff in turn results in increased silt loads, increased turbidity, decreased water quality, increased scouring during high flows, and altered pH levels. Increase sedimentation results in increased embeddedness which affects macroinvertebrates which is the prey base for frogs. All of these impacts can have an indirect adverse effect to aquatic systems, including lowland leopard frog habitat.

Proposed actions common to all alternatives include road improvements (repair of gabions, energy dissipaters, improve drainage), obliteration of unneeded roads and trails, rehabilitation of bare soil areas previously used for dispersed recreation, weed treatments, designating creek access trails, delineation and surfacing of parking lots, prohibiting road side parking, and implementing capacity control (such as reservation and permit systems, limits on group sizes, camping limitations, various prohibitions and restrictions). While some of these actions (parking areas), and new infrastructure (708 bridge and Irving bridge) will result in long-term disturbances to upland vegetation, BMPs and improvements (in drainage, closures and rehabilitation will overall improve upland watershed conditions and reduce indirect effects of erosion and sedimentation in Fossil Creek.

Overall and across all action alternatives, activities that will improve riparian habitat and thus benefit the habitat for these lowland leopard frogs, include better management through a comprehensive river management plan, monitoring, and adaptive management. It is expected to see a long-term reduction in bare soil area, better delineated creek access to hardened areas and fewer populations of invasive plants. Benefits are expected from increased restoration efforts, improved visitor distribution, reduced visitor impacts, and better quality refugia areas in between recreation sites.

Differences Among All Alternatives

Alternative A results in the most alteration of suitable occupied and suitable lowland leopard frog habitat at 26.54 acres. Alternatives, E, F, D, and B follow with 21.6, 14.6, 13.6 and 9.3 acres, respectively. Alternative C has the least amount of riparian acres disturbed at 8.6 acres. Acres of riparian restoration is most in alternative D (22.3) and then followed by alternative C (21.8). Alternatives E and B restore the same amount of riparian acres (20.5). Alternative F would restore 20.37 acres. There would be no restoration acres under the no action alternative. When the riparian acres to be restored is added to undisturbed riparian refugia, the full potential for riparian refugia is most in alternative C (665.4), followed by alternative B (663.4), then D (661.0), then F (657.94), then E (651.0) and last, the no action (625.6).

Because of the differences in implementation strategies, monitoring would be conducted before capacity changes in Alts B-E and capacity changes would only be implemented if monitoring show the riparian condition could support the change. However, Alternative F may have short term impacts to riparian from an initial increase to up to 2,580 PAOTs prior to when monitoring is conducted. These impacts would be short term because management changes would be implemented if monitoring shows an impacted resource.

The no action alternative results in the most alteration to suitable and occupied lowland leopard frog habitat with no decision to allow for habitat restoration. In considering both the amount of riparian habitat alteration, combined with the different implementation strategies, the action alternative with the most effects to habitat is alternative F, followed by alternatives E, B, D, and C.

In the no action and alternatives B-E, capacity at Fossil Springs would be regulated. However, in Alternative F, management of Fossil Springs will be a hands off approach with adaptive management allowing for a change in management if needed. Under Alternative F, there could be undesirable direct effects to lowland leopard frogs and their habitat. It would take time before management changes could be enacted and for the riparian and aquatic habitat to recover. Repeat visual and aural disturbance to lowland leopard frog egg masses, tadpoles and individual frogs.

Cumulative Effects for Action Alternatives

Refer to the general cumulative effects analysis for all species, above.

Because there is habitat occupied by lowland leopard frogs and that recreation and management activities result in direct effects to individuals and indirect effects to habitat, *it is the determination that no action and the action alternatives may impact the lowland leopard frog, but is not likely to result in loss of viability or trend toward federal listing.*

Reptiles

Northern Mexican and Narrow-headed Gartersnakes

Effects from Programmatic Components Common to All Alternatives

Under the no action alternative, there would be no management guidance from a comprehensive management plan, no monitoring, and no adaptive management. Restoration activities would not occur without completion of NEPA and therefore implementation would be delayed for one to three years.

In all action alternatives, there would be a CRMP that provides management direction to ensure the river's outstandingly remarkable values are protected or enhanced, including riparian habitat that is suitable for the both the northern Mexican and narrow-headed gartersnakes. The effects of the plan amendment are the same as the programmatic direction discussed above.

Direct and Indirect Site-Specific Effects Common to All Alternatives

There have been no detections of either species of gartersnakes in Fossil Creek, however, suitable habitat occurs along all of Fossil Creek. In addition, an optimal prey base exists in about 10 miles of restored fisheries.

Activities in the CRMP corridor that may occur in suitable habitat would include recreation, restoration, new construction, maintenance/repair of existing infrastructures, and road and trail maintenance.

Recreation activities can result in indirect to effects to gartersnakes, should they occur in the future, when activities degrade habitat conditions either through loss of habitat or by introducing/spreading non-native aquatic organisms. Recreation activities in the riparian area can destroy gartersnake habitat over time by denuding stream banks and point bars (ridges of fine sediments inside the banks of the creek), compacting soil thereby eliminating re-growth of riparian vegetation, removing vegetation for firewood, and affecting water quality directly through human wastes and indirectly by facilitating erosion and sediment runoff. Visitors can potentially (intentionally or accidentally) introduce and nonnative aquatic organisms to suitable habitat; thereby increasing predation upon gartersnakes as well as decreasing their suitable forage base.

Proposed actions common to all alternatives include road improvements (repair of gabions, energy dissipaters, improve drainage), obliteration of unneeded roads and trails, rehabilitation of bare soil areas previously used for dispersed recreation, weed treatments, designating creek access trails, delineating and surfacing of parking lots, prohibiting road side parking, and implementing capacity control (such as reservation and permit systems, limits on group sizes, camping limitations, various prohibitions and restrictions). While some of these actions (parking areas), and new infrastructure (708 bridge and Irving bridge) will result in long-term disturbances to vegetation, BMPs and improvements (in drainage, closures and rehabilitation will overall improve upland watershed conditions and reduce indirect effects of erosion and sedimentation in Fossil Creek.

Restoration activities, new construction (such as the FR 708 bridge), maintenance/repair of existing infrastructure (such as the gabion baskets), and road and trail maintenance could result in short-term disturbance to these gartersnake species, should they be present, because these activities could occur in the riparian area when gartersnakes are active, or in the uplands during shedding or brumation. In the long term, restoration activities will benefit these two species of gartersnakes by increasing the amount of riparian habitat.

Because neither species of gartersnakes have been detected from the Fossil Springs area downstream to the fish barrier where many aquatic surveys have been conducted over the years, it is very unlikely these species currently occur in Fossil Creek. However, should either species occur in the corridor in the future, the potential effects are disclosed in this analysis.

Overall and across all action alternatives, activities that will improve riparian habitat and thus benefit the habitat for these two gartersnake species, include better management through a comprehensive river management plan, monitoring, restoration of riparian habitat, and adaptive management. The project area is expected to have a long-term reduction in bare soil area, better delineated creek access to hardened areas and less area dominated by invasive plants. Benefits are expected from increased restoration efforts, improved visitor distribution, reduced visitor impacts, and better quality refugia areas in between recreation sites.

Proposed critical habitat occurs along the Verde River, including up the Fossil confluence 600 feet from the Verde River. Activities associated with Fossil within proposed critical habitat would be limited to canyoneering and backpacking. These activities are very limited in the lower end of Fossil Creek; use of the Deadman Mesa trail is minimal. Also, management of the ¼ mile of overlap of the Fossil and Verde wild and scenic corridors defers to the Verde CRMP.

Differences in Effects Among All Alternatives

Alternative A results in the most alteration of riparian habitat potentially used by gartersnakes at 26.54 acres. Alternatives E, F, D, and B follow with 21.6, 14.6, 13.6 and 9.3 acres, respectively. Alternative C has the least amount of riparian acres disturbed at 8.6 acres. Acres of riparian restoration is most in alternative D (22.3) and then followed by alternative C (21.8). Alternatives E and B restore the same amount of riparian acres (20.5). Alternative F would restore 20.37 acres. There would be no restoration acres under the no action alternative. When the riparian acres to be restored are added to undisturbed riparian refugia, the full potential for riparian

refugia is most in alternative C (665.4), followed by alternative B (663.4), then D (661.0), then F (657.94), then E (651.0) and last, the no action (625.6).

Because of the differences in implementation strategies, monitoring would be conducted before capacity changes in Alts B-F and capacity changes would only be implemented if monitoring show the riparian condition could support the change.

The no action alternative results in the most alteration to riparian habitat potentially used by gartersnakes with no decision to allow for habitat restoration. In considering both the amount of riparian habitat alteration, combined with the different implementation strategies, the action alternative with the most effects to habitat is alternative F, followed by alternatives E, B, D, and C.

Cumulative Effects for Action Alternatives

Refer to the general cumulative effects analysis for all species, above.

Snails

Fossil Springsnail

Effects from Programmatic Components of All Alternatives

Under the no action alternative, there would be no management guidance from a comprehensive management plan, no monitoring, and no adaptive management. Restoration activities would not occur without completion of NEPA and therefore implementation would be delayed.

In all action alternatives, there would be a CRMP that provides management direction to ensure the river's outstandingly remarkable values are protected or enhanced, including riparian and aquatic habitat that is occupied by Fossil springsnails. The effects of the plan amendment are the same as the programmatic direction discussed above.

Direct and Indirect Site-Specific Effects of All Alternatives

Fossil springsnails are only known to occur in the Fossil Creek corridor and there are only a few small populations making them vulnerable to population die-offs and risk of extinction. Therefore proposed activities that could affect occupied springsnail sites are given careful consideration. Some springsnail sites (3 sites along 708 road and above Flume trail) are not in areas visited by visitors either because they are in areas that are not developed or are inaccessible. Visitors may access areas where springsnails exist within or near recreation sites (especially in the Fossil Springs area and possibly along the waterfall trail). This may result in: direct trampling of individual springsnails; disruption of substrate to which they adhere and lay eggs; and reduced water quality from contaminants such as soap, insect repellent, and sunblock.

Continued existence and further invasion of Himalayan blackberry will continue to degrade springsnail habitat, especially in the Fossil Springs areas where this has been observed. While the action alternatives allow for treatment of invasive plants, use of herbicide on plant populations located near springsnail sites could result in contamination.

Poor watershed conditions in the uplands can have adverse indirect effects on springs and springsnail habitat. Disturbance associated with recreational activities can contribute to poor watershed conditions. Such activities result in the removal of organic material on the soil surface. Removal of vegetation cover, in addition to compaction, decreases infiltration of the soil, which enhances surface runoff. Increased runoff in turn results in increased silt loads, increased turbidity, decreased water quality, and altered pH levels. Increase sedimentation results in increased embeddedness which smothers the substrate to which springsnails adhere and upon which they lay their eggs. Embedded sediment can also smother algae and other forage needed by springsnails.

Proposed actions common to all alternatives that occur near springsnail sites include road and trail maintenance, obliteration of unneeded roads and trails, rehabilitation of bare soil areas previously used for dispersed recreation, weed treatments, designating creek access trails, prohibiting road side parking, and implementing capacity control (such as reservation and permit systems, limits on group sizes, camping limitations, various prohibitions and restrictions). BMPs and improvements (drainage, closures and rehabilitation) will overall improve upland watershed conditions and reduce indirect effects of erosion and sedimentation at occupied springsnail sites.

Overall and across all action alternatives, activities that will improve riparian habitat and thus benefit the habitat for the springsnail, include better management through a comprehensive river management plan, monitoring, and adaptive management. It is expected to see a long-term reduction in bare soil area, better delineated creek access to hardened areas and less area dominated by invasive plants. Benefits are expected from increased restoration efforts, improved visitor distribution, reduced visitor impacts, and better quality refugia areas in between recreation sites. Additionally, the modification to the corridor boundary by including a spring with springsnails near the FR 708 will benefit springsnails by providing all the above benefits from being covered by the CRMP.

Differences Among All Alternatives

Camping near springs occupied by springsnails can increase the effects to water quality, soil, vegetation, and impacts to individual snails. Camping increases the duration of a visit, increasing the need to pump water from Fossil Creek or springs inhabited by the springsnail. One springsnail site in Fossil Springs has had a social trail from the main trail down to the spring. During a springsnail survey in 2017, no springsnails were detected and one factor may be repeat disturbance and habitat degradation by recreators. Alternatives that allow for camping in/near Fossil Springs (A, B, E, and F) would have more affect to springsnails than alternatives that don't allow for camping at Fossil Springs (C and D). Also, alternatives that allow for access to Fossil Springs (A,B,E, and F) would have more affect to springsnails than alternatives that do not allow access to Fossil Springs (C and D). Overall, alternative C and D provide for the most protection for springsnails and habitat in the Fossil Springs area.

Monitoring would be conducted before capacity changes in Alts B-F and capacity changes would only be implemented if monitoring show the riparian condition could support the change.

Use of motorized off-road vehicles along the Flume trail for emergency purposes could crush springsnails occurring in seeps that cross the Flume trail. In order to reduce these effects, structures will be installed to avoid OHVs from touching wetted soil. Should these seeps be occupied by Fossil springsnails, these structures will ensure that snails are not crushed by OHV vehicles.

Cumulative Effects for Action Alternatives

Refer to the general cumulative effects analysis for all species, above.

Effects and Determination for Remaining Sensitive and Locally Important Species

The effects and determinations for sensitive and locally important species that were not covered in detail above (because there is either not enough information on their occurrence or that they have not been detected within the corridor), are summarized in Table 45 below. For full disclosure of how proposed activities may affect species and their habitat, refer to the General Effects Common to all Alternatives section, above.

Table 45. List of Sensitive and locally important species the Fossil Creek Wild and Scenic River Corridor

Common Name	Summary of Effects	Determination of Effects
Bald Eagle	Operations and maintenance, administrative activities, construction and maintenance of infrastructure, and recreational activities may result in disturbance to bald eagles that may occur in the area, especially during the high use months. Infrastructure (existing and new) results in habitat loss for nesting and wintering bald eagles.	It is the determination that no action and the action alternatives may impact the bald eagle, but is not likely to result in loss of viability or trend toward federal listing.

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Common Name	Summary of Effects	Determination of Effects
American Peregrine Falcon	Operations and maintenance, administrative activities, construction and maintenance of infrastructure, and recreational activities may result in disturbance to peregrine falcons that occur in the area, especially during the high use months.	It is the determination that no action and the action alternatives may impact the peregrine falcon, but is not likely to result in loss of viability or trend toward federal listing.
Northern Goshawk	Since operations and maintenance, administrative activities, construction and maintenance of infrastructure, and recreational activities occur along Fossil Creek which is well away from goshawk habitat, there will be no effect to nesting habitat. However, the above activities that occur in pinyon juniper woodlands may result in disturbance to wintering goshawks, should they occur in the project area.	It is the determination that no action and the action alternatives may impact the northern goshawk, but is not likely to result in loss of viability or trend toward federal listing.
Western Red Bat	Operations and maintenance, administrative activities, construction and maintenance of infrastructure, and recreational activities may result in disturbance to roosting and foraging red bats along Fossil Creek, especially during the high use months. Since activities within the corridor are fairly limited during the winter, there will be less potential for disturbance to hibernating bats. Recreational and administrative activities that occur at night may disturb spotted bats that forage and water along Fossil Creek.	It is the determination that no action and the action alternatives may impact the red bat, but is not likely to result in loss of viability or trend toward federal listing.
Allen's Lappet-browed Bat	Operations and maintenance, administrative activities, construction and maintenance of infrastructure, and recreational activities may result in disturbance to roosting bats but since these bats roost in juniper or pine trees, disturbance to roosting bats is anticipated to be low. And, since activities within the corridor are fairly limited during the winter, there will be less potential for disturbance to hibernating bats. Recreational and administrative activities that occur at night may disturb spotted bats that forage and water along Fossil Creek.	It is the determination that no action and the action alternatives may impact the Allen's lappet browed bat, but is not likely to result in loss of viability or trend toward federal listing.
Pale Townsend's Big-eared Bat	Operations and maintenance, administrative activities, construction and maintenance of infrastructure, and recreational activities may result in disturbance to roosting bats that occur in the area, especially during the high use months. Since activities within the corridor are fairly limited during the winter, there will be less potential for disturbance to hibernating bats. Recreational and administrative activities that occur at night may disturb spotted bats that forage and water along Fossil Creek.	It is the determination that no action and the action alternatives may impact the Pale Townsend's big-eared bat, but is not likely to result in loss of viability or trend toward federal listing.
Spotted Bat	Operations and maintenance, administrative activities, construction and maintenance of infrastructure, and recreational activities are unlikely to result in disturbance to roosting bats since these bats roost high up in cracks and crevices in cliffs and canyon. The only activities associated with cliffs would be rock scaling above FR 708 in alternatives D and E. Therefore, disturbance to roosting bats is anticipated to be low. There would be no effect to roosting spotted bats in alternatives A, B, C, and F. And, since activities within the corridor are fairly limited during the winter, there will be less potential for disturbance to hibernating bats. Recreational and administrative activities that occur at night may disturb spotted bats that forage and water along Fossil Creek.	It is the determination that no action and the action alternatives may impact the spotted bat, but is not likely to result in loss of viability or trend toward federal listing.
Arizona Toad	Operations and maintenance, administrative activities, construction and maintenance of infrastructure, and recreational activities may result in disturbance to habitat and possibly to individuals, should they be present.	It is the determination that no action and the action alternatives may impact the Arizona toad, but is not likely to result in loss of viability or trend toward federal listing.
Arizona Phlox	Activities in canyons where this plant may occur are limited, however, use and maintenance of existing roads (708) and trails (Flume, Fossil Springs and Mail trails) could result in disturbance to individuals.	It is the determination that the no action and the action alternatives may impact the Arizona phlox, but is not likely to result in loss of viability or trend toward federal listing.
Cochise Sedge	Although the only known occurrence for this plant is in lower Fossil Creek where use is very limited, suitable habitat occurs along the entire perennial stretch of Fossil Creek. Therefore, recreational	It is the determination that the no action and the action alternatives may impact the Cochise sedge, but

Common Name	Summary of Effects	Determination of Effects
	activities could result in trampling of plants along the entire perennial portion of the creek. Construction of bridges and repair of gabion may result in removal of individuals.	is not likely to result in loss of viability or trend toward federal listing.
Metcalf's Tick-trefoil	Activities on rocky slopes and in canyons where this plant may occur are limited, however, use and maintenance of existing roads (708 switchbacks) and trails (Fossil Springs and Mail trail) could result in disturbance to individuals.	It is the determination that the no action and the action alternatives may impact the Metcalfe's tick trefoil, but is not likely to result in loss of viability or trend toward federal listing.
Mt. Dellenbaugh Sandwort	This species is known to occur in the corridor. Activities in uplands with oak, pine, and pinyon/juniper woodlands could result in disturbance and even removal of individual plants. The use and maintenance of existing roads (708 switchbacks) and trails (Fossil Springs and Mail trail) could result in disturbance to individuals.	It is the determination that the no action and the action alternatives may impact the Mt. Dellenbaugh Sandwort, but is not likely to result in loss of viability or trend toward federal listing.
Eastwood Alumroot	Even though this plant is only known to occur outside of the corridor, there is potential for it to occur in the corridor on moist slopes in ponderosa pine forests and canyons toward the upper end of the corridor. Activities in the corridor where this appropriate vegetation and elevation exist is very unlikely to occur and so potential for disturbance is very low.	It is the determination that the no action and the action alternatives will not impact the Eastwood alumroot.

Bald and Golden Eagle Protection Act

To comply with the Eagle Act, the U.S. Fish and Wildlife Service (FWS) recommends using the *Conservation Assessment and Strategy for Bald Eagles in Arizona* (Driscoll et al. 2006) in conjunction with the *Bald Eagle National Management Guidelines* (USDI Fish and Wildlife Service 2007) to protect bald eagles in Arizona. For golden eagles, the FWS has issued a report titled *Interim Golden Eagle Technical Guidance: Inventory and Monitoring Protocols; and Other Recommendations in Support of Golden Eagle Management and Permit Issuance* (Pagel et al. 2010).

Most Forest Service authorized management activities would not meet the definition of take under the Eagle Act because court rulings make it clear that take occurs when there is a purposeful killing of an eagle. There is no likelihood that there be purposeful take with proposed activities. However, some activities could result in disturbance to eagles that could interfere with breeding, feeding, or sheltering behavior during the breeding season, or in the vicinity of roost sites in the winter. Examples include: fuel reduction activities; road, trail, and facility construction; prescribed burning; dispersed or developed recreation use including uncontrolled-off-highway vehicle use; and special use permits in the vicinity of eagle nests or roost sites. Direct injury to eagles from management activities is not a large threat, although collisions with communication towers, powerlines, and vehicles can occur and result in injury or death of eagles.

Bald Eagle

There are no known bald eagle nests or winter roosting areas within the Fossil WSR corridor. However, suitable food as well as roosting and nesting habitat is available in the corridor. Should eagles be discovered nesting or roosting in the WSR corridor, the following mitigations, which come from the National Bald Eagle Management Guidelines (2007), would be taken to avoid disturbance, harm, harassment, and take:

- Employ nest buffers zones 1, 2, or 3 as per the Conservation Assessment and Strategy for the Bald Eagle in Arizona (Driscoll et al. 2006).
- Maintain undisturbed, natural habitats between the activity around the nest tree.
- Avoid activities within buffers during the breeding season (Dec 1 through June 30) and avoid changes to the landscape outside of the breeding season.

Direct and Indirect Effects

Direct effects to the bald eagle would be from activities that cause auditory or visual disturbance to eagles within or adjacent to the project. The Verde River and Fossil Creek are flown by AGFD looking for eagle nests; no bald

eagle nests are known within or near the Fossil WSR corridor. The closest eagle nest is Coldwater, which has been unoccupied for the last three years. Because there are no bald eagles known to nest in the project area, there will be no direct effects to nesting eagles. Bald eagles that forage in the corridor, particularly near the riparian area of the recreation segment may be disturbed by people and vehicles, but due to the large amount of suitable foraging habitat this disturbance would be incidental and infrequent.

Indirect effects to the bald eagle include effects to eagle habitat, eagle prey species, or prey species habitat. Bald eagles prey mainly on waterfowl and large fish. While fishing is allowed in Fossil Creek during the fall, winter, and spring, it would minimally affect the age class of fish preferred by bald eagles and would be limited to the area between the powerline crossing and the large falls. There are no anticipated measurable adverse effects to prey species or their habitats.

Despite direct and indirect effects that may occur to bald eagles, should they occur in the corridor, most Forest Service authorized management activities would not meet the definition of take under the Eagle Act because court rulings make it clear that take occurs when there is a purposeful killing of an eagle.

Cumulative Effects

There are no effects to bald eagles anticipated from project activities therefore there are no cumulative effects.

Golden Eagle

Direct and Indirect Effects

Direct effects to the golden eagle would be from activities that cause auditory or visual disturbance to eagles within or adjacent to the project. Since the nearest known golden eagle sites are out of the corridor and in remote uplands, there will be no direct effects to nesting eagles. Eagles that forage in the corridor, particularly near the riparian area of the recreation segment may be disturbed by people and vehicles, but due to the large amount of suitable foraging habitat (uplands) this disturbance would be incidental and infrequent.

Indirect effects to the golden eagle include effects to eagle habitat, eagle prey species, or prey species habitat. There are no anticipated adverse effects to prey species or their habitats. There are no treatments proposed in potential nest habitat as rock outcrops and cliff ledges are not accessible.

Despite direct and indirect effects that may occur to golden eagles, should they occur in the corridor, most Forest Service authorized management activities would not meet the definition of take under the Eagle Act because court rulings make it clear that take occurs when there is a purposeful killing of an eagle.

Cumulative Effects

There are no effects to golden eagles anticipated from project activities therefore there are no cumulative effects.

Determination of Effect for Bald and Golden Eagles

The proposed treatments and activities will not result in take as defined by the Bald and Golden Eagle Protection Act. Neither species of eagle nests or roosts within the WSR corridor. Although there could be some level of disturbance to eagles foraging or passing through the corridor, they are not expected to cause 1) injury to an eagle, 2) a decrease in productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment by substantially interfering with normal breeding, feeding, or sheltering behavior.

Management Indicator Species – All Alternatives

The amount of MIS habitat disturbed by each alternative is listed below for the Coconino and in table 46 for the Tonto National Forests.

The amount of pronghorn habitat disturbed in alternatives A, B, C, D, E, and F are 34.5, 29.9, 32.6, 29.0, 33.6 and 38.5 acres, respectively. Because the no action and action alternatives would result in minor loss of habitat (less

than a fraction of one percent) for MIS species when compared to available habitat on the Coconino National Forest, the loss is too small to alter forest-wide habitat and population trends for any species. Therefore, it is the determination that the no action, the action alternatives, and the CRMP will have no effect to forest-wide trends for management indicator species on the Coconino National Forest.

Table 46: Amount of MIS Habitat Disturbed by Alternative on the Tonto NF

Species	Indicator Habitat Occurring Within Project Area	Acres of Habitat Disturbed						Forest-wide Acres
		No Action	Alt B	Alt C	Alt D	Alt E	Alt F	
Elk	All P/J types	45.0	39.3	39.6	38.3	41.4	29.4	469,898
Turkey	All P/J types	45.0	39.3	39.6	38.3	41.4	29.4	469,898
Juniper Titmouse	Late seral P/J and snags	45.0	39.3	39.6	38.3	41.4	29.4	810,881
Ash-throated Flycatcher	All P/J types	45.0	39.3	39.6	38.3	41.4	29.4	810,881
Gray Vireo	P/J woodland and Alligator/Utah Juniper Savannah	6.0	5.9	5.9	5.7	6.6	6.0	54,352
Townsend's Solitaire	P/J woodland and Alligator/Utah Juniper Savannah	6.0	5.9	5.9	5.7	6.6	6.0	54,352
Northern Flicker	P/J woodland and Alligator/Utah Juniper Savannah	6.0	5.9	5.9	5.7	6.6	6.0	54,352
Spotted Towhee	P/J woodland and Alligator/Utah Juniper Savannah	6.0	5.9	5.9	5.7	6.6	6.0	54,352
Black-chinned Sparrow	P/J woodland and Alligator/Utah Juniper Savannah	6.0	5.9	5.9	5.7	6.6	6.0	54,352
Savannah Sparrow	Juniper/Semi desert grassland and Alligator/Utah Juniper Savannah	40.4	34.7	35.1	33.7	36.1	34.8	756,529
Black-chinned Sparrow	Pinyon juniper with shrub	39.0	33.4	33.7	32.6	34.8	33.5	688,925
Horned Lark	Juniper/Semi desert grassland and Alligator/Utah Juniper Savannah	40.4	34.7	35.1	33.7	36.1	34.8	756,529
Black-throated Sparrow	Juniper – grassland transition and semi-desert grassland	6.0	5.9	5.9	5.7	6.6	5.9	415,546
Canyon Towhee	Juniper – grassland transition and semi-desert grassland	45.0	39.3	39.6	38.3	41.4	29.4	810,881
Arizona Gray Squirrel	Riparian	9.0	1.4	1.4	1.0	1.6	1.5	35,022
Common black-hawk	Riparian	9.0	1.4	1.4	1.0	1.6	1.5	35,022
Bald Eagle	Riparian	9.0	1.4	1.4	1.0	1.6	1.5	35,022
Bell's Vireo	Riparian	9.0	1.4	1.4	1.0	1.6	1.5	35,022
Summer Tanager	Riparian	9.0	1.4	1.4	1.0	1.6	1.5	35,022
Hooded Oriole	Riparian	9.0	1.4	1.4	1.0	1.6	1.5	35,022
Hairy Woodpecker		9.0	1.4	1.4	1.0	1.6	1.5	35,022
Arizona Gray Squirrel		9.0	1.4	1.4	1.0	1.6	1.5	35,022
Warbling Vireo		9.0	1.4	1.4	1.0	1.6	1.5	35,022

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Species	Indicator Habitat Occurring Within Project Area	Acres of Habitat Disturbed						Forest-wide Acres
		No Action	Alt B	Alt C	Alt D	Alt E	Alt F	
Western Wood Peewee		9.0	1.4	1.4	1.0	1.6	1.5	35,022

*Even though the query for vegetation types shows no acres for PJC in the project area or analysis area, this habitat type is present but it's included in other P/J veg types. So, black-chinned sparrow is included in this analysis and the acres for other P/J types are used as a proxy for PJC.

Because the no action and action alternatives would result in minor loss of habitat (less than a fraction of one percent) for MIS species when compared to available habitat on the Tonto National Forest, the loss is too small to alter forest-wide habitat and population trends for any species. Therefore, it is the determination that the no action, the action alternatives, and the CRMP will have no effect to forest-wide trends for management indicator species on the Tonto National Forest.

Migratory Birds – All Alternatives

Effects Common to All Alternatives

Most Forest Service management activities would not meet the definition of take under the Migratory Bird Treaty Act, which is "... to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect" (50 CFR 10.12). Activities that result in direct ground disturbance (construction, maintenance, restoration) and unintentional ground disturbance (recreation) can result in the removal or destruction of vegetation. Vegetation removal or destruction is not considered a taking; however, activities occurring during the breeding seasons, could result in unintentional take if active nests with eggs or young are present in trees, shrubs or on the ground. These activities would occur under all alternatives considered in this analysis.

One Important Bird Area (IBA), the Salt and Verde Riparian Ecosystems IBA occurs along the Verde from Childs downstream to the Fossil confluence. This IBA occurs in the area covered and managed under the Verde Comprehensive River Management Plan.

Though overwintering by bird species occurs in the project area, no areas within the Fossil WSR corridor have been designated as important overwintering areas.

Cumulative Effects Common to All Alternatives

Because migratory birds spend a good portion of the year in migration and on their wintering grounds, activities that degrade stopover or wintering habitats can have an effect on the food and cover requirements for these birds. Similarly, on breeding grounds, activities on non-Forest Service lands can also degrade habitats and disturb birds.

Determination of Effects for Action Alternatives

The CRMP guidance under all action alternatives provides for migratory bird habitat through desired conditions and guidelines for the vegetation types, as well as desired conditions and guidelines (restriction on loud activities during breeding season, treatment of invasive plant populations, and limiting new disturbance to mesquite bosques) for wildlife and their habitat. Additional general direction to improve habitats and maintain viable populations in wildlife direction also applies to migratory birds.

Monitoring specifically for migratory birds is not part of the Fossil Creek monitoring plan, however, a plot at Fossil Springs was monitored through a state-wide riparian bird monitoring led by AGFD. This plot will be monitored periodically through that effort. In addition, forest-wide migratory bird monitoring occurs in representative habitats across the forest. While forest-wide monitoring does not occur annually, it does occur on a rotational basis.

Unintentional take could occur when management activities or visitors destroy nests or kill individual birds. This may occur if trees and snags are removed for the construction of infrastructure and when hazard trees are removed. The scope and scale of these losses will be distributed throughout the 10+ years of plan implementation and in the long-term, management activities strive towards habitat improvement, sustaining priority bird habitat into the future.

Considering environmental and cumulative consequences common to all alternatives and the effects disclosed above, all action alternatives are likely to result in some unintentional take of migratory birds, but is not likely to be occurring to such an extent to have a measurable negative effect on migratory bird populations.

Determination of Effects for No Action Alternative

There would be no CRMP guidance to protect migratory birds and their habitat under the no action alternative. As a result, unintentional take could occur when management activities or visitors destroy nests or kill individual birds. The scope and scale of these losses will be distributed throughout the 10+ years of plan implementation and in the long-term, management activities strive towards habitat improvement, sustaining priority bird habitat into the future.

Considering environmental and cumulative consequences common to all alternatives and the effects disclosed above, the no action alternative would likely result in some unintentional take of migratory birds, but it would not likely occur to such an extent that would have a measurable negative effect on migratory bird populations.

Summary

Degree to Which the Purpose and Need for Action is Met

There is a need to develop a long-term management plan and site-specific actions to provide for the protection or enhancement of the biological ORV. Alternatives B-E will provide the protection and possibly enhancement of the biological ORV. However, alternatives A and F will not provide protection for populations of black-hawks and Fossil springsnails. Rationale is detailed in species effects and determination sections.

Degree to Which the Alternatives Address the Issues

Key issues were raised in regards to: recreation use and visitor capacities; recreation management; infrastructure development; motorized access; and economic and commercial opportunities. Specifically for wildlife the following issues were raised:

1. Recreational use in Fossil Creek may disturb wildlife and fish, damage streamside vegetation, impact travertine deposition and existing travertine structures, increase soil erosion, reduce water quality, damage archeological sites, and compromise contemporary tribal values.
2. Allowing camping may increase impacts to natural and cultural resources and result in additional trash in the Fossil Creek corridor.
3. Motorized use in the vicinity of Fossil Creek may increase noise, crowding, trash, invasive species, pollutants, erosion, and siltation into the creek.

Based on detailed analysis of effects, it is determined that alternatives B through E, best address the above issues due to the monitoring and adaptive management components.

The no action alternative will not address the above issues. Rationale for this determination is detailed in species effects and determination sections and in summary of environmental effects below.

Summary of Environmental Effects

In an attempt to summarize how the alternatives compare in terms of both impacts and benefits to wildlife habitat, the important factors considered in the effects analysis are ranked by alternative in the tables below. Important factors considered that would negatively impact habitat include total riparian acres disturbed, potential for impact to refugia based on the potential for crowding, and amount of stream accessible in designated recreation sites. See Table 47. The overall weighted ranking of alternatives in terms of least impact to habitat is as follows: B, A, C, then D, E and F.

Table 47: Ranked Comparison of Impacts to General Wildlife Habitat by Alternative

	No Action	B	C	D	E	F
Total Riparian Acres Disturbed	1	5	6	4	2	3
Potential for Impact to Refugia	5	6	3.5	3.5	2	1
Recreation Stream Access (crowding)	6	5	4	2	3	1
Score	12	16	13.5	9.5	8	5

Best = 6, worst = 1

Important factors considered that would benefit wildlife habitat include total acres of vegetation restored, total riparian acres restored, and full potential of refugia acres. See Table 48. The overall weighted ranking of alternatives in terms of most benefit to habitat is as follows: D and C, followed by B, then F, E, and last A.

Table 48: Ranked Comparison of Benefits to General Wildlife Habitat by Alternative

	No Action	B	C	D	E	F
Total Veg Acres Restored	1	4	5	6	2	3
Total Riparian Acres Restored	1	3.5	5	6	3.5	4
Full Potential Refugia Acres	1	5	6	4	2	3
Score	3	12.5	16	16	7.5	10

Best = 6, worst = 1

Even though there will be direct and indirect effects to special status species and their habitat and the level of these effects differ among alternatives, overall *it is the determination that alternatives B-F would not result in enough segment-wide disturbance to constitute adverse effect or degradation and as a result wildlife populations and wildlife habitat components of the Biological ORV will be protected and/or enhanced under alternatives B-F.* This is because disturbance is minimal when compared to the overall undisturbed area and monitoring will occur before incremental increases in capacity are implemented in alternatives D, E and F. With the no action alternative, effects to species could occur but would be unknown to managers because there would be no formal monitoring plan, no CRMP, nor forest plan amendments *resulting in adverse effect or degradation of wildlife populations and their habitat.*

Key Points:

- The wildlife population and habitat portion of the Biological ORV was designated based on the important populations of a locally important and management indicator species, the common black-hawk, and two Forest Service Sensitive species, the lowland leopard frogs and Fossil Springsnails.
 - The Fossil Creek population of black-hawks is important for numerous reasons (see that section for details). The alternatives that would have the most impact to nesting black-hawks, are E, F, and A. The alternatives that would have the least impact to nesting black-hawks, based on ranking of numerous factors analyzed in the effects section, are C, followed by B and then D. The alternatives that have the least impact to nesting black-hawks are C, followed by B and then D.

- The lowland leopard frog population in Fossil Creek is the Coconino National Forest's only viable population and is a significant population for the Tonto National Forest. The action alternative with the most effects to habitat is alternative F, followed by alternatives E, B, D, and C. In the no action and alternatives B-E, capacity at Fossil Springs would be regulated. However, monitoring data does not show a correlation to changes in lowland leopard frog numbers, rather decreases were correlated to major flooding that scoured habitat and increases were correlated to restoration of full flows and recovery after major flooding.
- The Fossil springsnail only occurs in springs associated with Fossil Creek and because it's a narrow endemic, this species is susceptible to extinction. When considering day use and camping in the Fossil Springs area, alternatives C and D provide for the most protection for springsnails and habitat in the Fossil Springs area.
- Because habitat for listed species occurs in the corridor, the effects analysis covers potential effects to species' habitat.
- There are no listed wildlife (excluding fish) species that are currently known to occur in the perennial portion of the Fossil corridor (where the majority of infrastructure and recreation occurs).
- There is potential for Mexican spotted owl, western yellow-billed cuckoo, southwestern willow flycatcher, northern Mexican gartersnake, and narrow-headed gartersnake to be present in the corridor. Effects analysis covers potential effects to these species should they occur in the future.
- The only critical habitat within the project area is: 1) for the two gartersnakes and occurs at the last 600 feet of Fossil at its confluence with the Verde and 2) a minor amount of MSO habitat at the very top end of the corridor. Therefore, there would be no effect to any species' designated critical habitat since there is either no critical habitat in the analysis area or it occurs in areas where recreation and management activities will not affect primary constituent elements.
- Short-term effects to species can occur before monitoring occurs (bare area monitoring occurs in the fall at the end of the high use season) and before adaptive management is implemented. In some cases, adaptive management measure may not be enough to ensure those effects aren't carried over into the next high use recreation season.
- In the action alternatives, the concept of refugia, forest plan direction (seasonal closures if needed, etc.), monitoring prior to incremental increases in capacity in D, E and F (capacities decrease for B and C), monitoring for recreational use and impacts outside of recreation sites and adaptive management, all provide for long-term adequate protection for wildlife and habitat. Therefore alternatives B-F would not cause a degradation of the wildlife population and wildlife habitat components of the Biological ORV.
- With the no action alternative, effects to species could occur but effects would be unknown or information about effects to ORVs would be delayed to managers, resulting in adverse effect or degradation of wildlife populations and their habitat.

Short-term Uses and Long-term Productivity

Proposed activities that have a short term impact but long term benefit to wildlife include maintenance of roads and trails, maintenance of facilities, construction of infrastructure that contains recreation impacts (parking area delineation), mitigative actions (runoff retention basins that reduce contaminants from reaching Fossil creek), and restoration activities.

Proposed activities that may result in disturbance to wildlife over the long term include; day use, camping, and dispersed back country recreation; use along roads and trails; and construction of infrastructure when it results in new ground disturbance.

Minimizing human-created bare areas particularly outside of recreation sites and within AMZ and implementing BMPs, site re-design, or restoration to reduce erosion and sedimentation into Fossil Creek will result in long-term benefits to wildlife and their habitat.

In general, a river management plan along with monitoring and adaptive management will, in the long term, reduce: bare soil areas; erosion, soil runoff and sedimentation in the stream; trash, human waste, and vehicle pollutants; creek access to areas with soft, unarmored banks; the creation and long-term use of unauthorized trails and roads; and uninformed and/or improperly behaved visitors.

Benefits are also expected from: obtaining federally reserved water rights; withdrawal from locatable mineral entry; use of sustainable materials and energy sources; more and focused education, interpretation, and research; more restoration and maintenance to reduce erosion and sediment; more appropriate infrastructure that hardens sites, improves visitor distribution, and reduces visitor impacts; more and better quality refugia areas; potential for future outfitter/guide activities which can help manage recreation; and consistent management of the Fossil Springs Botanical Area.

Overall, the implementation of action alternatives will not jeopardize the long-term productivity of the National Forest System lands.

Unavoidable Adverse Effects

While there will be new ground disturbance with the action alternatives, the acres are a fraction of a percent when compared to the total acreage in the corridor. Implementation of the CRMP management direction, resource protection measures, required monitoring and resulting adaptive management will minimize effects and in some cases, result in beneficial effects. Overall, there are no significant adverse effects as a result of implementing any of the action alternatives.

Irreversible and Irretrievable Commitments of Resources

While some actions (mainly construction of infrastructure) will result in an irretrievable loss of wildlife habitat, this loss is minimal when compared to the total acres within the corridor. However, none of the proposed infrastructure is irreversible; it would be possible to remove infrastructure and restore to natural conditions.

Other Agencies and Individuals Consulted

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Name	Title	Agency	Contribution
Christina Akins	Payson Ranger District Wildlife Biologist	Forest Service	Tonto Species Information
Debra Crisp	Botanist	Forest Service	Plant species occurrences
Rob Gibb	Red Rock Ranger District volunteer	Forest Service	Entry of species occurrence records into database.
Wendy Hodgson	Botanist	Desert Botanical Garden	Plant species occurrences
Jill Holderman	Tonto Forest Biologist	Forest Service	Tonto Species Information
Debbie Hom	Wildlife Biologist and GIS Specialist	Forest Service	GIS mapping
Tuk Jacobson	Eagle Biologist	Arizona Game and Fish Department	Bald and golden eagle nest and roost site data
Matt Johnson	Ornithologist	Northern Arizona University	Black-hawk, cuckoo and willow flycatcher surveys and results
Cecelia Overby	Coconino Forest Biologist	Forest Service	Migratory bird, MIS, and analysis guidance
Jeff Sorensen	Wildlife Biologist	Arizona Game and Fish Department	Fossil Springsnail Expertise
Joni Ward	Botanist	Desert Botanical Garden	Plant species occurrences

Acronyms

AMZ – Aquatic Management Zone
 BMP – Best Management Practice
 COBH – Common black-hawk
 CRMP – Comprehensive River Management Plan
 EIS – Environmental Impact Statement
 FC – Fossil Creek
 FCWSRC – Fossil Creek Wild and Scenic River Corridor
 FR – Forest Road
 SR – Stat Route
 IBA – Important Bird Area
 LIS – Locally Important Species
 LRMP – Land and Resource Management Plan
 MIS – Management Indicator Species
 NEPA – National Environmental Policy Act
 NTMB – Neotropical Migratory Birds
 ORV – Outstandingly Remarkable Value
 PAC – Protected Activity Center
 WSR – Wild and Scenic River
 WSRA – Wild and Scenic Rivers Act
 PAOT – people at one time

References Cited

- Adams, K., Harrop, B., James, M. and Marks J., 2015 Riparian Vegetation and Water Quality Monitoring: Middle Fossil Creek Riparian Habitat Protection and Restoration Project Final Report: Monitoring Data and Analysis, 2010-2014 (Task4).
- Adams et al 2013. Marks Lab 2012 report for the Fossil Creek Riparian Vegetation, Water Quality and Visitor Use Monitoring Plan
- Agyagos, Janie editor. Collins et al., 2003. Fossil Creek actual plant list and Botanical Area plant list. Internal document. Coconino National Forest. “Numerous vegetative surveys from the 1970s through the present ...” added cites individually
- Agyagos, Janie, Debra Crisp, Max Licher, 2009. Personal communication with botanists/ biologists. Coconino National Forest
- Agyagos, Janie, Barbara Phillips, Laura Moser, 2012. Personal communication with botanists/ biologists. Coconino National Forest.
- Agyagos J. 2017 - Site visit travertine pools Fossil Creek
- Airola D.A. 1986. Recreation activities can result in indirect effects to flycatchers when activities degrade habitat conditions and increase the amount of trash that attracts parasitic brown-headed cowbirds .
- Aitchison 1977. Vegetation changes in and near camping areas can cause bird species diversity to shift to more common and generalist species, while rarer and specialist species such as Common Black-Hawks and Yellow-billed Cuckoos decline.
- Anthony, R.G., R.L. Knight, G.T. Allen, B. Riley McClelland, and J.I. Hodges. 1982. Habitat use by nesting and roosting bald eagles in the Pacific Northwest. Trans. North Am. Wildl. and Nat. Resour. Conf. 47:332-342.
- AZ Game and Fish (AZGFD) In 2005 and 2013, monitored existing populations. In 2017, the AZGFD with the Forest Service monitored existing populations (noting an increase at two sites where counts in previous years were low and of concern) and documented an additional population of springsnails near the Waterfall trail.
- Arizona Game and Fish Department. 2006. *Rana yavapaiensis*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, AZ. 10 p
- Audubon Society website, accessed 2015. Birds and Climate Change. <http://climate.audubon.org/>
- Baker 1998. Botanical Surveys Fossil Creek
- Beatty, Gregory L. 1992. 1992 Arizona bald eagle winter count. Arizona Game and Fish Department. Nongame and Endangered Wildlife Program. Phoenix, Arizona. November 1992.
- Beatty, Gregory L., James T. Driscoll, and John G. Koloszar. 1995. Arizona Bald Eagle Winter Count: 1995. Technical Report 82. Nongame and Endangered Wildlife Program. Arizona Game and Fish Department. Phoenix, Arizona. September 1995.
- Beatty, Gregory L., James T. Driscoll, and Mitch C. Siemens. 1995. Arizona Bald Eagle Winter Count: 1994. Technical Report 68. Nongame and Endangered Wildlife Program. Arizona Game and Fish Department. Phoenix, Arizona. May 1995

- Beatty, Gregory L. and James T. Driscoll. 1999. Arizona Bald Eagle Winter Count: 1997-1998. Technical Report 137. Nongame and Endangered Wildlife Program. Arizona Game and Fish Department. Phoenix, Arizona. February 1999
- Blakesley and Reese 1988. found a possible correlation between recreational activities and decreased riparian bird abundance.
- Boeing, Wiebke J., Kerry L. Griffis-Kyle , and Jeremy M. Jungels. 2014. Anuran Habitat Associations in the Northern Chihuahuan Desert, USA. Published By: The Society for the Study of Amphibians and Reptiles. *Journal of Herpetology*, 48(1):103-110. 2014.
- Bouchard, Walter L, 2004. Noxious Weed Survey and Mapping for the Childs/ Irving Hydroelectric Plant Site (including addendum).
- Briggs 1996. Changes in structure, density and composition of vegetation can occur from recreation-induced soil compaction and erosion.
- Brusca, Richard C., John F. Wiens, Wallace M. Meyer, Jeff Eble, Kim Franklin, Jonathan T. Overpeck, and Wendy Moore. Dramatic response to climate change in the Southwest: Robert Whittaker's 1963 Arizona Mountain plant transect revisited. *Ecology and Evolution* 2013; 3(10): 3307–3319.
- Burger, Bill 2005 pers.comm. w/Agyagos J.
- Burger, Bill. Personal communication regarding river otter in the Verde River, 3/4/02.
- Carothers et al 1979. Brown-headed Cowbirds, skunks, ringtails (*Bassariscus astutus*), lizards, rodents and squirrels.
- Clay et al. 1984. Fungal endophyte-infected fescue is toxic when consumed by mammalian herbivores
- Cole, David and Peter Landres. Indirect Effects of Recreation on Wildlife. *Wildlife and Recreationists – Coexistence Through Management and Research*. Washington, DC: Island press: Chapter 11, 183-202.
- Cole and Landres 1995. More specifically, activities within the riparian area result in: loss of soil-stabilizing ground cover; soil compaction; decreased amount of grasses, forbs, shrubs, and recruitment trees; increased potential for invasion of exotic weeds; decreased infiltration of water during rain events; increase rates of runoff; increased sedimentation into streams; increase of contaminants into streams; and decreased water quality
- Cole and Spildie 1998. Activities contributing to these changes include hiking, horseback riding, camping and day use.
- Collins et al 1974. Botanical Surveys of Fossil Creek.
- Dargan, Cecelia M. 1991. Roost site characteristics of bald eagles wintering in north-central Arizona. M.S. Thesis. N. Arizona Univer. 73 pp.
- Defenders of Wildlife. Climate Change in the Southwest. PDF on website accessed 2018.
https://defenders.org/sites/default/files/publications/climate_change_in_the_southwest.pdf 2 p.
- DeSutter 2015. Following the lowering of the historic Fossil Springs dam and restoration of full water flows to Fossil Creek in 2005, public use of the river corridor has increased substantially. Recreational use during the summer season grew from an estimated 20,000 visitors in 2006.
- Driscoll, James. Personal communication with Janie Agyagos on June 5, 2000 regarding nesting bald eagles along the Verde River.

- Driscoll et al. 2006. To comply with the Eagle Act, the U.S. Fish and Wildlife Service (FWS) recommends using the Conservation Assessment and Strategy for Bald Eagles in Arizona
- Etzel , E. E., .T. C. Theimer, M.J. Johnson and J.A. Holmes. Variation in Prey Delivered to Common Black-hawks (*Buteo borealis*) nests in Arizona Drainage Basins. *J. Raptor Res.* 48(1):000–000
- Etzel 2010 blackhawk survey in Fossil
- Etzel et al. 2013. in Fossil Creek, abundant native prey (fish) is available to black-hawks, unlike all other perennial system in the Verde Valley
- Finch, Deborah M., ed. 2012. Climate change in grasslands, shrublands, and deserts of the interior American West: a review and needs assessment. Gen. Tech. Rep. RMRS-GTR-285. Fort Collins, CO: UIS. Department of Agriculture, Forest Service , Rocky Mountain Research Station. 139 p.
- Frost, J.S. and J.E. Platz. 1983. Comparative assessment of modes of reproductive isolation among four species of leopard frogs (*Rana pipiens* complex). *Evolution* 37:66-78.
- Garfin, Gregg; Angela Jardine, Robert Merideth, Mary Black, Sarah LeRoy. 2013. Assessment of Climate Change in the Southwest United States. A Report Prepared for the National Climate Assessment. National Climate Assessment Regional Technical Input Report Series. 506 p.
- Glinksi et al 1998 . Golden Eagle
- Goodwin 1979. Botanical Surveys of Fossil Creek.
- Grubb, T.G. and C.E. Kennedy. 1982. 1978 Bald Eagle Winter Habitat on the National Forest System in the Southwest. USDA Forest Service Southwestern Region. Wildl. Unit Tech. Series. 116 pp.
- Gutzwiller 1995. Some experts believe the primary natural resource management issue for this century will revolve around conflicts between recreation and wildlife
- Hall and Shelby 2000. visitors in Alternative F will be more likely to move away from the dispersed recreation site than in Alternative B
- Hammitt and Cole 1987. Ultimately recreation can reduce habitat structure and complexity, causing declines in species diversity and richness
- Hamann, B., H.. Johnston, P. McClelland, S. Johnson, L. Kelly and J. Gobielle. 1999. Birds. Pages 3.1-3.4 in G. Joslin and H. Youmans, coordinators. Effects of recreation on Rocky Mountain wildlife: A Review for Montana. Committee on Effects of Recreation on Wildlife, Montana Chapter of The Wildlife Society. 307 pp.
- Hansen, A.J., M.V. Stalmaster, and J.R. Newman. 1980. Habitat characteristics, function, and destruction of bald eagle communal roosts in western Washington. Pages 221-229. In: R.L. Knight et al., eds. Proc. Washington Bald Eagle Symposium. Seattle, Washington.
- Jacobson, Kenneth pers comm. w/Agyagos J. on Feb.1, 2010
- Jacobson, Tuk pers. comm. w/ Agyagos J. email 7/28/2017.
- Jaeger, Kristin L., Julian D. Olden, and Noel A. Pelland. 2014. Climate change poised to threaten hydrologic connectivity and endemic fishes in dryland streams. Proceedings of the National Academy of Sciences direct submission. 6

- Johnson, Matt, 2011. from NAU, through an agreement with the Forest Service, conducted surveys for the southwestern willow flycatcher in Fossil Creek in various locations.
- Johnson, Roy and Steven Carothers. 1982. Riparian Habitats and Recreation: Interrelationships and Impacts in the Southwest and Rocky Mountain Region. Eisenhower Consortium Bulletin 12, September 1982. 31 pp.
- Johnson et al 2008. The following information was obtained directly from the report “2008 Common Black-Hawk and Yellow-Billed Cuckoo Distribution and Abundance in the Upper Reach of Fossil Creek, AZ
- Johnson et al. 2009. Recreation effects to black-hawks are best described in the report 2009 Common Black-Hawk and Yellow-Billed Cuckoo Distribution and Abundance in the Upper Reach of Fossil Creek, AZ
- Johnson et al 2011. Yellow-billed Cuckoo “This is because, with low populations there are not enough yellow-billed cuckoos to disperse into all the suitable habitat
- Karl, Thomas R. Jerry M Melillo, and Thomas C, Peterson (eds.). Global Climate Change Impacts in the United States. Cambridge University Press, 2009.
- Keister, G.P. 1981. Characteristics of winter roosts and populations of bald eagles in the Klamath Basin. M.S. Thesis. Oregon State Univ. 82 pp.
- Keister, G.P. and R.G. Anthony. 1983. Characteristics of bald eagle communal roosts in the Klamath Basin, Oregon and California. J. Wild. Manage. 47(4):1072-1079.
- Knight, R.L., V. Marr, and S.K. Knight. 1983. Communal roosting of bald eagles in Washington. Page 11. In: Proc. Workshop on Habitat Manage. for Nesting and Roosting Bald Eagles in the Western United States.
- Knight, Richard L. and Cole, David N. 1991. Effects of recreational activity on wildlife in wildlands. In Transactions of the 56th North American wildlife and natural resources conference: 238-247.
- Leung, Yu-Fai and Jeffrey Marion. 2000. Recreation Impacts and Management in Wilderness: A State-of Knowledge Review. USDA Forest Service Proceedings RMRS-P-15 Vol-5. Pp 23-48.
- Lisle 1989. Poor road and trail drainage causes erosion and sediment delivery which can result in: altered channel morphology, loss of fish spawning and rearing habitat, and changes in the macroinvertebrate assemblage.
- Lutz, Daevid, 1996. Fossil Springs Flora List and Database. Internal document. Coconino National Forest.
- Lutz, Daevid, 1995. Coconino National Forest Flora List. Internal document. Coconino National Forest.
- Madej 1991. Birds that eat large portions of infected seed are subject to substantial weight loss
- Makings, Elizabeth, 2009. Personal communication w/ Agygos J. Tonto NF TEUI botanist.
- Manning and Valliere 2001. visitors in Alternative F will be more likely to move away from the dispersed recreation site than in Alternative B
- Marks et al, JC, Haden, GA, O'Neill, Pace, C. (2009). Effects of Flow Restoration and Exotic Species Removal on Recovery of Native Fish: Lessons from a Dam Decommissioning. Restoration Ecology, doi: 10:1111/j.1526-100x.2009.00574.x
- Maxell, B.A., and D.G. Hokit. 1999. Amphibians and Reptiles. Pages 2.1-2.29 in G. Joslin and H. Youmans, coordinators. Effects of Recreation on Rocky Mountain Wildlife: A Review for Montana. Committee on Effects of recreation on wildlife, Montana Chapter of The Wildlife Society. 307 pp.

McCarty et al 2015 Golden Eagle

Menasco 1985. Botanical Surveys of Fossil Creek.

Miller and Benda 2000. Poor road and trail drainage causes erosion and sediment delivery which can result in: altered channel morphology, loss of fish spawning and rearing habitat, and changes in the macroinvertebrate assemblage

Miller et al 2003 The conservation value of riparian areas is disproportionate to their spatial extent, particularly in arid and semi-arid environments (Miller et al. 2003

Miller, J.R., J.A. Wiens, N.T. Hobbs, and D.M. Theobald. 2003. Effects of human settlement on bird communities in lowland riparian areas of Colorado (USA). *Ecological Applications* 13(4): 1041-1059.

Miller, Rick. AZ Game and Fish Department. Pers. com with Janie Agyagos regarding drought in No. Arizona. August 2007.

Monz 1998. Changes in structure, density and composition of vegetation can occur from recreation-induced soil compaction and erosion

NatureServe Explorer: An online encyclopedia of life [web application]. 2001. Version 1.6. Arlington Virginia, USA: NatureServe. Available: <http://www.natureserve.org/explorer>. (Accessed June 12, 2002).

Nowak, E.M., M.A.Santana-Bendix. 2002. Status, distribution, and management recommendations for the narrow-headed gartersnake (*Thamnophis rufipunctatus*) in Oak Creek, Arizona. Final Report to Arizona Game and Fish Department Heritage Grant I99007. 56 pps.

Ohmart, R.D. 1995. Ecological condition of the East Fork of the Gila River and selected tributaries: Gila National Forest, New Mexico. Pages 312-317, In: D.W. Shaw and D.M. Finch, tech. coords. Desired future conditions for Southwestern riparian ecosystems: bringing interests and concerns together. USDA Forest Service, General Technical Report RM-GTR-272.

Ohmart R.D. 1996. Historical and present impacts of livestock grazing on fish and wildlife resources in western riparian habitats. Pp. 245-279. In: P.R. Krausman (ed.), Rangeland Wildlife. Society for Range Management: Denver CO.

Ohmart RD. 1994. The effects of human-induced changes on the avifauna of western riparian habitats. Stud. Avian Biol. 15:273–85

Ohmart, R. D. 1994. The effects of human-induced changes on the avifauna of western riparian habitats. Pp. 273-285 in J. R. Jehl and N. K. Johnson, eds., A century of avifaunal change in western North America. Proceedings of an International Symposium at the Centennial Meeting of the Cooper Ornithological Society, Sacramento, CA. Studies in Avian Biology No. 15.

Page,Hall pers. comm. w/ Agyagos J., 124 Northern Goshawk radio-telemetered CNF

Pagel et al 2010. Other Recommendations in Support of Golden Eagle Management and Permit Issuance

Phillips 1996. Botanical Surveys of Fossil Creek.

Phillips et al. 1979, 1982 and 1991. Botanical Surveys of Fossil Creek. .

Platt, J.B. 1976. Bald eagles wintering in a Utah desert. Amer. Birds 30(4):783-788.

Radd, Roger. Personal communication with Janie Agyagos regarding suitability of habitat in Fossil area for Yuma clapper rail.

- Regan et al 2014. Tadpoles (great basin spadefoot tadpoles and other species) in warmed pools opportunistically reached metamorphosis 15-17 days earlier with little cost to size.
- Rotert 2009. Bare Soil Monitoring Fossil Creek 2009
- Rotert, A. 2009. Red Rock Ranger District Fossil Creek visitor use data collection project, 2009. Red Rock Ranger District, Coconino N.F. 28 pp.
- Rotert, A. 2011. Red Rock Ranger District Fossil Creek visitor use data collection project, 2009-2010. Red Rock Ranger District, Coconino N.F. 17 pp.
- Rotert, A. 2012a. Visitor use data collection project 2009-2011, Fossil Creek Wild & Scenic River. Red Rock Ranger District, Coconino N.F. 27 pp.
- Rotert, A. 2012b. Fossil Creek Wild and Scenic River Bare Ground Inventory Project 2011. Red Rock Ranger District, Coconino N.F., Payson Ranger District, Tonto N.F. 14 pp.
- Rotert, A. 2013. Personal communication with Agyagos, J. biologist/ recreation specialist summarizing campsite data Fossil Creek
- Rotert, A. 2013a. Fossil Creek Wild & Scenic River visitor use monitoring and bare ground inventory project 2012. Red Rock Ranger District, Coconino N.F. 30 pp.
- Rotert, A. 2013b. Visitor use data collection project 2009-2013, Fossil Creek Wild & Scenic River. Red Rock Ranger District, Coconino N.F., Payson Ranger District, Tonto N.F. 15 pp.
- Sabine, N. 1981. Ecology of bald eagles wintering in eastern Illinois. M.S. Thesis, Southern Illinois University., Carbondale.
- Sadoti 2008. New Mexico Common Black Hawk nesting density
- Sadoti et al 2014. Common Black Hawk nesting disturbance
- Sayers 1998. Botanical Surveys of Fossil Creek.
- Schnell, J.H. 1994. Common black-hawk (*Buteogallus anthracinus*). In *The Birds of North America*, No. 122 (A. Poole and F. Gill, Eds.). Philadelphia: The Academy of Natural Sciences; Washington, D.C.: The American Ornithologists' Union.
- Schnell, J. H., R. L. Glinski and H. Snyder. 1988. "Common Black-Hawk." In *Southwest Raptor Management Symposium and Workshop*, edited by R. L. Glinski and et al, 65-70. Washington, D.C: Natl. Wildl. Fed.
- Schnell, Jay H.(1994).Common Black Hawk (*Buteogallus anthracinus*), *The Birds of North America* (P. G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the *Birds of North America*: <https://birdsna.org/Species-Account/bna/species/comblh1> DOI: 10.2173/bna.122.
- Sferra, S.J., R.A. Meyer, and T.E Corman. 1995. Arizona Partners in flight 1994 southwestern willow flycatcher survey. Nongame and Endangered Wildlife Program Technical Report 69. Arizona Game and Fish Department, Phoenix, Arizona.
- Sferra et al 1997. Southwestern Willow Flycatcher
- Smith, E.L. and Gordon L. Bender, 1973. Fossil Creek Springs Report No. 11 prepared by Arizona Academy of Science. 15 pages
- Sogge et al 1997, Hughes 1999, USFWS 2002 low pop. levels Yellow-billed Cuckoo

- Spencer, J.A., S. Sferra, T. Corman, J. Rourke and M. Sumner. 1996. Arizona Partners in Flight 1995 southwestern willow flycatcher survey. Draft Technical Report. Nongame and Endangered Wildlife Program, Arizona Game and Fish Department, Phoenix.
- Sredl, M.J. and R.D. Jennings. in press. *Rana chiricahuensis* (Platz and Mecham 1979) Chiricahua Leopard Frogs. In Lannoo, M.J. (Ed.), Status and conservation of U.S. Amphibians. Volume 2: Species Accounts. university of California Press, Berkely, CA.
- Sredl, M.J., J.M. Howland, J.E. Wallace and L.S. Saylor. 1997. Status and distribution of Arizona's native ranid frogs. Pages 45-101, In: M.J. Sredl, ed. Ranid frog conservation and management. Technical Report 121, Nongame and Endangered Wildlife Program, Arizona Game and Fish Department, Phoenix.
- Sredl, M.J. and L.S. Saylor. 1998. Conservation and management zones and the role of earthen cattle tanks in conserving Arizona leopard frogs on large landscapes. Pages 211-225, In: Proceedings of the symposium on environmental, economic, and legal issues related to rangeland water developments, November 13-15, 1997, Tempe, Arizona.
- Sredl, M.J., S.G. Seim, D.L. Waters, and J.M. Howland. 1993. Coconino National Forest Riparian Amphibians and Reptiles Survey: Locality Information and Survey Results for 1992 Field Season. Submitted to Coconino National Forest, Flagstaff, Arizona, by Nongame and Endangered Wildlife Program, Arizona Game and Fish Department, Phoenix, Arizona.
- Sredl, M.J., S.G. Seim, D.L. Waters, and J.M. Howland. 1995. Coconino National Forest Riparian Amphibians and Reptiles Survey: Locality Information and Survey Results for 1993 Field Season. Nongame and Endangered Wildlife Program Technical Report 65. Arizona Game and Fish Department, Phoenix, Arizona.
- Sredl, M.J., E.P. Collins, and J.M. Howland. 1997a. Mark-recapture of Arizona leopard frogs. Pages 1-20 in M.J. Sredl, editor. Ranid frog conservation and management. Nongame and Endangered Wildlife Program Technical Report 121. Arizona Game and Fish Department, Phoenix, Arizona.
- Sredl, M.J., J.M. Howland, J.E. Wallace, and L.S. Saylor. 1997b. Status and distribution of Arizona's native ranid frogs. pages 37-89 in M.J. Sredl, editor. Ranid frog conservation and management. Nongame and Endangered Wildlife Program Technical Report 121. Arizona Game and Fish Department, Phoenix, Arizona.
- Sredl, M. pers.comm.w/ Agyagos J. Sept 2001 Chiricahua Leopard Frog
- Stalmaster, M.V. and J.R. Newman. 1979. Perch-site preferences of wintering bald eagles in northwest Washington. *J. Wildl. Manage.* 43(1):221-224.
- Steenhof, K. 1976. The ecology of wintering bald eagles in southeastern South Dakota. M.S. Thesis. Univ. of Missouri, Columbia. 148 pp.
- Stevens L.E. ,BT Brown, JM Simpson 1977 The importance of riparian habitat to migrating birds
- In: The Importance of Riparian Habitat to Migrating Birds
Stevens, LE | Brown, BT | Simpson, JM | Johnson, RR
- Importance, Preservation and Management of Riparian Habitat: A Symposium July 9, 1977, Tuscon, Arizona, USDA Forest Service General Technical Report RM-43, p. 156-164. 2 fig, 4 tab, 24 ref.
- Sullivan, B.K. 1991. Distribution and status of the Arizona toad, *Bufo microscaphus microscaphus*. Report submitted to Arizona Game and Fish Department. 24 pp. plus locality information.

- Sullivan, Marie E. and Mary E. Richardson. 1993. Functions and Values of the Verde River Riparian Ecosystem and an Assessment of Adverse Impacts to These Resources. Report prepared for U.S. Environmental Protection Agency, Region 9, San Francisco, California. U.S. Fish and Wildlife Service, Arizona Ecological Services Office. Phoenix, Arizona. 364 pp.
- Taylor 1986. This increase has the potential of impacting Common Black-Hawk, yellow-billed cuckoo, and other riparian bird species, by degrading riparian habitat.
- Tellman et al. 1997. Increased water turbidity, bank erosion, water pollution, noise disturbance and over-water movement resulting from waters sports like swimming, fishing, and boating can also reduce suitability of habitat
- U.S. Environmental Protection Agency website accessed 2016. Climate Change Impacts in the Southwest. <https://www.epa.gov/climate-impacts/climate-impacts-southwest>.
- USDA Forest Service, Coconino National Forest. Terrestrial Ecosystem Unit Inventory summary for Fossil Creek.
- USDA Forest Service, Washington, D.C.. Forest Service Manual 2500 – Watershed and Air Management.
- USDA Forest Service. 1979 Action program for resolution of livestock-riparian conflicts on the Salt and Verde River. 129 p. Region Three, Arizona, Tonto, Prescott, and Coconino National Forest. Albuquerque, N.M. Cited in: [HTML] Riparian problems and initiatives in the American Southwest: a regional perspective [HTML] from google.comRR Johnson... - California Riparian Systems: Ecology, ..., 1984 - books.google.com.
- USDA Forest Service, Southwestern Region, 1981. Range and Vegetation Scorecard Handbook.
- USDA Forest Service, Southwestern Region. 1985. Terrestrial Ecosystems Survey Report for Tonto National Forest, Northern Portion. 325pp.
- USDA Forest Service, Southwestern Region, 1985. Tonto National Forest Plan as amended.
- USDA Forest Service. 1987a. Coconino National Forest land and resource management plan. Southwestern Region. Albuquerque, NM. 270pp.
- USDA Forest Service, Southwestern Region. 1995. Terrestrial Ecosystems Survey of the Coconino National Forest. 405pp.
- USDA Forest Service. 1996. Record of Decision to Amend National Forest Plans in the Southwestern Region. Albuquerque, New Mexico.
- USDA Forest Service. 2005a. Framework for Streamlining Informal Consultation for Cattle Grazing Activities. Southwestern Region. Albuquerque, NM. 112 pp.
- USDA Forest Service. 2005c. Range Specialist Report – Deep Lake Allotment.
- USDA Terrestrial Ecosystems Survey (TES) Handbook, 1984
- USDI Fish and Wildlife Service (USFWS). 1982. Bald Eagle Recovery Plan (Southwestern Population). U.S. Fish and Wildlife Service, Albuquerque, New Mexico. 65 pp.
- USDI 1993. MSO listing
- USDI Fish and Wildlife Service. 1993. Endangered and threatened wildlife and plants, final rule to list the Mexican spotted owl as a threatened species. Federal Register 58: 14248-14271.

- USDI Fish and Wildlife Service. 1993a. Threatened and endangered wildlife and plants: Proposed rule to list the southwestern willow flycatcher as endangered with critical habitat. Federal Register 58:39495-39522.
- U.S. Fish and Wildlife Service. 1993b. Functions and values of the Verde River riparian ecosystem and an assessment of adverse impacts to these resources: A supporting document for the initiation of the Verde River advanced identification. Prepared for U.S. Environmental Protection Agency. 364 pp.
- USDI Fish and Wildlife Service. 1995. Recovery plan for the Mexican spotted owl: Vol.I. Albuquerque, New Mexico. 172 pp.
- USDI Fish and Wildlife Service. 1995a. Threatened and endangered wildlife and plants: Final rule determining endangered status for the southwestern willow flycatcher. Federal Register 60:10694-10715.
- USDI Fish and Wildlife Service. 1995b. Biological Opinion for the Windmill Allotment grazing permit issuance. Consultation no. AESO/SE 2-21-95-F-399. U.S. Fish and Wildlife Service, Phoenix, Arizona.
- USDI 1999a Peregrine Falcon removed from Endangered Species List
- USDI Fish and Wildlife Service. 2000. Draft recovery plan for the California red-legged frog (*Rana aurora draytonii*). U.S. Fish and Wildlife Service, Portland, Oregon.
- USDI Fish and Wildlife Service. 2002. Endangered and Threatened Wildlife and Plants; Listing of the Chiricahua Leopard Frog (*Rana chiricahuensis*); Final rule Federal Register, Vol. 67, No. 114, pages 40790-40811.
- USDI Fish and Wildlife Service. 2002. Southwestern Willow Flycatcher Recovery plan. Albuquerque, New Mexico. I-ix +210 pp. Appendices A-O.
- USDI Fish and Wildlife Service. 2007. Endangered and Threatened Wildlife and Plants; Removing the bald eagle in the lower 48 states from the list of endangered and threatened wildlife; Final rule Federal Register, Vol. 72, No. 130, pages 37346-37372.
- USFWS 1993. Mexican Spotted Owl listed as a Fed. Threatened Sp.
- USFWS 1993b. Removal of vegetation cover, in addition to compaction, decreases infiltration of the soil, which enhances surface runoff”
- USFWS 2012. Mexican Spotted Owl habitat est. in 1995, revised in 2012
- Webb 1983. Changes in structure, density and composition of vegetation can occur from recreation-induced soil compaction and erosion Changes in structure, density and composition of vegetation can occur from recreation-induced soil compaction and erosion.
- Welsh and Toft 1972. Botanical Surveys Fossil Creek
- Wong, Debbie, 1996. Long term ecological change of vegetation communities along spring areas. Internal document. Coconino National Forest
- Wood and Armitage 1997. Page Poor road and trail drainage causes erosion and sediment delivery which can result in: altered channel morphology, loss of fish spawning and rearing habitat, and changes in the macroinvertebrate assemblage.

Appendix A – Current Forest Plan Direction

Forest Plan Direction pertinent to wildlife and plants from both the Tonto and the Coconino forest plans follows.

Tonto National Forest

General TE&S

Standard Identify, survey, map, and analyze habitat for all Federally listed species. Identify management conflicts and enhancement opportunities. Correct any management conflicts or problems.

Standard Continue to clear all projects for threatened, endangered, proposed, and candidate plant and animal species. Clearances will be done by Wildlife Biologist and reviewed by Forest Biologist.

Standard New additions of listed, proposed, or candidate species by the US Fish and Wildlife Service will be protected.

Standard Habitat requirements for endangered species will have precedence over threatened species. Habitat requirements for threatened, endangered, and sensitive species will take precedence over requirements for other species and habitat requirements for sensitive species will take precedence over nonsensitive species.

Standard Initiate informal or formal consultation, as required by the Endangered Species

Act, with the U.S. Fish and Wildlife Service on all actions that effect T&E plant and animal species.

Standard Survey, study and assess the status of candidate species on a priority basis. Identify document and correct any management conflicts to the species or their habitats.

Habitat requirements for threatened, endangered, and sensitive species will take precedence over requirements for other species (131, 155).

General Wildlife

Manage for wilderness values, wildlife habitats and natural ecological processes while allowing livestock grazing and recreation opportunities that are compatible with maintaining these values and processes (p. 119)

Tonto National Forest Land Management Plan Management Area 4F (p. 138-139)

- Manage for a variety of renewable natural resources with primary emphasis on wildlife habitat improvement, livestock forage production, and dispersed recreation. Watersheds will be managed so as to improve them to a satisfactory or better condition. Improve and manage the included riparian areas (as defined by FSM 2526) to benefit riparian dependent resources.

Retain all raptor nest tree groups.

Require bird guides to apply for and obtain a special use permit. A condition of the permit shall be that they obtain a subpermit under the .S. Fish and Wildlife Service Master endangered species permit. The permit should stipulate the sites, dates, number of visits and maximum group size permissible.

Bald Eagles

Standard Identify and delineate the home range of all Bald Eagle breeding areas. Document and correct any resource conflicts and disturbances to Bald Eagles and their habitat. During portions of any year that a Bald Eagle's nest site is active, an appropriate area of land surrounding the nest will be closed to public entry if such closure is necessary.

Rehabilitate Bald Eagle nesting habitat by planting large cottonwood poles on alluvial benches.

Evaluate need for additional planting of large cottonwood poles to aid in rehabilitating Bald Eagle nesting habitat.

Caves/Bats

Standard Bat roosts and other sensitive biological resources within cave will be managed using all appropriate means identified in the Cave Implementation Plan.

Standard All surface-disturbing activities planned near or within a known cave area will be examined to potential impacts to the cave(s) and the area around each cave entrance(s), (plus feeder drainages and surface areas immediately over cave passages). The cave area will be evaluated to determine protection measures needed.

Standard Protection measures for caves will be incorporated into project planning, and may include (but not be limited to) education, seasonal closures, and installation of entrance gates.

Mammals

Coordinate with Arizona Game & Fish Department on maintenance of viable populations of Razorback suckers and River otters. Study to identify and correct any management conflicts.

Riparian

Emphasize maintenance and restoration of healthy riparian ecosystems through conformance with Forest Plan riparian standards and guidelines. Management strategies should restore degraded riparian areas to good condition as soon as possible. Damage to riparian vegetation, stream banks, and channels should be prevented (p. 40-9; goshawk prescription).

Standard Coordinate with range to achieve utilization in the riparian areas that will not exceed 20 percent of the current annual growth by volume of woody species.

Standard Coordinate with range to achieve at least 50 percent of the cottonwood-willow and mixed broadleaf acres in structural Type 1 by 2030.

Standard Rehabilitate at least 80 percent of the potential shrub cover in riparian areas through the use of appropriate grazing systems and methods.

Any surface or vegetation disturbing projects in riparian areas will be coordinated and will specify protection or rehabilitation of riparian dependent resources..

All Riparian Areas- Rehabilitate and maintain, through improved management practices, mixed broadleaf riparian to achieve 80 percent of the potential overstory crown coverage. Natural regeneration is anticipated to achieve most of this goal. Artificial regeneration may be necessary in some areas.

Standard Re-establish riparian vegetation in severely degraded but potentially productive riparian areas. Natural regeneration is anticipated to achieve this goal, but artificial regeneration may be necessary in some areas.

Standard Rehabilitate cottonwood willow Type 11 to achieve C- 140 conversion to Type 1 by the year 2030. Natural regeneration is anticipated to achieve most of this goal, but artificial regeneration may be necessary in some areas.

Guideline Manage riparian areas to the level needed to provide protection and improvement.

Guideline Where possible, locate roads on natural benches, ridges, flat slopes near ridges or valley bottoms, and away from stream channels.

Guideline Roads should be located on well-drained and stable ground, avoiding seeps and other unstable areas.

Guideline Stream crossing approaches should avoid steep pitches and grades in order to prevent sedimentation.

Guideline Where channel crossings are necessary, select an area where the channel is straight and cross the channel at right angles.

Guideline In streams inhabited by fish, structures need to provide for fish passage. In addition, structures containing natural stream bottoms are preferred over culverts.

Guideline Reduce road dimensions to that which will adequately fulfill anticipated needs and avoid large road cuts and fills.

Guideline Avoid channel changes or disturbance of stream channels and minimize impacts to riparian vegetation.

- Rehabilitate and maintain, through improved management practices, mixed broadleaf riparian to achieve 80% of the potential overstory crown coverage. Natural regeneration is anticipated to achieve most of this goal. Artificial regeneration may be necessary in some areas (p. 41)
- Re-establish riparian vegetation in severely degraded but potentially productive riparian areas. Natural regeneration is anticipated to achieve this goal, but artificial regeneration may be necessary in some areas (p. 41)
- Rehabilitate cottonwood-willow Type 11 to achieve conversion to Type 1 by the year 2030. Natural regeneration is anticipated to achieve most of this goal, but artificial regeneration may be necessary in some areas (p. 42)
- Manage riparian areas to the level needed to provide protection and improvement (p. 42-2)
- Manage vegetation to achieve satisfactory or better watershed conditions (p.44)
- Mitigate the adverse effects of planned activities on the soil and water resources through the use of Best Management Practices (p. 44)

Pesticides

Pesticide proposals will be handled through additional environmental analysis and documentation to ensure project objectivity and public safety (pg 43).

Post all boundaries and close road at Fossil Springs (pg 137).

Botanical Area

Tonto National Forest Land Management Plan Management Area 4E (p.137)

- This management area is the proposed Fossil Springs Natural Area located in the SE1/4 of Section 14, Township 12N, Range 7E. The State of Arizona's Parks Board identified this area as a potential natural area. This area will be included in the Arizona State Park's State Natural Area Register. Total management area size is 20 acres.
- Management emphasis is "Manage to provide protection to natural features and vegetative communities. Management is directed toward maintaining as nearly as possible existing conditions and natural processes for public enjoyment, demonstration and study. A high level of protection is required to maintain water flows and water quality. The visual resource is an important consideration in the management of this area."

Coconino National Forest Revised Forest Plan

Following are the major Forest Plan components that apply to Fossil WSR. Other plan components may apply. The Forest Plans provide over-arching direction and should be consulted if the the Fossil CRMP is silent for a situation or resource.

Chapter 2. Forestwide Management

All Ecosystems

Desired Conditions for All Ecosystems

FW-Eco-DC

- 1 Within their type and capability, ecosystems are functioning properly, provide habitat for native species, and are resilient to natural disturbances (such as flooding, fire, and periodic drought) and climate change. Ecosystem processes and contributions (for example, nutrient cycling, water [infiltration](#), and wildlife habitat) are sustained, as vegetation on the Forest adapts to a changing climate.
- 2 The composition, structure, function, and arrangement of [vegetation conditions](#) reduce the threat of uncharacteristic disturbances.
- 3 Uncharacteristic fires are infrequent as is the associated flooding and sedimentation into downstream communities, perennial streams and their tributaries, headwaters, wildernesses, and other areas and resources.
- 4 [Desirable non-native species](#) and subspecies are present and in balance with properly [functioning ecosystems](#). Ecosystem conditions promote [endemic](#) levels of invertebrates, including pollinators, and disease, with occasional outbreaks.

Management Approaches for All Ecosystems

Following large or uncharacteristic disturbance events, focus management actions on human health and safety, long-term restoration, soil and watershed stabilization, restoration or protection of ecosystem processes and resource values.

Soil

Desired Conditions for Soil

FW-Soil-DC

- 1 Soils function properly to distribute water and cycle nutrients to a variety of vegetation including lichens, mosses, grasses, [forbs](#), shrubs, and trees.
- 2 [Soil productivity](#) and functions are sustained and functioning properly within the capability of the site, so the soil has the ability to resist [erosion](#), infiltrate water and recycle nutrients. Coarse woody debris, including downed logs, provides for long-term soil productivity. Soil productivity and functions contribute to the resiliency and adaptability of terrestrial and riparian ecosystems to climate change.
- 3 Vegetative ground cover is maintained at levels that contribute to suitable hydrologic function, soil stability, and nutrient cycling. Soils are protected by adequate vegetative ground cover on the soil surface to prevent erosion from exceeding [natural](#) rates of soil formation (soil tolerance), within their inherent capability. Soils are permeable and capable of infiltrating water to reduce instances of [overland flows](#) during precipitation events. The composition of grass and forb species and presence of plant [litter](#) and grass, forb, shrub, and tree [basal area](#) surface cover reduce occurrences of compaction and erosion.
- 4 [Biological soil crusts](#) stabilize soil and improve nutrient cycling.

Objectives for Soil

FW-Soil-O

- 1 Maintain satisfactory [soil conditions](#) and/or improve impaired and unsatisfactory soil conditions on 100,000 to 350,000 acres during each 10-year period over the life of the plan. Maintenance and improvement would

occur as a result of some management actions in other resources. For example, re-locating a road in a grassland could improve impaired soil conditions.

Guidelines for Soil

FW-Soil-G

- 1 The forest should implement and monitor BMPs for all activities with the potential to impair water quality in accordance with the intergovernmental agreement between ADEQ and the Forest Service Southwestern Regional Office to control and manage nonpoint source pollution.
- 2 Projects should be designed to avoid disturbance that would result in long-term impacts to soil function and productivity. Where disturbance cannot be avoided, project-specific soil and water conservation practices should be developed.
- 3 Project-specific design features should be used when projects occur on slopes with a grade of about 40 percent or greater, on soils with moderate or severe [erosion hazard](#), or on soils that are sensitive to degradation when disturbed, such as calcareous soils, to minimize or avoid soil impacts.

Management Approaches for Soil

Use published terrestrial ecosystem survey information: (1) for broad resource and forestwide assessments and land management and project planning at regional, forest, and district levels; (2) as the basis for determining project goals and objectives, desired ecological conditions, and for predicting effects and impacts of the different management prescriptions and activities upon each terrestrial ecosystem; and (3) for the initial selection of areas for proposed projects.

Conduct onsite soil investigations and refine mapping for soil-disturbing projects that require site-specific, precise, highly detailed soil information, which is beyond the scale of the terrestrial ecosystem survey. Analyze or collect site-specific terrestrial ecosystem survey information as needed to accurately determine limitations, suitability, and productivity potentials of the different terrestrial ecosystems that occur.

Work with the Rocky Mountain Research Station and other research organizations to understand the linkages among the physical and biological components of soil and plant populations that can inform managers on responses of ecological and hydrological structure and function to management and disturbance.

Biophysical Features - Geological Features

Desired Conditions for Geological Features

FW-BioPhys-Geo-DC

- 1 Geological features are generally undisturbed by human activities. The cultural, archaeological, geological, hydrological, paleontological, biological, and aesthetic resources associated with caves, karst, talus slopes, and cliffs are maintained.
- 2 Karst landscapes and cave formations continue to develop or erode under natural conditions. Water flowing into, from, or within these systems contains naturally fluctuating background levels of water, sediment, organic matter, and dissolved minerals; and is not polluted.
- 3 Caves and karst provide habitat for species, particularly bats, that require specialized niches for raising young, roosting, and overwintering. Caves maintain humidity, temperature, and disturbance levels consistent with historic conditions. Caves known to be important for endemic, rare, federally listed, Southwestern Region sensitive species, or cave-roosting bats are intact or provide habitat for these species. Disease is within natural levels.

- 5 Significant caves have excellent examples of the values for which they were designated, with little evidence of human activity or disturbance. Visitor access and use occurs at levels that maintain the values of the significant cave.
- 6 Cliffs provide specialized habitats for a variety of species including nesting and feeding habitats for birds of prey and roosting habitat for bats. They provide escape, bedding, and lambing cover for bighorn sheep. They provide habitat for rare plants such as cliff fleabane and Senator Mine alumroot.
- 7 Talus slopes provide specialized habitats for lichens, plants, invertebrates, and vertebrates, including rare and federally listed species, such as the San Francisco Peaks ragwort. They maintain natural levels of moisture and are free from excessive sedimentation.

Standards for Geological Features

FW-BioPhys-Geo-S

- 1 Designated or nominated significant caves shall be managed to perpetuate those features, characteristics, values, or opportunities for which they were designated.

Guidelines for Geological Features

FW-BioPhys-Geo-G

- 1 Projects should be designed and uses should 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.
- 2 Projects and activities should be designed to prevent siltation into sinkholes and cave entrances, collapse of cave passageways, and alteration of the chemical, physical, and biological conditions of the cave resource. A radius of 300 feet should be used for restrictions on activities that can alter the cave's resources, functions, and associated features unless site-specific adjustments are made, based on topography, drainage, soil type, and the expected impact of the proposed activity.
- 4 Blasting and/or controlled-source seismic surveys requiring explosives or other disruptive techniques should avoid, where possible, or minimize damage to cave features, condition, and function. The purpose is to maintain the chemical, physical, and biological conditions of the cave.
- 5 **When closing caves to public entry, wildlife friendly gates that meet Bat Conservation International recommendations should be installed to protect bats and/or other wildlife species that are present.**
- 6 **Caves and abandoned mines that are used by bats should be managed to prevent disturbance to species and spread of disease such as white-nose syndrome (*Pseudogymnoascus destructans*).**
- 7 **Caves containing endemic species should be managed to emphasize protection of those species.**
- 8 **[Aquatic management zones](#) or best management practices should 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.**

Management Approaches for Geological Features

Encourage partnerships with organizations, scientists, and outdoor recreationists to secure, preserve, and protect forest geological features and their resources.

Foster collaboration with the U.S. Fish and Wildlife Service, Bat Conservation International, Arizona Game and Fish Department, the National Speleological Society, and other stakeholders to address conservation, [interpretation](#), and education management for cave-dependent species and associated resources. For example, this collaboration could assist with understanding the cause and transmission of white-nose syndrome (which is not currently well understood) or with the development and implementation of cave and karst management plans.

Keep cave locations confidential except for caves that have been identified for recreational use. Cave records are managed at Forest Service locations, where they are kept secured.

Coordinate with partners and State and Federal agencies to both manage and monitor bat roosts to determine population dynamics.

Work with stakeholders to develop collaborative solutions to problems associated with cliff resources such as wildlife, archaeological, vegetation, and geological features.

Educate the public about the unique ecological and aesthetic value of biophysical features including safety, etiquette, disease prevention, and resource protection.

Watersheds and Water

Desired Conditions for Watersheds and Water

FW-Water-DC

- 1 Watersheds are functioning properly and are resilient to natural and human disturbances.
- 2 Watersheds exhibit high [geomorphic](#), hydrologic, and biotic integrity within their inherent capability. Natural hydrologic, hydraulic, geomorphic, and biologic processes function at a level that allows retention of their unique physical and biological properties to maintain or improve downstream water quality.
- 3 Vegetation and soil conditions in watersheds support important ecosystem services such as clean water, base flow, riparian communities, and long-term soil productivity. These conditions also help moderate climate variability and change. Soil and vegetation function to facilitate precipitation infiltration and groundwater recharge.
- 4 Watersheds exhibit a high degree of connectivity along streams, laterally across the [floodplains](#) and valley bottoms and vertically between surface and subsurface flows. Streamcourses and other links between aquatic and upland components provide access to food, water, cover, nesting areas, and protected pathways for aquatic and upland species.
- 5 Water quantity (base flows) of intermittent and perennial streams are sustained to mimic seasonal flow regimes. Peak flows and flood potential occur within the historic range of variability for that stream system. For baseflows, this means that during low-flow periods (fall and winter, generally), water flow is sustained within its natural capability.
- 6 Water quality, water quantity and the timing of water flows support ecological functions, habitat for aquatic and riparian species, and water sources for municipalities. Water quality, water quantity, and the timing of flows are sustained at levels that retain the biological, physical, and chemical integrity of associated systems and benefit survival, growth, reproduction, and migration of native species.
- 7 Water quality meets or exceeds Arizona water quality standards and supports identified designated beneficial uses.

Guidelines for Watersheds and Water

FW-Water-G

- 1 Watersheds should have enough vegetative ground cover to recover rapidly from natural and human disturbances and to maintain long-term soil productivity.
- 2 **Watershed restoration and maintenance, and vegetation treatments should focus on priority 6th code watersheds to ensure that ecosystem processes, resilient vegetation conditions, and natural disturbance regimes are functioning properly.**

- 3 **Instream flow water rights should be procured for those streams without instream water rights to ensure that sufficient flow is provided for aquatic species, habitat, and recreation.**
- 4 **Best management practices for management activities should be identified, implemented, and monitored to maintain water quality, quantity, and timing of flows, and to prevent or reduce accelerated erosion.**
- 5 For [impaired waters](#) or non-attaining waters, approved [total maximum daily load \(TMDL\)](#) recommendations or implementation plans should be implemented to maintain or improve water quality to meet or exceed Arizona water quality standards and support identified designated beneficial uses.
- 6 Within existing water rights, excess water should remain in or be allowed to flow freely back into the natural channel, spring, and riparian habitat to maintain and improve ecological function, water quality, quantity, and timing of flows, and to benefit native species and their habitat.

Management Approaches for Watersheds and Water

Coordinate with the Rocky Mountain Research Station, U.S. Geological Survey and other research organizations on long-term and landscape studies of watershed function.

File for water rights on appropriable waters following State procedures. Complete all documentation required for the adjudication process in the Little Colorado and Gila River (Verde watershed) specified by the courts.

Prioritize streams for water right filing based on risk of diversion and subsequent onsite loss of water, and habitat for threatened and endangered aquatic species. Complete required stream gaging and file applications on priority streams. Gaging, filing, and any associated adjudication are completed as budgets allow.

Participate in State water rights adjudications and settlement discussions for negotiating water rights settlements outside of extended adjudication.

Secure water rights through purchase or severance and transfer when additional sources are needed.

Consider water rights during project planning and implementation.

Provide input and recommend strategies for implementation plans as required by Arizona Revised Statute 49-234 for existing TMDLs to provide strategies to reduce existing pollutant loads identified in TMDLs, and to be in compliance with applicable water quality standards for impaired waters.

Collaborate with volunteers, other agencies, private landowners, and other stakeholders on education, interpretation, and monitoring relating to water quality, public health, and fish and wildlife habitat especially in regard to threats to water quality from leaking septic tank systems; threats to water supply and water quality from wildfires; threats to downstream resources from the use of fertilizers; and threats to health and resources from improper disposal of diapers and other garbage or when State water quality standards have been exceeded.

Use table 1 as a general starting point for determining the width of the aquatic management zone relative to erosion hazard. Aquatic management zones may be wider or narrow than suggested in table 1 and would be decided at the project level. Considerations for the size and shape of an aquatic management zone include amount and type of material on the ground, width and slope of the zone, soil type or hydrologic soil group, orientation of stream or river to the Sun, connection of stream to impaired or non-attaining waters, presence of threatened or endangered species, condition of the riparian area, adjacent land use, and threat of contamination from pollutants or chemicals. Significant topographic changes, such as abrupt canyon edges may be used as boundaries for aquatic management zones, as long as activities beyond the canyon walls do not negatively influence the functioning of the aquatic management zone.

Develop and maintain relationships with stakeholders on water rights issues. Coordinate and work with stakeholders toward maintaining and improving riparian attributes.

Coordinate with Federal, State, and county organizations and interested stakeholders with respect to groundwater and surface water issues including preservation, water quantity, and timing of flows.

Riparian Areas - All Riparian Areas

Desired Conditions for All Riparian Areas

FW-Rip-All-DC

- 1 Within their type and capability, riparian ecosystems and corridors promote the natural role of water, sediment, woody debris, and root masses, and maintain water tables. This includes perennial and intermittent riparian streamcourses. The associated water table supports riparian vegetation.
- 2 Instream flows provide for channel and floodplain maintenance, recharge of alluvial-aquifers, water quality, and temperature fluctuations within the natural range of variability.
- 3 Riparian areas exhibit connectivity between and within aquatic, riparian and upland components that reflects their natural range of variability and linkages. Naturally isolated springs remain isolated. Riparian areas are connected vertically between surface and subsurface flows. Streamcourses and other links between aquatic and upland components support ecological functions, and provide habitat and movement corridors for aquatic and upland species.
- 4 Riparian areas are managed consistent with designated beneficial uses associated with existing claimed or certified water rights. Water quality is maintained or improved so it fully supports State water quality standards or designated beneficial uses identified by ADEQ.
- 5 Where the potential exists, vegetation, root masses, and woody debris stabilize and protect banks, edges, and shorelines of riparian areas from disturbances. Plant distribution and occurrence are resilient to natural disturbances.

Guidelines for All Riparian Areas

FW-Rip-All-G

- 1 Management activities such as vegetation treatments or other restoration actions should be designed to maintain or move toward desired conditions for other uses and resources.
- 2 Riparian areas should be managed to promote natural movement of water and sediment, to maintain ecological functions, and to maintain habitat and corridors for species.
- 3 An aquatic management zone should be identified and maintained in riparian areas to protect water quality and to avoid detrimental changes in water temperature or chemical composition, blockages of streamcourses, or sediment deposits that would seriously and adversely affect water conditions, fish habitat, or connected downstream cave, karst, and lava tube resources. Soil and vegetation disturbance from management activities should be managed to meet these intents, but is not necessarily excluded in this zone. The general starting points for widths of aquatic management zones are shown in table 1.

Table A-1. General starting points for aquatic management zones in riparian areas

Erosion Hazard	Width of Zone in Riparian Areas
Severe	150 feet each side of streamcourse or riparian area
Moderate	125 feet each side of streamcourse or riparian area
Slight	100 feet each side of streamcourse or riparian area

Management Approaches for All Riparian Areas

Consider table 1 as a general starting point for determining the width of the aquatic management zone relative to erosion hazard. Aquatic management zones may be wider or narrow than suggested in table 1, and would be

decided at the project level. Considerations for the size and shape of an aquatic management zone include amount and type of material on the ground, width and slope of the zone, soil type or hydrologic soil group, orientation of stream or river to the Sun, connection of stream to impaired or non-attaining waters, presence of threatened or endangered species, condition of the riparian area, adjacent land use, and threat of contamination from pollutants or chemicals. Significant topographic changes, such as abrupt canyon edges may be used as boundaries for aquatic management zones, as long as activities beyond the canyon walls do not negatively influence the functioning of the aquatic management zone.

Riparian Areas - Stream Ecosystems

Desired Conditions for Stream Ecosystems

FW-Rip-Strm-DC

- 1 Perennial and intermittent riparian streamcourses maintain their natural sinuosity and have access to their floodplains so that when floods do occur, energy can be dissipated without causing damage to the streambanks of the channel. Stream channel stability is maintained or restored.
- 2 Flooding is the primary natural disturbance in perennial, intermittent, and ephemeral streamcourses. In some streamcourses, flooding creates a mix of stream substrates for fish habitat, and sites for germination and establishment of riparian vegetation.
- 3 Perennial and intermittent riparian streamcourses, and associated floodplains, are capable of filtering sediment, capturing and/or transporting [bedload](#), aiding floodplain development, improving floodwater retention, improving or maintaining water quality, and providing groundwater recharge within their natural potential.
- 4 Streams maintain a natural hydrograph, or waterflow over time, including periodic flooding, which promotes natural movement of water, sediment, nutrients, and woody debris.

Guidelines for Stream Ecosystems

FW-Rip-Strm-G

- 1 In perennial and intermittent riparian streamcourses, projects and management activities should be designed and implemented to retain or restore natural streambank stability, native vegetation, and riparian and soil function.
- 2 An aquatic management zone for non-riparian, intermittent streamcourses should be identified and maintained to reduce sedimentation, maintain functioning of the channel within its floodplain, and maintain downstream water quality and riparian habitat and function. This management zone would also avoid detrimental changes in water temperature or chemical composition; blockages of streamcourses; or sediment deposits that would seriously and adversely affect water conditions, fish habitat, or connected downstream cave, karst, and lava tube resources. Soil and vegetation disturbance from management activities should be managed to meet these intents, but is not necessarily excluded in this zone. The general starting points for widths of aquatic management zones are shown in table 2.

Table A-2. General starting points for aquatic management zones in nonriparian intermittent streamcourses

Erosion Hazard	Width of Zone in Nonriparian Intermittent Streamcourses
Severe	100 feet each side of streamcourse
Moderate	70 feet each side of streamcourse
Slight	35 feet each side of streamcourse

Management Approaches for Stream Ecosystems

Consider table 2 as a general starting point for determining the width of the aquatic management zone relative to erosion hazard. Aquatic management zones may be wider or narrow than suggested in table 2, and would be decided at the project level. Depending on downstream water quality issues, ephemeral streamcourses may be identified and protected at the project level. Considerations for the size and shape of an aquatic management zone include amount and type of material on the ground, width and slope of the zone, soil type or hydrologic soil group, orientation of stream or river to the Sun, connection of stream to impaired or non-attaining waters, presence of threatened or endangered species, condition of the riparian area, adjacent land use, and threat of contamination from pollutants or chemicals. Significant topographic changes, such as abrupt canyon edges may be used as boundaries for aquatic management zones, as long as activities beyond the canyon walls do not negatively influence the functioning of the aquatic management zone.

Coordinate with local, State, private, and other Federal agencies to make sure natural streamcourses are maintained and not fragmented by development.

Coordinate with the ADEQ to monitor and achieve acceptable total maximum daily loads (TMDLs) [suspended sediment concentration](#) in the Verde River.

Riparian Areas - Wetlands

Desired Conditions for Wetlands

FW-Rip-Wtlnds-DC

- 1 Wetlands provide functional soil and water resources on most acres, consistent with their flood regime and flood potential, and provide diverse habitats for native species. Wetlands are in or trending toward [proper functioning condition](#).
- 2 Consistent with the natural hydrologic cycle, wetland vegetation has a variety of [age classes](#) ranging from young to old and a composition of [native species](#) that reflects the individual wetland types. Plant composition can vary considerably at the fine- and mid-[scales](#) depending on site potential (as determined by TEUI or other appropriate ecological classification system) and geomorphology, elevation, climate, topography, soils, and smaller scale disturbances. Wetlands include vegetation that indicates maintenance of riparian soil moisture characteristics (plants that occupy the deepest zones in table 3).

Objectives for Wetlands

FW-Rip-Wtlnds-O

- 1 Restore 5 to 10 wetlands currently not in proper functioning condition so that they are in, or are trending toward, proper functioning condition during each 10-year period over the life of the plan.

Management Approaches for Wetlands

Coordinate with stakeholders on water management, recreation, private land issues, etc.

Coordinate with the U.S. Fish and Wildlife Service (USFWS) and Arizona Department of Game and Fish on the management of wetlands, lakes, and protection measures for species.

Riparian Areas - Springs

Desired Conditions for Springs

FW-Rip-Spr-DC

- 1 Springs have functional soil, water, and vegetative resources consistent with natural waterflow patterns, recharge rates, and geochemistry appropriate for the site.

- 2 Spring vegetation has young, mid, and late [seral stages](#) and a composition of native aquatic and riparian species consistent with spring type, slope, aspect, natural disturbances, and natural solar energy budget (amount of radiation during different times of the year¹⁰).
- 3 Spring riparian zones are capable of filtering sediment, capturing and/or transporting bedload, improving or maintaining water quality, providing groundwater recharge and supporting perched water-bearing zones within their natural potential, consistent with the spring type.
- 4 Consistent with existing [water rights and claims](#), springs are rarely developed and altered by human-made structures such as head boxes, cisterns, and pipelines.
- 5 The physical and biological components of springs provide habitat for [narrowly endemic](#) species and those with [restricted distributions](#).

Objectives for Springs

FW-Rip-Spr-O

- 1 Restore riparian function to at least 25 springs identified as not in proper functioning condition to provide water quantity and aquatic habitat for the recovery of plant and animal species during each 10-year period during the life of the plan.

Guidelines for Springs

FW-Rip-Spr-G

- 1 Spring recharge areas, where known, should be managed to maintain or improve spring discharge.
- 2 Water rights should be maintained or procured to protect in situ (onsite) water quantity where no water rights exist.
- 3 Projects and activities should be designed and implemented to maintain or improve soil and riparian function; maintain or improve native vegetation; and/or prevent the introduction or spread of disease, invasive, or undesirable species. Design features could include road, recreation, and/or livestock management.
- 4 Where there is a structure in place to use water from a spring as a water source or when designing restoration projects, priority should be given to the protection of spring source areas and riparian habitat to safeguard the unique ecological and biophysical characteristics, higher biodiversity, endemic species, and cultural values associated with spring sources. For example, water could be piped out of the riparian area to avoid negative impacts to soil, water, and vegetation or if water is to be diverted, a flow-splitter could be installed to maintain some flow at the source.

Management Approaches for Springs

Continue working with partners and stakeholders, including tribes, to inventory, classify, assess, and prioritize springs and recharge areas for restoration, and to implement restoration activities. Include consideration of rare species and endemic species when evaluating springs for restoration.

Riparian Forest Types

Desired Conditions for Riparian Forest Types

FW-Rip-RipType-DC

- 1 Riparian forests are in proper functioning condition. Periodic flooding and scouring are the primary natural disturbances and promote a diverse plant structure consisting of herbaceous, shrub, and tree species of all

¹⁰ The number of species and the number of endemic species are correlated with solar energy.

ages and size classes necessary for the recruitment and succession of riparian-dependent species. Age and size classes include seedling, sapling, mature, and overmature vegetation. Fire is infrequent.

- 2 Riparian forests provide the composition and structure to filter sediments, ash, and contaminants; build and stabilize banks; reduce the effects of flooding; store and release water; and recharge aquifers. Riparian forests provide habitat and help maintain temperatures necessary for maintaining populations of native aquatic and riparian-dependent species and for their dispersal. At the landscape scale, overall plant composition is similar to [site potential](#) (greater than 66 percent). Plant composition can vary considerably at the fine- and mid-scales, depending on site potential (as determined by TEUI or other appropriate ecological classification system) and climate, elevation, geomorphology, topography, soils, and smaller scale disturbances.
- 3 Protective litter and plant cover is similar to site potential (greater than 66 percent) which allows higher stream terraces and floodplains to recycle nutrients, and resist erosion and compaction. The amounts of litter and cover can vary considerably at the fine- and mid-scales, depending on site potential (as determined by TEUI or other appropriate ecological classification system).
- 4 Root masses and herbaceous vegetation stabilize banks, filter sediment, and maintain or improve water quality.
- 5 Dead ([snags](#)) and live trees, and down woody material provide prey base habitat, aquatic nutrient cycling, and soil retention.
- 6 Collectively, Cottonwood Willow Riparian Forest, Mixed Broadleaf Deciduous Riparian Forest, and mesquite bosques provide a unique vegetation community favored by bird species such as the western yellow-billed cuckoo and Bell's vireo. When water tables are high, mesquite bosques persist on upland terraces. In mesquite bosques, a variety of age classes are present, including seedling, sapling, mature, and overmature trees. The understory is comprised of native grasses and forbs.

Objectives for Riparian Forest Types

FW-Rip-RipType-O

- 1 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.

Guidelines for Riparian Forest Types

FW-Rip-RipType-G

- 1 Water diversions and groundwater pumping should not lower the water table to prevent loss of or undesired changes to composition, structure, or function to riparian forests or mesquite bosques.
- 2 Connectivity within the unique vegetation community created by the combination of Cottonwood Willow Riparian Forest, Mixed Broadleaf Deciduous Riparian Forest, and mesquite bosques should be maintained and enhanced. The intent is to maintain ecological functions, tree density, and growth, native understory, and reduce the risk of predation and nest parasitism and to provide habitat for western yellow-billed cuckoo, Bell's vireo, and other wildlife species.
- 3 In riparian forests, recreation activities, permitted uses, and management activities should occur at levels that maintain or allow improvement of soil function, riparian vegetation, and water quality at the stream reach scale. 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.
- 4 Fire wood cutting or wood removal should be managed in remaining mesquite bosques to avoid impacts to understory species, tree density, tree growth, and to avoid channel downcutting and accelerated erosion.

Management Approaches for Riparian Forest Types

As opportunities arise, consider the relocation or modification of existing developments and infrastructure where appropriate to reduce fragmentation of the unique vegetation community of Cottonwood Willow Riparian Forest, Mixed Broadleaf Deciduous Riparian Forest, and mesquite bosques.

Terrestrial ERUs

Desired Conditions for All Terrestrial ERUs

FW-TerrERU-All-DC

- 1 Each ERU contains a [mosaic](#) of vegetation conditions, densities, and structures. This mosaic occurs at a variety of scales across landscapes and watersheds, and reflects the natural disturbance regimes affecting the area.
- 2 Within their type and capability, terrestrial ERUs are functioning properly and are resilient to the frequency, extent, intensity, and severity of disturbances, such as fire in fire-adapted systems, and adapt to climate variability. Natural and human disturbances provide desired overall plant density, species composition (mix of species), [structure](#), [coarse woody debris](#), and nutrient cycling. Desired disturbance regimes, including fire, are restored where practical.
- 3 Vegetation and stream ecosystems are connected based on natural patterns that are consistent with landforms and topography and provide for upland and aquatic species movements and genetic exchange.
- 4 Vegetation conditions allow for [inclusions](#) and variability within the landscape as well as for transition zones or [ecotones](#) between riparian areas, forests, woodlands, shrublands, and grasslands. Transition zones shift in time and space due to factors affecting site conditions (such as fire or climate). Stringers persist where they naturally occur. For example, pine stringers are noncontiguous narrow communities of pine (often large old trees) that extend into lower elevation vegetation.
- 5 Vegetation provides ecologically sustainable amounts of products, such as wood fiber or forage.

Guidelines for All Terrestrial ERUs

FW-TerrERU-All-G

- 1 Management activities such as vegetation treatments or other restoration actions should be designed to maintain or move toward desired conditions, to minimize impacts to other uses and resources, and to maintain biodiversity created by inclusions, landscape variability, and transition zones.
- 3 If needed to support restoration activities, seeding with native species appropriate for the ecological unit (or similar in elevation, soil type, and ecosystem) should be used to restore the desired native species composition of the area. Use of desirable, non-native plant materials may be allowed where native plant materials are unavailable, cost-prohibitive, insufficient to address site-specific problems, and the non-native plant materials do not impede re-establishment of native species.

Management Approaches for All Terrestrial ERUs

Foster partnerships with the Rocky Mountain Research Station and other science organizations to identify and develop concepts, tools, and research opportunities applicable to ecosystem restoration and vegetation management on the Coconino NF.

Work with volunteer groups on projects that improve vegetation and ecosystem function.

Grassland ERUs**Desired Conditions for Grassland ERUs**

FW-TerrERU-Grass-DC

Landscape Scale (1,000 to 10,000+ acres)

- 1 Grasslands occur on soils classified as Mollisol or those with relatively thick organic surfaces. Canopy cover of trees and shrubs on grasslands is less than 10 percent. Grassland vegetation is dominated by native grasses, forbs and annuals of varying seral stages where they naturally occur. Early seral stages will typically contain more forbs, and as stages get older, they are dominated by more grasses and fewer forbs. Native plant species are present in natural patterns of abundance and density, and regenerate successfully in most years depending on seasonal climatic conditions. At the landscape scale, overall plant composition is similar to site potential (greater than 66 percent). Plant composition can vary considerably at the fine- and mid-scales depending on site potential (as determined by TEUI or other appropriate ecological classification system) and climate, topography, soils, and smaller scale disturbances. Succulents are present on more arid sites.
- 2 Native understory vegetation is capable of supporting frequent surface fires (Fire Regime II) except in Verde Formation soils, which support infrequent fires of low to mixed severity. The abundance of invasive annual species does not facilitate the spread, intensity, or severity of uncharacteristic fire.
- 3 Grasslands are connected based on the distribution of soils classified as Mollisol or those with relatively thick organic surfaces and are not fragmented.
- 4 A mix of cool and warm season understory species, of varying heights and density, provide food and cover for invertebrates and wildlife, including pronghorn.

Mid-Scale (10 to 999 acres)

- 5 In Semi-desert Grasslands, arroyos and gullies are stabilizing and recovering. Water infiltration is at natural rates, which reduces arroyos and gullies and prevents head cuts from forming in drainages.

Fine Scale (less than 10 acres)

- 7 Trees occur as individuals, but occasionally in smaller groups.
- 8 A mosaic of vegetation patches with varying vegetation densities is present, depending on site potential (as determined by TEUI or other appropriate ecological classification system). Densely vegetated areas provide cover for ground-nesting birds and pronghorn fawns. Bare areas are the result of natural processes such as freeze-thaw action, erosion, drought, or prairie dog burrowing.
- 9 Populations of big sacaton grass (*Sporobolus wrightii*) are reproducing sustainably and expanding on suitable habitat on the Red Rock Ranger District.

Objectives for Grassland ERUs¹¹

FW-TerrERU-Grass-O

- 1 Restore or improve at least 3,500 acres of Semi-desert Grasslands during each 10-year period over the life of the plan.

¹¹ Objectives for Semi-desert Grasslands and Great Basin Grasslands maintain and improve habitat for pronghorn.

Guidelines for Grassland ERUs

FW-TerrERU-Grass-G

- 2 **Grassland composition, structure, and productivity and soil function should be protected and enhanced using methods such as fencing, aerating soil (decompacting soils), improved grazing strategies, or strategic location of constructed waters or of roads.**

Management Approaches Grassland ERUs

Collaborate with partners and stakeholders on grassland restoration, grassland connectivity, and education.

Coordinate with Arizona Game and Fish Department (AZGFD) and U.S. Fish and Wildlife Service on objectives for wildlife conservation, education, habitat restoration, and [improvements](#), particularly regarding pronghorn, prairie dogs, and black-footed ferrets.

Species-specific wildlife needs are addressed on a site-specific basis and considered during project-level planning and implementation. Project specialists work together to determine achievable conditions that would optimize wildlife habitat at the site level, and give consideration to follow-up monitoring that could assess how well such conditions have been met.

Pinyon Juniper ERUs

Desired Conditions for Pinyon Juniper ERUs

FW-TerrERU-PJ-DC

- 10 In Pinyon Juniper Woodland, at the landscape scale, even-aged patches of pinyons and junipers form multi-aged woodlands. Very old trees (greater than 300 years old) are present. Tree density and canopy cover are high, and where interlocking crowns shade the ground over extensive areas, shrubs are sparse to moderate and herbaceous cover is low and discontinuous. The patch size of woodlands ranges from tens to hundreds of acres.
- 11 In Pinyon Juniper Woodland, old-growth structure and components are often concentrated in mid- and fine-scale units as patches of old growth. Old-growth components include old trees, dead trees (snags), downed wood (coarse woody debris), and structural diversity. The location of old-growth components shifts on the landscape over time as a result of succession and disturbance (tree growth and mortality).
- 12 In Pinyon Juniper Woodland, snags and older trees with dead limbs and/or tops are scattered across the landscape. Snags 8 inches and above at diameter at root collar average 5 snags per acre, while snags 18 inches and above average 1 snag per acre. Coarse woody debris increases with succession and averages 2 to 5 tons per acre.
- 13 In Pinyon Juniper Woodland, fire as a disturbance is less frequent and variable due to differences in ground cover. The fires that do occur are mixed- to high-severity (Fire Regime III, IV, and V).
- 14 In Pinyon Juniper Woodland, ground cover consists of shrubs, perennial grasses, and forbs and some sites are capable of carrying surface fire. The amount of shrub cover depends on the TEUI unit. At the landscape scale, overall plant composition is similar to site potential (greater than 66 percent), but can vary considerably at fine- and mid-scales owing to a diversity of seral conditions. The seral state proportions apply at the landscape scale, where low overall departure from reference proportions is a positive indicator of ecosystem condition.
- 15 Plant litter (such as leaves, needles) and coarse woody debris create microclimate conditions necessary for pinyon seed germination. There are sufficient [nurse trees](#) to provide microclimate conditions in the understory. Nurse trees provide improved nutrient and soil properties, higher soil moisture, lower temperatures, and light levels which increase pinyon seedling survival under harsh conditions.

- 16 A robust crop of pinyon nuts is regularly produced, consistent with the capability of the site.

Guidelines for Pinyon Juniper ERUs

FW-TerrERU-PJ-G

- 1 In all pinyon juniper ERUs, soils classified as Mollisols should be managed toward grassland desired conditions.
- 2 In areas where there is little understory and treatments are proposed, slash treatments (such as lop and scatter and mastication) should be used that improve herbaceous vegetation growth, [watershed condition](#), and soil productivity. The intent is to encourage response in herbaceous vegetation and allow smaller debris to decompose in place on the ground.
- 3 Large accumulations of green material (such as slash, wind-thrown trees) should be managed to reduce the risk of uncharacteristic bark beetle outbreaks.
- 4 To increase small mammal occupancy in areas where coarse woody debris is deficient and to provide nesting habitat and cover for turkeys, birds, small mammals, reptiles, and invertebrates, slash piles should be retained across the landscape for several years, rather than immediately being burned. The number and distribution of retained slash piles should be consistent with [scenic integrity objectives](#) (SIO) and balanced with potential threats from bark beetles and fire/fuels concerns. If slash is scattered, it should be at a height that still allows big game movement.

Management Approaches for Pinyon Juniper ERUs

In all pinyon juniper ERUs, consider managing soils classified as Mollisols (soils with relatively thick organic surfaces) as grasslands, because these soils are typical of and generally develop under grassland conditions.

Ponderosa Pine

Desired Conditions for Ponderosa Pine

FW-TerrERU-PP-DC

Landscape Scale (1,000 to 10,000+ acres)

- 1 Ponderosa Pine has a mosaic of trees with varying age classes and understory vegetation, which provide habitat for a variety of species, including Mexican spotted owls and northern goshawks, and ground fuels conducive to low-severity fires.
- 2 The composition, structure, and function of vegetation conditions are resilient to the frequency, extent, intensity, and severity of disturbances and climate variability. The landscape is a functioning ecosystem that contains its components, processes, and conditions that result from natural levels of disturbances (such as insects, diseases, fire, dwarf mistletoe, lightning, drought, and wind), including snags, downed logs, and old trees. Dwarf mistletoe occurs at natural levels. Infections may be present in stands, particularly those that include Douglas-fir or ponderosa pine. Infection size, degree of severity, and amount of mortality varies among infected stands. Grasses, forbs, shrubs, and needle cast (fine fuels), and small trees maintain the natural fire regime. Vegetative ground cover provides protection from accelerated soil erosion, promotes water infiltration, and contributes to soil nutrient cycling, plant and animal diversity, and to ecosystem function. The amount of shrub cover depends on the TEUI unit. Across the Ponderosa Pine Bunchgrass and Ponderosa Pine/Gambel Oak subtypes, perennial grasses and forbs dominate the understory, though shrubs are present throughout. In areas where Ponderosa Pine Evergreen Oak subtype occurs and perennial grasses dominate the understory, shrubs average less than 30 percent canopy cover and do not inhibit ponderosa pine regeneration. In areas where Ponderosa Pine Evergreen Oak subtype occurs and evergreen shrubs dominate the understory, shrubs average greater than 30 percent canopy cover. At the landscape scale, overall plant composition is similar to site potential (greater than 66 percent), but can vary considerably at the fine- and

mid- scales owing to a diversity of seral conditions. The seral state proportions apply at the landscape scale, where low overall departure from reference proportions is a positive indicator of ecosystem condition.

- 3 Frequent, low-severity fires (Fire Regime I) are characteristic in the vast majority of this ERU, including throughout northern goshawk home ranges. Spatial heterogeneity and discontinuous crowns (interspaces between groups and single trees) prevents crown fire spread. However, in the Ponderosa Pine Evergreen Oak subtype, where evergreen shrubs dominate the understory, low- and mixed-severity fires are characteristic and burn on the forest floor as well as in the overstory, and crown fires occur in small patches. Natural and human disturbances are sufficient to maintain desired overall tree density, structure, species composition, coarse woody debris, and nutrient cycling.
- 4 At the landscape scale, Ponderosa Pine is composed of trees in structural stages that range from young to old and are dominated by ponderosa pine trees. Forest appearance is variable, but generally uneven-aged and open; occasional areas of even-aged structure are present. Forest arrangement is in individual trees, small clumps, and groups of trees interspersed within variably sized openings of grasses, forbs, and shrubs that are similar to historic patterns. [Openness](#) typically ranges from 10 percent in more productive sites to 70 percent in the less productive sites.
- 5 The ponderosa pine forest vegetation community is composed predominantly of vigorous trees, but [declining](#) trees are a component and provide for snags, top-killed, lightning- and fire-scarred trees, and coarse woody debris (greater than 3-inch diameter), all well-distributed throughout the landscape. Snags, down logs and coarse woody debris are representative of the species within the vegetation community. Ponderosa pine snags are typically 18 inches or greater at [diameter at breast height \(d.b.h.\)](#) and average 1 to 2 snags per acre. There are varying sizes of snags greater than 18 inches d.b.h. In the Gambel oak subtype, large oak snags (greater than 10 inches) are a well-distributed component. Downed logs (greater than 12-inch diameter at mid-point, greater than 8 feet long) average 3 logs per acre within the forested area of the landscape. Coarse woody debris, including downed logs, ranges from 3 to 10 tons per acre and is sufficient to maintain or improve long-term soil productivity and provide cover and food for a variety of species.
- 6 Old-growth structure occurs throughout the landscape consistent with vegetative characteristics of a frequent, low-severity fire regime. Old growth is a component of uneven-aged forests, generally composed of groups of similarly aged trees and single trees interspersed with open grass–forb–shrub interspaces, but occasionally, it occurs in larger even-aged patches where local microsites facilitate less frequent fire regimes. Within-[group](#) variability may be low, but variation among groups is typically high, and proportions of patches with different developmental stages may vary, depending on site-specific conditions. Old-growth components include old trees, dead trees (snags), and dead and downed wood (coarse woody debris including large size classes). Snags and large dead and downed fuels are irregularly distributed across the landscape and may not exist in some patches. The location of old-growth components shifts on the landscape over time as a result of succession and disturbance (tree growth and mortality).
- 7 In the Ponderosa Pine Gambel Oak and Ponderosa Pine Evergreen Oak subtypes, all sizes, structures (that is, the shrub or tree forms depending on the capability of the site), and ages of oak trees are present in natural patterns of abundance and density. These subtypes are reproducing and maintaining their presence on suitable sites across the landscape. Old oak trees occur as dominant individuals or in small groups. Where they naturally occur, large to moderate-sized oak snags are well-distributed across the landscape, as are moderate to large live oak trees with dead limbs, hollow boles, and cavities. These provide shelter and habitat for rare plants and a variety of wildlife species, including owls and bats.

Mid-Scale (10 to 999 acres)

- 8 At the mid-scale, Ponderosa Pine is characterized by variation in the size and number of tree groups depending on elevation, soil type, aspect, and site productivity. The more biologically productive sites contain more trees per group and more groups per area, resulting in less space between groups. At the mid-scale, openness typically ranges from 30 percent in more productive sites to 60 percent in the less productive sites. Openness in outlying sites may be as low as 10 percent in some situations such as in high-elevation,

mesic sites or where needed to meet wildlife habitat requirements. Openness in outlying sites may be as high as 90 percent in situations such as low-elevation sites on south-facing slopes, where ponderosa pine transitions into grasslands, or where site-specific information indicates the site was historically more open. Tree density within forested areas generally ranges from 22 to 89 square feet basal area per acre. Forest conditions may exceed these densities in some areas, such as on steep slopes and in canyons. In addition, the density of larger trees and canopy cover may be higher where needed to manage for Mexican spotted owls. Ground cover consists primarily of perennial grasses and forbs capable of carrying surface fire, with basal vegetation values ranging between about 5 and 20 percent, depending on the TEUI unit.

- 9 The mosaic of tree groups generally comprises an uneven-aged forest with all age classes present, including old growth. Groups of seedlings and saplings are maintained at sufficient levels to provide a reliable source of replacement as trees grow and progress into succeeding size and age classes. Infrequently, patches of even-aged forest structure are present. Disturbances (such as insects, diseases, fire, dwarf mistletoe, lightning, drought, and wind) sustain the overall age and structural distribution.
- 10 Diversity of understory species (such as grasses, forbs, and shrubs) is within the capability of the site and provides for water infiltration and soil stability. The understory has a variety of heights of cool and warm season vegetation and produces seed heads and all age classes of vegetation food and cover for wildlife and forage for livestock. A mosaic of dense cover, high amounts of litter, and bare soil provide habitat for a variety of species.
- 11 Fires burn primarily on the forest floor and do not spread between tree groups as crown fire. Single tree torching and small group torching, however, are not uncommon, resulting in a mosaic across the landscape. Crown fires may occur in small patches in the Ponderosa Pine Evergreen Oak subtype where evergreen shrubs predominate in the understory.

Fine Scale (less than 10 acres)

- 13 Trees typically occur in irregularly shaped groups and are variably spaced with some tight clumps. Crowns of trees within the mid-aged to old groups are interlocking or nearly interlocking. Interspaces surrounding tree groups are variably shaped and composed of a grass/forb/shrub mix. Some natural openings contain individual and randomly distributed patches of trees and a diversity of grasses and forbs, which provide habitat for species, including invertebrates, small mammals, migratory birds, and turkey. Trees within groups are of similar or variable ages and may contain species other than ponderosa pine. Size of tree groups typically is less than 1 acre, but they may range from a few to many trees in extent and be larger in areas managed for bald eagles and Mexican spotted owls or where site-specific information indicates the group was larger historically. Old-growth groups contain trees having similar age characteristics and conditions. Such groups may include fairly similar tree ages and sizes or combinations of ages and sizes, limited amounts of dead and downed material, and dead trees and spike tops (snags), but they are readily distinguished from adjacent groups having different characteristics. Groups at the mid-aged to old stages consist of 2 to approximately 40 trees per group.
- 14 Witches brooms (dense mass of branches and stems growing from a single point) may form on trees infected by dwarf mistletoe, providing valuable habitat components for wildlife species.
- 15 Large oak trees and pine-oak groups in the Ponderosa Pine Gambel Oak and Evergreen Oak subtypes provide cooler, moister microsites and higher overstory diversity than found in the Ponderosa Pine Bunchgrass subtype. Acorns provide food for wildlife species.

Guidelines for Ponderosa Pine

FW-TerrERU-PP-G

- 1 To protect old-growth forest components, existing old-growth forest attributes should be protected from uncharacteristic natural disturbances. Methods of protecting existing old-growth forest components on the landscape may include prescribed cutting, prescribed fire, and wildfires managed for resource objectives.

- 2 To perpetuate old-growth forest components, the development of old-growth conditions should be encouraged in areas where old growth is lacking. Uneven-aged vegetation treatments should be designed such that replacement structural stages and age classes are proportionally present to assure continuous representation of old-growth characteristics across the landscape over time.
- 3 In promoting an uneven-aged forest condition that maintains or contributes to the restoration of old-growth conditions characteristic of the forest type, preference for retention should be given to presettlement trees, often the largest, oldest, and tallest trees onsite. For Ponderosa Pine, presettlement trees may be determined by the following characteristics described by Thomson (1940) as age class 3 (intermediate to mature) and age class 4 (mature to over-mature) and vigor class A (full), B (medium), C (light), and D (weak):
 - **Age** – approximately 150 years and older.
 - **Bark** – ranging from reddish brown, shading to black in the top with moderately large plates between the fissures, to reddish brown to yellow, with very wide, long and smooth plates.
 - **Branching** – ranging from upturned in upper third of the crown, horizontal in the middle third and drooping in the lower third of the crown to mostly large, drooping, gnarled or crooked. Branch whorls range from incomplete and indistinct except at the top to completely indistinct and incomplete.
- 4 To promote old-growth attributes consistent with desired conditions, manage for large Gambel oak trees and snags to be sustained over time.
- 5 To provide necessary habitat components, the largest and tallest snags representative of the stand and downed logs should be emphasized along edges of openings and within groups/clumps of trees to provide habitat and roost sites for wildlife species such as small mammals, cavity-nesting birds, and tree-dwelling bats.
- 6 Large accumulations of green material (such as slash, wind thrown trees) should be managed to reduce the risk of uncharacteristic bark beetle outbreaks.
- 7 To increase small mammal occupancy in areas where logs are deficient and to provide nesting habitat and cover for turkeys, birds, small mammals, reptiles, and invertebrates, slash piles should be retained across the landscape for several years, rather than immediately being burned. This should be consistent with SIOs and balanced with potential threats from bark beetles and fire/fuels concerns.

Management Approaches for Ponderosa Pine

Species-specific wildlife needs are addressed on a site-specific basis and considered during project-level planning and implementation. For example, where they occur, turkey typically benefit from grasses and herbaceous vegetation between 4 and 10 inches in height to provide food and cover for young turkeys. This habitat consideration is, however, dependent in large part on weather. Optimal brood habitat conditions may not always be achievable due to variable environmental conditions (such as winter snowfall and spring precipitation). Project specialists work together to determine achievable conditions that would optimize wildlife habitat at the site level, and give consideration to follow-up monitoring that could assess how well such conditions have been met.

Southwestern dwarf mistletoe is a natural disturbance agent in ponderosa pine that occurs at natural levels. In some areas, the infection is widespread and would inhibit the long-term maintenance of diverse age classes and long term sustainability. Treatments for mitigating dwarf mistletoe impacts are not intended to completely eliminate this naturally occurring disturbance agent. Rather, they are typically aimed at reducing infection levels across the stand and increasing host vigor. Doing so would increase stand resilience, reduce susceptibility to insect infestations, increase resistance to droughts and adverse climate change, and allow for development of a diversity of age classes across the landscape. Treatments can consist of a combination of mechanical treatments and fire.

Wildlife, Fish, and Plants

Desired Conditions for Wildlife, Fish, and Plants

FW-WFP-DC

- 1 Properly functioning ecosystems and ecologically responsible forest activities support sustainable populations of native plant and animal species distributed throughout their potential natural range. Properly functioning ecosystems reflect the diversity, quantity, quality, and site potential of natural habitats on the Forest. Habitat is available at the appropriate spatial, temporal, compositional, and structural levels for a wide variety of species.
- 2 Habitat conditions contribute to the survival and recovery of listed species, allow for repatriation of extirpated species, contribute to the delisting of species under the Endangered Species Act, preclude the need for listing new species, improve conditions for Southwestern Region sensitive species, and keep common native species common. Habitat conditions provide the resiliency and redundancy necessary to maintain species diversity and [metapopulations](#).
- 3 Terrestrial ERUs and riparian areas provide the necessary physical and biological habitat components for carrying out growth, reproduction, survival, dispersal, and other key life cycle needs of associated native species.
- 4 Stream ecosystem conditions within perennial and intermittent riparian streamcourses support habitat for self-sustaining populations of native aquatic and riparian species. Woody and herbaceous overstory and understory (where the natural potential exists) and overhanging banks provide fish habitat, regulate stream temperatures, and maintain soil moisture in the aquatic management zone. Stream substrates provide clean gravels for fish spawning, woody debris for hiding cover, and sites for germination and establishment of riparian vegetation. Abiotic structure such as silt, sand, gravel, cobble, boulders, and bedrock provide habitat for a variety of aquatic and terrestrial species.
- 5 The composition, structure and function of ERUs and associated physical elements (such as canyons, cliffs, caves, karst, talus slopes, rock piles, specific soil types, springs, wet areas, and other special features) provide functioning habitat and [refugia](#) to support populations of federally listed, Southwestern Region sensitive species, narrowly endemic species, and species with restricted distributions.
- 6 Interconnected terrestrial, riparian, and aquatic habitats promote wildlife, fish, and plant species movements and genetic exchange, allow for movement of wide ranging species, and promote natural predator-prey relationships, particularly for strongly interactive species (such as mountain lions). Species are able to access adjoining habitat, disperse, migrate, meet their life history requirements, and adjust their movements in response to climate change. Ephemeral and intermittent streamcourses function as habitat and movement corridors for species.
- 7 Forest attributes such as multistory structure; large, old trees; large trees with sloughing, exfoliating bark; snags; large downed logs; and other indicators of mature stands are present in all forest and woodland ERUs, providing habitat for the associated species.
- 8 Species populations are supported by their natural habitats. When natural habitats are unable to support species populations, active management and human-made or altered habitats support populations and meet conservation objectives.
- 9 Passage barriers are present in some streams when needed to physically separate native and non-native aquatic species.
- 10 Residents and visitors appreciate, learn, and have ample opportunities to experience, appreciate, and learn about the wildlife, fish, and plant resources of the Forest including vulnerable species such as native fish and migratory birds, charismatic species such as bald eagles and elk, and threats such as invasive species. Wildlife viewing or native sport fishing is emphasized where the opportunities exist. This results in increased forest stewardship, ecological awareness, partnerships, and volunteerism.

11 Activities, facilities, and uses are managed to have minimal human-wildlife conflicts.

Objectives for Wildlife, Fish, and Plants

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.
- 2** 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.
- 3** Restore or enhance at least 60,000 acres of terrestrial wildlife habitat during each 10-year period over the life of the plan.
- 4** Restore or enhance at least 70 miles of stream habitat during each 10-year period over the life of the plan.
- 5** Complete at least 30 products or activities that educate the public about wildlife, fish, and plant resources during each 10-year period over the life of the plan. Examples of products include: educational signs and brochures, website pages, species checklists, presentations, and field trips.

Standards for Wildlife, Fish, and Plants

FW-WFP-S

- 1** Direction for species listed as threatened, endangered, proposed, or candidate takes precedence over direction for species not listed by the U.S. Fish and Wildlife Service.
- 2** Timing restrictions will be applied to projects and activities that have the potential to negatively affect federally listed species, bald eagles, and golden eagles to minimize or avoid impacts to survival or successful reproduction.

Guidelines for Wildlife, Fish, and Plants

FW-WFP-G

- 1** Habitat management objectives and species protection measures from approved recovery plans should be applied to activities occurring within federally listed species habitat to promote recovery of the species.
- 2** To improve the status of species and prevent Federal listing, management activities should comply with species conservation agreements, assessments, strategies, or national guidelines.
- 3** Projects and management activities should be designed or managed to maintain or improve habitat for native species and to prevent or reduce the likelihood of introduction or spread of disease.
- 4** Project design should include measures to minimize the negative impact of pesticides, herbicides, or chemicals to species and their habitat. For example, chemical-free buffers could be placed around bat roosts, riparian or aquatic habitat.
- 5** Structural improvements should be planned and managed to provide wildlife with safe use of water, and to allow safe passage for wildlife prone to movement restrictions, such as pronghorn. For example, the bottom wire of fences should be smooth and at least 18 inches high to allow pronghorn passage.
- 6** Important wildlife movement corridors and pronghorn habitat should be generally free of impediments to movement caused by fences, so species can meet basic life history needs and access suitable habitat. For example, in these areas, construction of additional fences should be minimal, fence maintenance should be a priority, and fences that are no longer needed should be removed.

- 7 All open top vertical pipes with an inside diameter greater than 1 inch should be capped or otherwise designed to prevent animal entrapments. Examples of open top vertical pipes are pipe used for fences, survey markers, building plumbing vents, or sign posts.
- 8 Timing restrictions should be applied to projects and activities that potentially negatively affect Southwestern Region sensitive species and pronghorn. The intent is to minimize or avoid impacts to survival or successful reproduction.
- 9 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.
- 10 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.
- 11 Project-related activities with the potential to disturb active raptor nests should be restricted within a minimum of 300 yards of these nest sites to promote survival or successful reproduction.
- 12 Established protocols should be followed to prevent the introduction and spread of disease, such as chytrid fungus (*Batrachochytrium dendrobatidis*) that kills amphibians.
- 13 New road and new trail locations should be designed to maintain species access to adjoining habitat, to maintain habitat for dispersal and migration, and to meet species' life history requirements, including fawning habitat for pronghorn.
- 15 To maintain rare plant populations, seed collection and cuttings (rather than whole plant removal) should be the preferred collection methods when forest product and research collection permits are issued. An exception would be when whole plant removal is required to meet the needs of the permittee and removal would not have the potential to negatively impact rare plant populations. This guideline does not apply to pre-cleared areas for wilding permits of specific species.
- 16 Permits for cutting stalks off of agaves should not be issued in order to protect stalks used as nesting and overwintering habitat for key pollinators of desert ecosystems such as carpenter bees. Exceptions may be made for limited research purposes and traditional tribal uses.

Management Approaches for Wildlife, Fish, and Plants

Coordinate with the Arizona Game and Fish Department, U.S. Fish and Wildlife Service, and the statewide Native Fish Conservation Team regarding maintenance of habitat for listed and native species; reintroductions, introductions, or transplants of species; control or eradication of non-native species; and the management of sport and native fishes, including the identification of refugia for native fish and the establishment or removal of fish barriers. Coordination includes referencing current agency recommendations for improving wildlife habitat such as guidelines for wildlife-friendly fencing.

Coordinate with the Arizona Game and Fish Department, the U.S. Fish and Wildlife Service, sportsman groups, the scientific community—including the Rocky Mountain Research Station—and other stakeholders about information, education, and knowledge gaps as they relate to promoting and improving wildlife, fish, and plant resources and management. Education opportunities could include collaboration with research partners to provide student and volunteer participation in scientific studies.

Coordinate with the Arizona Game and Fish Department regarding the State Wildlife Action Plan as well as hunting recommendations for various wildlife populations that would lead to maintenance and improvement of habitat elements such as vegetation, aspen, riparian, and soil condition and productivity.

Place an emphasis on natural habitats. Consider active management of habitat when needed to support species populations and meet conservation objectives.

Use current literature and the best available science when making site-specific decisions relevant to project planning. This is done in an interdisciplinary context with input from other resource specialists. For example; the guideline specifying disturbance buffers around raptor nests (FW-WFP-G-11) is intended as a minimum buffer. Some raptor species (such as osprey) are more adapted to disturbance and are likely to tolerate a buffer of just 300 yards during the breeding season while other, less tolerant species (such as peregrine falcons (*Falco peregrinus*)) may require buffers of up to one-half mile. Wildlife biologists work with other resource specialists to identify and define the appropriate site-specific buffers (within the context of plan guidance) for other raptors on a case-by-case basis.

The application of seasonal timing restrictions is site-specific and may vary depending on variables such as species, weather, timing of activity relative to species life cycle, or duration, frequency, and type of activities that are occurring in the species' habitat. Other variables to be considered could include the duration, extent, and intensity of the proposed activity, or the type of activity itself, such as emergency or safety-related actions versus non-emergency activities. The best available information and science is utilized to develop seasonal restrictions to reduce impacts to disturbance-sensitive species.

Work with Arizona Game and Fish Department, Arizona Department of Transportation, Arizona Wildlife Linkages Working Group, and others to identify linkages and barriers to wildlife movements and to mitigate such threats during project design.

Maintain the native-fish-only status of Fossil Creek and streams free of non-natives through public education, signs, and law enforcement.

Invasive Species

Desired Conditions for Invasive Species

FW-Invas-DC

- 1 Invasive species are absent or exist at levels where they do not disrupt ecological composition, structure, and function; do not disrupt the natural fire regime; or do not affect the sustainability of native and desirable non-native species.
- 2 Infestations of invasive species are detected at an early stage.

Guidelines for Invasive Species

FW-Invas-G

- 1 Measures should be incorporated into authorized activities, project planning, and implementation to prevent, control, contain, and eradicate priority infestations or populations of invasive species to ensure the integrity of native species populations and their habitats is maintained.
- 2 [Integrated pest management approaches](#) and other treatments to control invasive species should be used to improve watershed condition and maintain ecosystem function while minimizing project impacts on native species.¹²
- 3 Weed-free plant material should be selected for all seeding and mulching projects to restore natural species composition and ecosystem function to the disturbed area. Plant or seed materials should be used that are appropriate to the site, capable of becoming established, and are not invasive.

Management Approaches for Invasive Species

Maintain a current inventory of invasive species on forest lands. For plant inventories, prioritize areas of unique and rare habitats first, areas of high use and disturbance second (such as material pits, trailheads, campgrounds, corrals, roads, boat ramps, and bridges), and areas where invasive species are just getting established.

Prioritize areas such as wilderness, research natural areas, botanical areas, wild and scenic areas, and riparian areas for control of invasive species to maintain and restore the integrity of native species and ecosystems. Promote early detection of new populations of invasive species and rapid management response as an effective approach to minimize spread.

Coordinate with stakeholders and the public to reduce, minimize, or eliminate the potential introduction, establishment, spread, and impact of non-native invasive species and to monitor the effectiveness of project design features.

Encourage the prevention of accidental introduction and spread of invasive species carried by contaminated vehicles, equipment, personnel, or materials (including plants, wood, plant/wood products, water, soil, rock, sand, gravel, mulch, seeds, grain, hay, straw, animal feeds, or other materials).

Forest Products

Desired Conditions for Forest Products

FW-FProd-DC

- 3 Traditional and ceremonial tribal uses for forest products, such as the collection of medicinal plants, wild plant foods, basketry materials, kiva beams, and firewood, are available under conditions and procedures that minimize restrictions and are consistent with laws, regulations, and agreements with tribes.

Guidelines for Forest Products

FW-FProd-G

- 3 Collection of forest products should be authorized only when information is available to ensure the product will persist on the forest.
- 4 Plant species recognized as rare, limited in distribution, or on the Southwestern Region's sensitive species list should not be collected unless the forest has information that the species can withstand collection and will persist on the forest. Research collection requests should be considered when the results of the research will aid management of the collected species.

Management Approaches for Forest Products

Recognize the needs of members of tribes whose historic ties include the land now administered by the Coconino NF to collect forest materials for traditional, ceremonial, and subsistence purposes.

Work with tribal members to facilitate collection of forest products needed for traditional activities and ceremonial uses.

Roads and Facilities

Desired Conditions for Roads and Facilities

FW-RdsFac-DC

Roads

- 1 The transportation system (roads) provides reasonable motorized access to the public, city, county, State, and other Federal entities for permissible uses such as recreation, fire management, wildlife management, and

access to infrastructure or neighboring land. The transportation system expands and contracts commensurate with use and needs, and it balances the desire for access with management activities and ecological impacts. An economical system of sustainable, well maintained, and marked roads provides diverse opportunities to explore the forest while protecting watershed conditions, recreation opportunities, scenery, heritage resources, rare plants, fisheries, and wildlife habitat and movement. However, the transportation system does not necessarily provide for user comfort or all-weather access on all roads.

- 2 Road corridors and associated infrastructure (including those under easement or permit) are designed, constructed, and maintained to provide safe access while maintaining and meeting other desired conditions applicable to the area.
- 5 Motor vehicle use occurs at sustainable levels on the Coconino NF to provide opportunities for a variety of motorized use types and levels of challenge for a diversity of users. Travel restrictions are clearly understood by forest visitors.

Guidelines for Roads and Facilities

FW-RdsFac-G

- 1 Roads should be located, designed, and maintained to move toward or maintain desired conditions for other uses and resources.
- 2 Roads should have adequate drainage to avoid accelerated soil erosion, loss of vegetation, and long-term impacts to soil productivity.
- 3 Roads should be signed to facilitate navigation of designated motorized routes and to prevent motorized use outside of designated areas and routes. Boundaries and routes should be clearly and uniformly identified through appropriate tools and management techniques.
- 5 Soil and water BMPs should be implemented to protect water quality while designing, constructing, reconstructing, or relocating new and existing roads, parking areas and pullouts. For example, permanent and temporary road construction and relocation should:
 - Occur outside of streamcourses and aquatic management zones, except where crossing is required.
 - Avoid wetlands, springs, seasonally wet meadows, and montane meadows.
 - Avoid soils that are unstable and highly erodible where connected to streamcourses.
- 6 Unneeded roads should be decommissioned to maintain an efficient and sustainable road system that maintains or moves toward other resource desired conditions.
- 7 Existing roads should be used or realigned before new roads are constructed to avoid areas where disturbance-sensitive threatened and endangered species are present.
- 8 For projects where long-term access is not needed, temporary roads should be used and [naturalized](#) in a timely manner. The intention is to have the road footprint, and potential impacts from road use, such as possible introduction of invasive species, modification of scenic integrity objectives, or increased sedimentation into connected waters, on the landscape for as short a time as possible.
- 9 Bridges, culverts, stream crossings on permanent roads, and diversion structures should be designed to allow safe passage for aquatic organisms. Passage barriers are acceptable when needed to physically separate native and non-native species.
- 10 Facilities on National Forest System lands should be designed to incorporate principles of sustainability and to reflect their place within the natural and cultural landscape. To manage unique design issues associated with specific areas or unusual circumstances, specific built environment image guides should be developed.

Management Approaches for Roads and Facilities

Roads

Consider wildlife and plant habitat needs early in the transportation and development planning process.

Work closely with the Arizona Game and Fish Department, Arizona Wildlife Linkages Working Group, Arizona Department of Transportation, and others to identify linkages and potential barriers to wildlife movement and to mitigate such threats during project design.

The application of seasonal timing restrictions is site-specific and may vary depending on variables such as species; weather; timing of activity relative to species life cycle; or duration, frequency, and type of activities that are occurring in the species' habitat. Other variables to be considered could include the duration, extent, and intensity of the proposed activity, or the type of activity itself, such as emergency or safety-related actions versus non-emergency activities. The best available information and science is utilized to develop seasonal restrictions to reduce impacts to disturbance-sensitive species.

Factors in prioritizing the naturalization of decommissioned and unauthorized roads include the following:

- Watershed Condition
 - Soils that are receiving, or are expected to receive, damage to the extent that soil productivity is or will be significantly impaired outside of the road prism.
 - Riparian areas (springs, wetlands, or stream reaches) that are impaired or non-attaining due to sedimentation or alterations to [hydrology](#) related to the road.
 - Poorly located, designed, or maintained roads connected to downstream impaired or non-attaining waters, where potential for increased runoff and sedimentation is high.
- Wildlife, Fish, and Plants
 - Habitats for threatened, endangered, or sensitive species that are susceptible to roads as barriers or roads as mortality hazards.

Facilities

Protect native plants to the extent possible by site design and mitigation measures during construction.

Special Uses

Desired Conditions for Special Uses

FW-SpecUse-DC

Land Special Uses

- 5 The forest supports renewable energy production and facilitates its development consistent with land capability, desired conditions for other resources, and public values.
- 6 Research permitted on the national forest is focused on improving the scientific understanding of natural and social systems. Research projects conducted under special use permits:
 - Help realize and understand the scientific potential of the abundant cultural and natural resources found on the Coconino NF.
 - Are clearly related to the mission of the Forest Service.
 - Provide needed data or other resources for future forest management.
 - Expand the knowledge of rare species on the forest.

Recreation Special Uses

- 10 The footprints for recreation residences and commercial facilities are stable with some exceptions to accommodate improvements that address health, safety, and environmental issues.
- 11 Organization camps managed under special use permits are focused on natural resource values, conservation education, and emphasize non-motorized recreation opportunities.

Guidelines for Special Uses

FW-SpecUse-G

All Special Uses

- 1 Lands and recreation special uses should be designed to maintain or move toward desired conditions for other uses and resources.
- 3 Lands and recreation special use permits should not be issued 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. The intent is to protect riparian resources. Exceptions may be made for hardened or slickrock sites, water-dependent activities, or safety.

Land Special Uses

- 5 New and reconstructed overhead utility lines, support towers, and other utility infrastructure should be located and designed to minimize adverse ecological, wildlife, and scenic impacts.
- 6 Vegetation that does not interfere with meeting vegetation clearance requirements in rights-of-ways should be retained to allow screening for scenery, habitat for species, and corridors for wildlife movement.
- 8 To optimize use of existing utility sites and corridors and to limit impacts to undisturbed areas, sites and corridors for existing utilities and areas adjacent to road rights-of-way should be used or expanded before creating new sites or corridors.
- 9 Utility lines should be buried to maintain scenic values. Where environmental, cultural, economic, or technical concerns prevent the burial of utility lines, site-specific design features should be developed to protect scenic values.
- 10 To support the purposes of research natural areas, geological areas, botanical areas, and environmental study areas, new [utility corridors](#) should avoid these areas.
- 11 Alternative energy developments, such as wind energy, should be designed to minimize or avoid impacts to other uses and resources, in particular wildlife and scenic integrity.
- 13 Aircraft activities related to commercial filming should be restricted to protect threatened, endangered, and sensitive species from noise disturbance.
- 15 Research projects should be co-located with other research activities, when possible, to optimize the use of existing research sites and reduce conflicts with other uses, or resources.

Recreation Special Uses

- 16 To improve resource management and promote recreation opportunities, outfitter-guide permits should only be issued for activities that have demonstrated public need, promote transportation services, or improve public safety. Any new permit should maintain or increase protection of cultural or natural resources.
- 18 To prevent compaction of soils and overutilization of popular areas, outfitter-guide activities, such as motor vehicle use and camping, should be excluded from areas with sensitive resource issues, such as a high density of archaeological sites, sensitive wildlife areas (including riparian areas or areas with sensitive or rare plants), and adjacent to urban areas.

- 19 To minimize impacts and to protect sensitive resources, large group gatherings and recreation events should occur in suitably developed sites or other areas that have already been analyzed and approved for these uses. In addition, applicants are encouraged to use lands of other ownership for staging when possible.

Management Approaches for Special Uses

Collaborate with the Rocky Mountain Research Station in assessing research needs, opportunities, and methods relevant to current and future forest management.

Coordinate with the research community to identify and manage long-term research locations with the intent of balancing research and management needs.

Recreation Special Uses

Coordinate wildlife-dependent special use permits with the Arizona Game and Fish Department.

Recreation

Desired Conditions for All Recreation

FW-Rec-All-DC

- 5 Low impact recreation principles are widely practiced by the visiting public. Recreation settings and forest resources are free from human litter, graffiti, and vandalism.
- 6 Recreation opportunities are balanced with the capacity of forest resources to support them. There are minimal user and resource conflicts. As development and population in the region continue to grow and new forms of recreation emerge, recreation settings on the Coconino NF are stable, retaining their natural character. Short-term increases in recreation during holidays and weekends do not result in long-term adverse effects to other forest resources.
- 8 Wildlife-based recreation takes place in a variety of settings, from highly developed to primitive.
- 9 Water-based recreation opportunities at waterways and lakes emphasize day-use, nature-based activities.

Guidelines for All Recreation

FW-Rec-All-G

- 1 Recreational activities, locations, and/or settings should be designed and managed to maintain or move toward desired conditions for other uses and resources.
- 2 Recreational activities, locations, and/or settings should be managed to have minimal user conflicts, to be in balance with the capacity of other resources to support them, to promote public health and safety, and/or to prevent wildlife access to food, trash, and human waste.
- 4 Parking should be restricted or designated parking spots should be provided to prevent resource damage and to promote public safety while ensuring visitor access within the capacity of the site.
- 6 Forest visitors with recreational stock should carry hay, cubed, pelleted, or rolled feed that is certified weed-free to prevent the spread of invasive plants.

Management Approaches for All Recreation

Coordinate with the Arizona Game and Fish Department and other stakeholders to provide a network of wildlife viewing opportunities.

Coordinate with the Arizona Game and Fish Department to provide fishing access to meet goals and objectives of the Department's fisheries plans.

Collaborate with local agencies, communities, groups, organizations, and other stakeholders on transportation solutions that reduce traffic and resource impacts at high use recreation areas.

Adopt design standards and best management practices as they become available for recreation activities to provide safe recreation opportunities and to minimize resource impacts.

Developed Recreation

Desired Conditions for Developed Recreation

FW-Rec-Dev-DC

- 3 Where there are high levels of visitor use, most visitor activities occur at developed sites and on trails designed for high levels of use. High levels of developed recreation use are accommodated by facilities and/or services, such as potable water, sanitation, refuse, and recycling, that balance resource protection with recreation demand.
- 8 Developed sites adjacent to water protect water quality, and prevent vegetation damage, soil erosion, and compaction from water-based recreation activities.
- 9 In and around developed sites, invasive weeds and invasive aquatic organisms are not established or transported.

Guidelines for Developed Recreation

FW-Rec-Dev-G

- 2 To promote a natural-appearing landscape, use of native plant species should be emphasized during planning activities (such as design of new sites or improvements to existing sites). Invasive species should be removed or treated on existing sites before they become widespread within recreational sites.
- 3 Developed recreation sites should be managed to discourage or prohibit broken or cut tree limbs or the removal of all downed woody debris to maintain a natural-appearing landscape, to maintain the integrity of the site, and to control accelerated erosion.

Dispersed Recreation

Desired Conditions for Dispersed Recreation

FW-Rec-Disp-DC

- 3 Areas used for dispersed recreation across the forest retain their natural character to the extent possible and have minimal evidence of human waste and litter, sanitation issues, and resource damage.
- 5 The Coconino NF provides abundant and high-quality opportunities for hunting, fishing and other wildlife-based recreation opportunities.

Guidelines for Dispersed Recreation

FW-Rec-Disp-G

- 3 Visitors should be restricted from soil and plant restoration sites to promote re-establishment of vegetation and functioning soil.
- 5 Dispersed camping along riparian areas should be managed to maintain or move toward desired conditions for riparian areas and water.

Management Approaches for Dispersed Recreation

Establish long-term partnerships with recreation organizations to help plan, construct, and maintain motorized and non-motorized recreation opportunities and foster a low-impact conservation ethic.

Trails and Trailheads

Desired Conditions for Trails and Trailheads

FW-Rec-Trails-DC

- 4 Damage to resources from visitor use of trailheads and trails is minimal and within the ability of the forest to mitigate or restore.
- 11 Trail use remains on the established trail surface, especially in high traffic or sensitive areas. Unplanned unauthorized trails are rare.

Guidelines for Trails and Trailheads

FW-Rec-Trails-G

- 1 Trails and trailheads should be designed, built, rerouted, or maintained utilizing current best practices that promote sustainable trail surfaces, prevent conflicts with neighboring lands, address impacts to other resources, and consider user experiences.
- 3 Unplanned, unauthorized trails should be managed to prevent future access. Resources damaged by unplanned, unauthorized trails should be rehabilitated to accelerate recovery and to prevent further resource impacts.

Management Approaches for Trails and Trailheads

Coordinate trails and trailhead parking with future development on adjacent lands so as to be proactive in designing trails and trailheads to maintain access to public lands and protect resources.

Interpretation and Education

Desired Conditions for Interpretation and Education

FW-InterpEd-DC

- 1 Forest Service communication and interpretive messages show respect for the diverse backgrounds and needs of visitors. Visitors are well informed and interpretation emphasizes a land ethic that explains how to reduce their impacts on ecosystems and support the Coconino NF's efforts to protect natural resources and wilderness values. "Leave no Trace," "Tread Lightly," fire prevention, wildlife awareness (such as lead reduction, Be Bear Aware, Animal Inn, etc.) and archaeological resource protection principles are promoted and practiced by the visiting public.
- 2 Through a variety of strategically located interpretive facilities and/or efforts, forest visitors learn about, become oriented to, and appreciate forest and cultural resources, history, and management, such as wilderness, geology, botanical communities, biodiversity, and heritage site etiquette.
- 3 Coconino NF information boards provide recreation maps and visitor information that may include site-specific interpretation, trip preparedness, ethics, seasonal information, and restrictions or closures. Information kiosks concentrate messages, eliminating the need for multiple signs.
- 4 Interpretation and education on the Coconino NF adapts over time and responds to changes in population to inform forest visitors on local and regional resource topics, best available science, sustainable practices, and environmental ethics.
- 6 Roving and guided interpretive activities are available in areas of high visitor use.

Guidelines for Interpretation and Education

FW-InterpEd-G

- 1 A sense of place should be incorporated into interpretive efforts to encourage forest visitors to practice low impact uses and informed stewardship of national forest lands and resources.

Management Approaches for Interpretation and Education

Share Leave No Trace and Tread Lightly concepts and practices in forest interpretation and visitor education.

Collaborate with volunteers, other agencies, and stakeholders to promote interpretive efforts both on and off the forest.

Scenic Resources

Desired Conditions for Scenic Resources

FW-Scenic-DC

- 1 The scenic values of the Coconino NF are conserved and enhanced. Visitors see that the forest is being actively managed through visual cues such as seeing forests and grasslands with more historic conditions where there are abundant native wildflowers, grasses, and forbs; some fire effects where appropriate; and vegetation management to frame views from trails and or provide some privacy for users of developed recreation sites.
- 3 Long-term soil and plant productivity, and proper functioning ecosystems and watersheds are important components of landscape character.
- 4 Vegetation openings and stand boundaries are naturally shaped and are oriented to contours and existing vegetation patterns to blend with existing landscape characteristics, except where other natural resource concerns need different shapes or patterns, such as along powerline corridors.
- 5 Meadows and riparian areas are visually appealing and evidence of physical impacts is confined to specified road crossings, trail crossings, and access points.
- 6 Cultural, historic, and unique geologic features are recognized for their inherent scenic values.
- 7 [Constructed features](#), facilities, and management activities closely follow the form, line,

Standards for Scenic Resources

FW-Scenic-S

- 1 Management activities that are unable to maintain or move toward the desired SIO and whose effects persist in the long term shall not occur unless a decision is made to change the SIO.¹³

Chapter 3. Area-specific Direction

Management Areas

Verde Valley Management Area

Desired Conditions for Verde Valley Management Area

MA-VerdeV-DC

- 1 Watersheds are managed to reduce the risk of uncharacteristic flooding and sedimentation into downstream communities, perennial streams and their tributaries, wildernesses, and other special areas. This would include watersheds that affect drainages such as Beaver Creek, Dry Beaver Creek, Red Tank Draw, Russell Wash, Walker Creek, West Clear Creek, and Oak Creek.
- 4 Areas used for dispersed recreation retain their natural character to the extent possible, while maintaining or moving toward other desired conditions. These areas have little evidence of human waste and litter, and emphasize resource protection.
- 5 The prehistoric, historic, and settlement history of the Verde Valley is an integrated part of interpretive programs throughout the area. The relationship between the landscape of the Forest and nearby national monuments is highlighted.
- 6 For scenery desired conditions, see the forestwide section on Scenic Resources and map 13 for SIOs.

Guidelines for Verde Valley Management Area

MA-VerdeV-G

- 1 Projects and activities should be designed and implemented to maintain or improve watershed and riparian function and/or prevent the introduction or spread of disease, invasive, or undesirable species.
- 2 Recreation should be managed to reduce user conflicts, to maintain the desired conditions of other resources, and/or to promote public health and safety.

Management Approaches for Verde Valley Management Area

Work with stakeholders to develop collaborative solutions to problems that arise from high-use recreation.

Special Areas

Designated Wilderness Areas

Desired Conditions for Designated Wilderness Areas

SA-Wild-DC

- 1 Wilderness areas retain their primitive integrity and provide their full range of social and ecological values.
- 2 Ecosystems and ecological resources within wilderness are functioning properly and reflect natural processes. Unique features are preserved, such as the scarp of the Mogollon Rim and the travertine in the Fossil Springs Wilderness Area, and hanging gardens in the West Clear Creek Wilderness Area.
- 3 Topography and an array of ecosystems and elevations collectively provide for a variety of habitats that support species diversity. A natural assemblage of native species that are indigenous to the wilderness area is present and supported by properly functioning habitat conditions.
- 4 Disturbances, including fire and flooding, are able to play their natural role within the wilderness area while accounting for public health and safety concerns outside of the wilderness area.

- 7 Wilderness-dependent opportunities and activities are consistent with resource values and the [wilderness opportunity spectrum](#).
- 9 Educational materials and interpretation encourage widespread and common understanding of and support for wilderness values, philosophy, resources, and benefits. Consequently, residents and visitors not only appreciate and learn about wilderness, but understand their role in protecting ecological systems and wilderness values. This results in increased forest stewardship, ecological awareness, partnerships, and volunteerism.
- 10 Visitors learn about wilderness and associated prehistoric, historical, and ecological resources at wilderness gateways and nearby high-traffic roadside facilities.
- 11 Special use permits authorizing activities in wilderness facilitate protection, education, and/or the enjoyment of the wilderness character. These permitted activities maintain the challenging and self-reliant experience of other wilderness visitors and do not cause widespread negative impacts to wilderness character.

Standards for Designated Wilderness Areas

SA-Wild-S

- 1 In wilderness, group size limit is 12 persons and stock animals (combined).

Guidelines for All Designated Wilderness Areas

SA-Wild-G

- 1 Management activities and permitted uses should be designed to maintain or move toward the desired conditions for wilderness and other resources.
- 2 Use levels should be managed through permit systems or other methods to prevent wilderness values and opportunities from being compromised.
- 5 Wilderness interpretation should emphasize topics such as group size limitations, mechanized transport limitations, importance of self-reliance, and sensitive ecological features, to help preserve wilderness opportunities and character.
- 8 In the Fossil Creek Wilderness, projects and activities should be designed to maintain the travertine formations and water chemistry of Fossil Creek.

Management Approaches for Designated Wilderness Areas

Closely monitor wilderness areas for overuse and unacceptable resource damage to identify when onsite management is needed.

Collaborate 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 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.

Coordinate with the Arizona Game and Fish Department on management of native species within wilderness per the current memorandum of understanding.

Recommended Wilderness

Desired Conditions for Recommended Wilderness

SA-RWild-DC

- 2 Ecological systems are substantially free from the effects of modern civilization, and evidence of modern human control or manipulation is reduced.
- 3 Native species and unique features of the area are preserved.

Designated and Eligible Wild and Scenic Rivers

Fossil Creek Wild and Scenic River Segment 1 and Segment 2

Fossil Creek Wild and Scenic River was designated by Congress in spring 2009. This designation included approximately 17.3 miles from the confluence of Sand Rock and Calf Pen Canyons to the confluence with the Verde River. The river is managed jointly by the Tonto and Coconino NFs.

The Fossil Creek Wild and Scenic River is currently managed under interim direction until the comprehensive river management plan is completed under a separate decision.

Desired Conditions for Designated and Eligible Wild and Scenic Rivers

SA-WSR-DC

- 1 Designated and eligible wild and scenic river segments retain their free-flowing condition and their outstandingly remarkable values (that is, archaeological, scenic, fishery, wildlife, recreational, and botanical). Eligible classifications remain intact until further study is conducted or designation by Congress.
- 2 Activities in designated and eligible rivers and associated corridors are primarily nature-based, are consistent with the river's classification, and maintain the outstandingly remarkable values.
- 4 Educational materials and interpretation of designated and eligible wild and scenic rivers encourage widespread and common understanding of and support for values, philosophy, resources, and benefits. Consequently, residents and visitors not only appreciate and learn about wild and scenic rivers, but understand their role in protecting wild and scenic river values. This results in increased stewardship, ecological awareness, partnerships, and volunteerism.

Guidelines for Designated and Eligible Wild and Scenic Rivers

SA-WSR-G

- 1 Recreation and other activities at designated and eligible rivers and associated corridors should be managed to occur at appropriate locations and intensities to protect and enhance the free-flowing condition, and the outstandingly remarkable values, consistent with the classification.

Established and Proposed Research Natural Areas and Designated Botanical and Geological Areas

Desired Conditions for Established and Proposed Research Natural Areas and Designated Botanical and Geological Areas

SA-RNABotGeo-DC

Designated Botanical and Geological Areas

- 5 The unique characteristics of botanical and geological areas are protected and maintained. The inherent physical and biological processes of botanical areas and geological areas are sustained, and not negatively impacted from human activities or permitted uses. Natural processes continue to shape and define the unique features, characteristics, and formations of these areas.
- 6 Botanical areas and geological areas provide opportunities for study, monitoring, and interpretation.

Guidelines for Established and Proposed Research Natural Areas and Designated Botanical and Geological

Areas

SA-RNABotGeo-G

- 1 To support the area's purpose, human activities, permitted uses, and types and levels of access should be managed to protect the uniqueness and/or ecological condition of these special areas, and the values for which they were designated, established, or proposed.
- 3 Fire should be managed using minimal impact suppression tactics or other appropriate suppression tactics to protect the resources for which research natural areas, botanical areas, and geological areas were designated, established, or proposed.

Management Approaches for Established and Proposed Research Natural Areas and Botanical and Geological Areas

Encourage partnerships with interested parties to provide interpretation and monitoring for botanical areas and geological areas.

Inventoried Roadless Areas*General Description and Background for Inventoried Roadless Areas*

The U.S. Department of Agriculture adopted a final rule to establish prohibitions on road construction, road reconstruction, and timber harvesting in inventoried roadless areas on National Forest System lands, effective March 13, 2001 (36 CFR 294; Federal Register Vol. 66, No. 9, pp. 3244-3273).

There are nine inventoried roadless areas on the forest totaling about 50,571 acres (table 10).

Table A-3. Inventoried roadless areas on the Coconino NF

Name	Acres	Name	Acres
Cimarron Hills	5,300	Padre Canyon	9,424
Hackberry	17,873		

Desired Conditions for Inventoried Roadless Areas

SA-IRA-DC

- 1 The inventoried roadless areas identified in the 2001 Roadless Area Conservation Rule maintain their overall roadless character.

Standard for Inventoried Roadless Areas

SA-IRA-S

- 1 Projects and management activities shall be designed to maintain the overall roadless character of inventoried roadless areas.

Appendix B – Resource Protection Measures

Fossil Creek WSR EIS design features, best management practices (BMPs), and mitigation that are common to all action alternatives (B–F) are presented for each resource as resource protection measures.

Table B-1. Fossil Creek CRMP resource protection measures

Description	Comment or Purpose
FR 502 locations include the spring near Sally May Wash and along FR 708 on the Tonto NF spring snail site. Permeable road fill should be used to facilitate water movement across road surface. Drainage features on FR 708 from Fossil Springs trailhead to Fossil Creek should consider any of the following improvements, water bars, rolling dips, culverts, properly placed outsloped or insloped roads with outlets draining water across adequate filter strips. FR 502 location with gabion baskets should consider similar drainage improvements or culverts to divert water and sediment before depositing at gabion basket exit points and fortification of gabion baskets.	To minimize sediment delivery into Fossil Creek. To restore and protect spring riparian function and spring snail habitat.
Determine potential occurrences and habitat of Southwestern Region sensitive plants and known invasive species in proposed activity areas when planning for implementation of any site disturbing project. Identify potential species and survey the area to be treated before implementation.	Complies with FSM direction 2670 and 2900. Manual direction (FSM 2670.5(19)) emphasizes that management actions should avoid or minimize impacts to sensitive species.
Mitigate negative effects from management actions on Southwestern Region sensitive plants during design and implementation.	Complies with FSM direction, minimizes impacts to Southwestern Region sensitive plants.
Prohibit road and trail construction/ reconstruction within populations of Southwestern Region sensitive plants and promote road and trail decommissioning in potential habitat.	Eliminates direct loss of plants.
Survey springs for Southwestern Region sensitive plants and springsnails before implementation and identify locations. Inform the forest botanist if new locations are found and mitigate effects to plants and populations. Mitigations include avoiding plants, altering designs, or including plants in enclosures. Incorporates buffer strips along drainages	Springs provide unique habitats for many rare and endemic species. Protects populations and habitat of Southwestern Region sensitive plants.
Follow current guidance for invasive weed management, currently contained in appendix B of the “Final Environmental Impact Statement for Integrated Treatment of Noxious or Invasive Weeds, Coconino, Kaibab, and Prescott NFs within Coconino, Gila, Mojave, and Yavapai Counties, Arizona” including: (1) surveying the treatment area and evaluating weeds present before implementation; avoiding or removing sources of weed seed and propagules to prevent new weed infestations and the spread of existing weeds; (2) treating weed infestations within project area before implementation; (3) managing prescribed fires as an aid to control existing weed infestations and to prevent the spread of existing weeds; and (4) monitoring all disturbed sites regularly for invasive weeds and control noxious or invasive weeds.	Complies with FSM 2900. Provides guidance and mitigation for noxious or invasive weeds and complies with amendment 20 of the Coconino NF forest plan. Complies with the record of decision and Appendix C of the EA for Integrated Treatment of Noxious or Invasive Plants on the Tonto NF.
Control noxious or invasive weeds and treat weed infestations as needed to minimize impacts to other ORVs, especially before implementing ground-disturbing actions.	Complies with FSM 2900 Amendment 20 of the Coconino National Forest Plan. Complies with the record of decision and Appendix C of the EA for Integrated Treatment of Noxious or Invasive Plants on the Tonto NF.
Prevent spread of potential and existing noxious or invasive weeds by vehicles used in ground disturbing activities by washing vehicles and equipment prior to entering the project area and when moving from one infested area to another.	Complies with FSM 2900. Mitigates effects of management actions on existing and potential noxious or invasive weed infestations, Forest plan direction is complementary to watershed best management practices.

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Description	Comment or Purpose
Monitor the effects of project activities on Region 3 sensitive plants after treatments are completed.	Provides opportunities to obtain knowledge on local species that are often poorly understood. Allows for adaptive management in future projects.
Incorporate surveys for rare and endemic plants into surveys for Region 3 sensitive plants and/or noxious or invasive weeds prior to implementation. Survey needs will be dependent on known or potential occurrences in the treatment areas.	Addresses the desired conditions for rare or endemic species in the Kaibab NF Plan (2014) and the Coconino NF plan (in revision).
Improve road and natural spring drainage at two springs where forest roads interfere with riparian functions. Road improvements and repairs on the 502 and 708 road are needed to protect and enhance the springs that are draining across these roads. Permeable road fill or other pertinent BMP's need to be applied to improve the condition of these springs while still providing for a stable and safe road for travel. One spring is located above FR 502 near Sally May Wash north of Stehr Lake at UTM NAD83 coordinates of 443766 3807169. The other spring is located above FR 708 at UTM NAD 443766 3807169. The persistence of the 502 spring needs to be monitored prior to implementing road work to ensure the need.	To improve riparian spring conditions and to restore and protect spring snail habitat.
Site rehabilitation on riparian sites for stream channel and road reconstruction projects where ground disturbance occurs: seed at 5 pounds per acre with certified weed-free native seed mix to rehabilitate the site and minimize impacts of noxious weeds. Potential vegetation for individual sites should utilize the Coconino NFs TES to identify species to be utilized. Where feasible, protect site with a variety of methods.	To comply with State and Federal water quality standards by minimizing soil erosion through the stabilizing influence of vegetation ground cover. Minimize noxious weed spread.
Identify locations where improved drainage on FR 502 and 708 are necessary. FR 502 locations include the spring near Sally May Wash and along FR 708 on the Tonto National Forest spring snail site. Permeable road fill should be used to facilitate water movement across road surface. Drainage features on FR 709 from Fossil Spring's trailhead to Fossil Creek should consider any of the following improvements, water bars, rolling dips, culverts, properly placed out sloped or in sloped roads with outlets draining water across adequate filter strips. FR 502 location with gabion baskets should consider similar drainage improvements or culverts to divert water and sediment before depositing at gabion basket exit points and fortification of gabion baskets.	To minimize sediment delivery into Fossil Creek. To restore and protect spring riparian function and spring snail habitat.
Road maintenance and non-emergency construction activities involving loud heavy machinery or other loud activities (e.g. blasting) occurring within the Fossil Creek WSR corridor will occur only between Sept 1 and March 15 to avoid the breeding season for nesting birds.	
Activities in the high, very high, and extremely high range (listed at the end of this appendix) will not occur during the critical periods.	
Incorporate weed prevention and control into project layout, design, alternative evaluation, and project decisions. Avoid or remove sources of weed seed and propagules to prevent new weed infestations and the spread of existing weeds.	
To benefit pollinators, use only local native seeds in restoration, rehabilitation and revegetation efforts.	
Assure continuity of nectar and pollen resources when pollinators are active, especially from spring to late summer.	
Increase abundance and diversity of wild flowers to improve pollinator diversity.	
Ensure that pollinator nesting habitat is in close proximity (500-800 m; 0.3-0.5 mi) to foraging habitat.	
Identify and remove invasive species.	
Manage wildlife openings to improve and sustain pollinator habitat	

Description	Comment or Purpose
Time prescribed burns when bumble bees are dormant, if possible. When not possible, stagger treatment areas to ensure that some flowers are always available.	
Incorporate bat roosting specifications into designs for new bridge construction.	

Table B-2. Typical Noise Levels for Most Equipment Types at 50 feet (If not on list, must look up)

Equipment	Decibel Range (dB)	Relative Noise Level (see ranking below)
Pneumatic riveter	125 @ 4'	Extreme
Sandblasting, loud rock concert	115	Extreme
Power saw at 3'	110dB @ 3'	Extreme
Explosives	94 @ 50' – 145 @ 330'	Extreme
Helicopter	77 @ 800 ft – 106 @ 100 ft	Extreme
Pneumatic tools, jackhammers, & pile driver	101-110	Very High
Road grader	83 @ 50'	
Rock drill	85 - 98 @ 50'	Very High
Heavy Trucks	90-95	Very High
Jake Brake on Truck	110 @ 8'	High
Jackhammer	74 (when muffled -89 @ 50'	High
Dozer	84-88 @ 50'	High
Front-end Loader	80-87 @ 50'	High
Crane	85-88 @ 50'	High
Hammer Hoe	85-90 @ 50'	High
Excavator	81 @ 50'	High
Pumps, generators, compressors	81-87	Medium
Chainsaw	75-86	Medium
Road Grader	83-85 @ 50'	Medium
Concrete Truck	81-85 @ 50'	Medium
Concrete Mixer	80 @ 50'	Medium
Dump Truck	84 @ 50'	Medium
Crane	81 @ 50'	Medium
Backhoe	80-84 @ 50'	Medium
Roller	74-80 @ 50'	Medium
Auger Drill Rig	84 @ 50'	Medium

Note that for humans, pain begins at 125 dB, short term exposure can cause permanent damage at 140 dB, death of hearing tissue occurs at 180 dB and the loudest sound possible is 194dB.

Noise Level Ranking

Zero: < 45 dBA

Very low: 46-65 dBA

Low: 66-76 dBA

Medium: 77-87 dBA

High: 88-95 dBA

Very High: 96-108 dBA

Extreme: >108 dBA

Appendix C: Fossil Corridor Access Database Reports

Plants of the Greater Fossil Creek Area

Category	Family	Scientific Name	Common Name	Growth Habit
Fern				
	<u>Dennstaedtiaceae</u>	<u>Bracken Fern family</u>		
		<i>Pteridium aquilinum</i>	western brackenfern	Forb/herb
	<u>Pteridaceae</u>	<u>Maidenhair Fern family</u>		
		<i>Adiantum capillus-veneris</i>	common maidenhair	Forb/herb
		<i>Astrolepis sinuata</i>	wavy scaly cloakfern	Forb/herb
		<i>Cheilanthes</i>	lipfern	
		<i>Pellaea truncata</i>	spiny cliffbrake	Forb/herb
Monocot				
	<u>Agavaceae</u>	<u>Century-plant family</u>		
		<i>Agave chrysantha</i>	goldenflower century plant	Subshrub, Shrub,
		<i>Agave parryi</i>	Parry's agave	Forb/herb, Subshrub,
		<i>Yucca angustissima</i>	narrowleaf yucca	Shrub, Forb/herb,
		<i>Yucca baccata</i>	banana yucca	Subshrub, Forb/herb,
	<u>Iridaceae</u>	<u>Iris family</u>		
		<i>Iris</i>	iris	
		<i>Iris missouriensis</i>	Rocky Mountain iris	Forb/herb
	<u>Juncaceae</u>	<u>Rush family</u>		
		<i>Juncus</i>	rush	
		<i>Juncus torreyi</i>	Torrey's rush	Graminoid
	<u>Liliaceae</u>	<u>Lily family</u>		
		<i>Nolina microcarpa</i>	sacahuista	Subshrub, Shrub
	<u>Orchidaceae</u>	<u>Orchid family</u>		
		<i>Epipactis gigantea</i>	stream orchid	Forb/herb
	<u>Poaceae</u>	<u>Grass family</u>		
		<i>Aegilops cylindrica</i>	jointed goatgrass	Graminoid
		<i>Arundo donax</i>	giant reed	Subshrub, Shrub,
		<i>Avena fatua</i>	wild oat	Graminoid
		<i>Bromus madritensis</i>	compact brome	Graminoid
		<i>Bromus tectorum</i>	cheatgrass	Graminoid
		<i>Cynodon dactylon</i>	Bermudagrass	Graminoid

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<i>Elymus elymoides</i>	squirreltail	Graminoid
<i>Elymus glaucus</i>	blue wildrye	Graminoid
<i>Eragrostis intermedia</i>	plains lovegrass	Graminoid
<i>Eragrostis lehmanniana</i>	Lehmann lovegrass	Graminoid
<i>Hilaria belangeri</i>	curly-mesquite	Graminoid
<i>Leptochloa dubia</i>	green sprangletop	Graminoid
<i>Muhlenbergia emersleyi</i>	bullgrass	Graminoid
<i>Muhlenbergia porteri</i>	bush muhly	Graminoid
<i>Muhlenbergia rigens</i>	deergrass	Graminoid

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Category	Family	Scientific Name	Common Name	Growth Habit
		<i>Pascopyrum smithii</i>	western wheatgrass	Graminoid
		<i>Phalaris minor</i>	littleseed canarygrass	Graminoid
		<i>Poa fendleriana</i>	muttongrass	Graminoid
		<i>Polypogon monspeliensis</i>	annual rabbitsfoot grass	Graminoid
		<i>Polypogon viridis</i>	beardless rabbitsfoot grass	Graminoid
		<i>Sorghum halepense</i>	Johnsongrass	Graminoid
		<i>Sporobolus cryptandrus</i>	sand dropseed	Graminoid
	<u>Typhaceae</u>	<u>Cat-tail family</u>		
		<i>Typha domingensis</i>	southern cattail	Forb/herb
		<i>Typha latifolia</i>	broadleaf cattail	Forb/herb
Dicot				
	<u>Acanthaceae</u>	<u>Acanthus family</u>		
		<i>Anisacanthus thurberi</i>	Thurber's desert honeysuckle	Shrub
	<u>Aceraceae</u>	<u>Maple family</u>		
		<i>Acer negundo</i>	boxelder	Tree
	<u>Anacardiaceae</u>	<u>Sumac family</u>		
		<i>Rhus glabra</i>	smooth sumac	Tree, Shrub
		<i>Rhus ovata</i>	sugar sumac	Tree, Shrub
		<i>Rhus trilobata</i>	skunkbush sumac	Shrub
		<i>Toxicodendron radicans</i>	eastern poison ivy	Shrub, Subshrub, Vine
	<u>Apiaceae</u>	<u>Carrot family</u>		
		<i>Conium maculatum</i>	poison hemlock	Forb/herb
		<i>Daucus carota</i>	Queen Anne's lace	Forb/herb
	<u>Apocynaceae</u>	<u>Dogbane family</u>		
		<i>Vinca major</i>	bigleaf periwinkle	Vine, Forb/herb
	<u>Asclepiadaceae</u>	<u>Milkweed family</u>		
		<i>Matelea producta</i>	Texas milkvine	Vine
	<u>Asteraceae</u>	<u>Aster family</u>		
		<i>Acourtia wrightii</i>	brownfoot	Forb/herb
		<i>Artemisia ludoviciana</i>	white sagebrush	Subshrub, Forb/herb
		<i>Baccharis brachyphylla</i>	shortleaf baccharis	Subshrub, Shrub
		<i>Baccharis sarothroides</i>	desertbroom	Shrub
		<i>Baileya multiradiata</i>	desert marigold	Forb/herb
		<i>Brickellia grandiflora</i>	tasselflower brickellbush	Subshrub, Forb/herb
		<i>Centaurea solstitialis</i>	yellow star-thistle	Forb/herb
		<i>Chaetopappa ericoides</i>	rose heath	Subshrub, Forb/herb

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<i>Cirsium neomexicanum</i>	New Mexico thistle	Forb/herb
<i>Cirsium vulgare</i>	bull thistle	Forb/herb
<i>Erigeron divergens</i>	spreading fleabane	Forb/herb
<i>Erigeron flagellaris</i>	trailing fleabane	Forb/herb
<i>Gaillardia pulchella</i>	Indian blanket	Forb/herb, Subshrub
<i>Gutierrezia microcephala</i>	threadleaf snakeweed	Subshrub, Shrub

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Category	Family	Scientific Name	Common Name	Growth Habit
		<i>Helianthus annuus</i>	common sunflower	Forb/herb
		<i>Lactuca graminifolia</i>	grassleaf lettuce	Forb/herb
		<i>Lactuca serriola</i>	prickly lettuce	Forb/herb
		<i>Machaeranthera canescens</i>	hoary tansyaster	Forb/herb
		<i>Machaeranthera gracilis</i>	slender goldenweed	Forb/herb
		<i>Machaeranthera tanacetifolia</i>	tanseyleaf tansyaster	Forb/herb
		<i>Melampodium leucanthum</i>	plains blackfoot	Subshrub, Forb/herb
		<i>Parthenium incanum</i>	mariola	Shrub
		<i>Perityle ciliata</i>	fringed rockdaisy	Subshrub, Forb/herb
		<i>Sonchus asper</i>	spiny sowthistle	Forb/herb
		<i>Sonchus oleraceus</i>	common sowthistle	Forb/herb
		<i>Stephanomeria pauciflora</i>	brownplume wirelettuce	Subshrub, Forb/herb
		<i>Taraxacum officinale</i>	common dandelion	Forb/herb
		<i>Tragopogon dubius</i>	yellow salsify	Forb/herb
<u>Berberidaceae</u>	<u>Barberry family</u>			
		<i>Mahonia trifoliolata</i>	algerita	Shrub
<u>Betulaceae</u>	<u>Birch family</u>			
		<i>Alnus oblongifolia</i>	Arizona alder	Tree
<u>Boraginaceae</u>	<u>Borage family</u>			
		<i>Cryptantha barbiger</i>	bearded cryptantha	Forb/herb
		<i>Lithospermum incisum</i>	narrowleaf stoneseed	Forb/herb
<u>Brassicaceae</u>	<u>Mustard family</u>			
		<i>Arabis perennans</i>	perennial rockcress	Subshrub, Forb/herb
		<i>Capsella bursa-pastoris</i>	shepherd's purse	Forb/herb
		<i>Chorispora tenella</i>	crossflower	Forb/herb
		<i>Descurainia pinnata</i>	western tansymustard	Forb/herb
		<i>Lepidium lasiocarpum</i>	shaggyfruit pepperweed	Forb/herb
		<i>Nasturtium officinale</i>	watercress	Forb/herb
		<i>Sisymbrium altissimum</i>	tall tumbledustard	Forb/herb
		<i>Sisymbrium irio</i>	London rocket	Forb/herb
<u>Cactaceae</u>	<u>Cactus family</u>			
		<i>Echinocereus coccineus</i>	scarlet hedgehog cactus	Shrub
		<i>Echinocereus fasciculatus</i>	pinkflower hedgehog cactus	Shrub
		<i>Echinocereus triglochidiatus</i>	kingcup cactus	Shrub
		<i>Opuntia</i>	pricklypear	
		<i>Opuntia chlorotica</i>	dollarjoint pricklypear	Shrub

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	<i>Opuntia engelmannii</i>	cactus apple	Shrub
	<i>Opuntia phaeacantha</i>	tulip pricklypear	Shrub
<u>Campanulaceae</u>	<u>Bellflower family</u>		
	<i>Lobelia cardinalis</i>	cardinalflower	Forb/herb
<u>Capparaceae</u>	<u>Caper family</u>		
	<i>Cleome lutea</i>	yellow spiderflower	Forb/herb

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Category	Family	Scientific Name	Common Name	Growth Habit
	<i>Koeberlinia spinosa</i>	crown of thorns	Tree, Shrub	
<u>Caprifoliaceae</u>	<u>Honeysuckle family</u>			
	<i>Lonicera arizonica</i>	Arizona honeysuckle	Vine, Shrub	
<u>Caryophyllaceae</u>	<u>Pink family</u>			
	<i>Silene antirrhina</i>	sleepy silene	Forb/herb	
<u>Celastraceae</u>	<u>Bittersweet family</u>			
	<i>Canotia holacantha</i>	crucifixion thorn	Tree, Shrub	
<u>Chenopodiaceae</u>	<u>Goosefoot family</u>			
	<i>Atriplex canescens</i>	fourwing saltbush	Shrub	
	<i>Chenopodium fremontii</i>	Fremont's goosefoot	Forb/herb	
<u>Convolvulaceae</u>	<u>Morning-glory family</u>			
	<i>Convolvulus equitans</i>	Texas bindweed	Vine, Forb/herb	
<u>Cuscutaceae</u>	<u>Dodder family</u>			
	<i>Cuscuta indecora</i>	bigseed alfalfa dodder	Vine, Forb/herb	
<u>Ericaceae</u>	<u>Heath family</u>			
	<i>Arctostaphylos pringlei</i>	Pringle manzanita	Tree, Shrub	
	<i>Arctostaphylos pungens</i>	pointleaf manzanita	Subshrub, Shrub	
<u>Euphorbiaceae</u>	<u>Spurge family</u>			
	<i>Chamaesyce polycarpa</i>	smallseed sandmat	Forb/herb	
	<i>Tragia ramosa</i>	branched noseburn	Shrub, Subshrub, Vine	
<u>Fabaceae</u>	<u>Pea family</u>			
	<i>Caesalpinia gilliesii</i>	bird-of-paradise shrub	Tree, Shrub, Vine	
	<i>Calliandra humilis</i>	dwarf stickpea	Subshrub, Forb/herb	
	<i>Dalea albiflora</i>	whiteflower prairie clover	Subshrub, Forb/herb	
	<i>Dalea formosa</i>	featherplume	Subshrub, Shrub	
	<i>Gleditsia triacanthos</i>	honeylocust	Shrub, Tree	
	<i>Lathyrus latifolius</i>	perennial pea	Forb/herb, Vine	
	<i>Lotus humistratus</i>	foothill deervetch	Forb/herb	
	<i>Lotus rigidus</i>	shrubby deervetch	Subshrub, Forb/herb	
	<i>Lotus wrightii</i>	Wright's deervetch	Forb/herb	
	<i>Medicago polymorpha</i>	burclover	Forb/herb	
	<i>Melilotus indicus</i>	annual yellow sweetclover	Forb/herb	
	<i>Melilotus officinalis</i>	sweetclover	Forb/herb	
	<i>Phaseolus angustissimus</i>	slimleaf bean	Vine, Forb/herb	
	<i>Prosopis glandulosa</i>	honey mesquite	Shrub, Tree	
	<i>Prosopis velutina</i>	velvet mesquite	Tree, Shrub	

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<u>Fagaceae</u>	<i>Psoraleidium tenuiflorum</i>	slimflower scurfpea	Forb/herb
	<i>Robinia neomexicana</i>	New Mexico locust	Tree, Shrub
	<u>Beech family</u>		
	<i>Quercus arizonica</i>	Arizona white oak	Shrub, Tree
	<i>Quercus emoryi</i>	Emory oak	Tree, Shrub
	<i>Quercus gambelii</i>	Gambel oak	Shrub, Tree

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Category	Family	Scientific Name	Common Name	Growth Habit
		<i>Quercus palmeri</i>	Palmer oak	Shrub, Tree
		<i>Quercus turbinella</i>	Sonoran scrub oak	Shrub, Tree
<u>Fouquieriaceae</u>	<u>Ocotillo family</u>			
		<i>Fouquieria splendens</i>	ocotillo	Shrub
<u>Fumariaceae</u>	<u>Fumitory family</u>			
		<i>Corydalis aurea</i>	scrambled eggs	Forb/herb
<u>Garryaceae</u>	<u>Silk Tassel family</u>			
		<i>Garrya flavescens</i>	ashy silktassel	Tree, Shrub
		<i>Garrya wrightii</i>	Wright's silktassel	Shrub, Tree
<u>Geraniaceae</u>	<u>Geranium family</u>			
		<i>Erodium cicutarium</i>	redstem stork's bill	Forb/herb
		<i>Geranium caespitosum</i>	pineywoods geranium	Subshrub, Forb/herb
<u>Grossulariaceae</u>	<u>Currant family</u>			
		<i>Ribes aureum</i>	golden currant	Shrub
<u>Hydrangeaceae</u>	<u>Hydrangea family</u>			
		<i>Fendlera rupicola</i>	cliff fendlerbush	Shrub
<u>Hydrophyllaceae</u>	<u>Waterleaf family</u>			
		<i>Eriodictyon angustifolium</i>	narrowleaf yerba santa	Shrub
		<i>Phacelia cryptantha</i>	hiddenflower phacelia	Forb/herb
<u>Juglandaceae</u>	<u>Walnut family</u>			
		<i>Juglans major</i>	Arizona walnut	Tree
<u>Lamiaceae</u>	<u>Mint family</u>			
		<i>Hedeoma drummondii</i>	Drummond's false pennyroyal	Subshrub, Forb/herb
		<i>Lamium amplexicaule</i>	henbit deadnettle	Forb/herb
		<i>Marrubium vulgare</i>	horehound	Subshrub, Forb/herb
		<i>Prunella vulgaris</i>	common selfheal	Forb/herb
<u>Loasaceae</u>	<u>Loasa family</u>			
		<i>Mentzelia pumila</i>	dwarf mentzelia	Forb/herb
<u>Malvaceae</u>	<u>Mallow family</u>			
		<i>Abutilon incanum</i>	Indian Mallow	Subshrub, Forb/herb
		<i>Malva parviflora</i>	cheeseweed mallow	Forb/herb
		<i>Sphaeralcea fendleri</i>	Fendler's globemallow	Subshrub, Forb/herb
		<i>Sphaeralcea laxa</i>	caliche globemallow	Subshrub, Forb/herb
<u>Moraceae</u>	<u>Mulberry family</u>			
		<i>Morus microphylla</i>	Texas mulberry	Tree, Shrub
<u>Nyctaginaceae</u>	<u>Four o'clock family</u>			

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<u>Oleaceae</u>	<i>Allionia incarnata</i>	trailing windmills	Forb/herb
	<i>Mirabilis multiflora</i>	Colorado four o'clock	Forb/herb, Subshrub
	<u>Olive family</u>		
	<i>Forestiera pubescens</i>	stretchberry	Shrub
	<i>Fraxinus anomala</i>	singleleaf ash	Tree, Shrub
	<i>Fraxinus velutina</i>	velvet ash	Tree

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Category	Family	Scientific Name	Common Name	Growth Habit
	<i>Menodora scabra</i>	rough menodora	Subshrub, Forb/herb	
<u>Onagraceae</u>	<u>Evening Primrose family</u>			
	<i>Epilobium brachycarpum</i>	tall annual willowherb	Forb/herb	
<u>Papaveraceae</u>	<u>Poppy family</u>			
	<i>Argemone pleiacantha</i>	southwestern pricklypoppy	Forb/herb	
<u>Plantaginaceae</u>	<u>Plantain family</u>			
	<i>Plantago major</i>	common plantain	Forb/herb	
<u>Platanaceae</u>	<u>Plane-tree family</u>			
	<i>Platanus wrightii</i>	Arizona sycamore	Tree	
<u>Polemoniaceae</u>	<u>Phlox family</u>			
	<i>Eriastrum diffusum</i>	miniature woollystar	Forb/herb	
	<i>Gilia flavocincta</i>	lesser yellowthroat gilia	Forb/herb	
	<i>Ipomopsis aggregata</i>	scarlet gilia	Forb/herb	
<u>Polygonaceae</u>	<u>Buckwheat family</u>			
	<i>Eriogonum abertianum</i>	Abert's buckwheat	Forb/herb	
	<i>Eriogonum wrightii</i>	bastardsage	Subshrub, Shrub,	
	<i>Rumex crispus</i>	curly dock	Forb/herb	
<u>Portulacaceae</u>	<u>Purslane family</u>			
	<i>Claytonia perfoliata</i>	miner's lettuce	Forb/herb	
	<i>Montia chamissoi</i>	water minerslettuce	Forb/herb	
<u>Ranunculaceae</u>	<u>Buttercup family</u>			
	<i>Anemone tuberosa</i>	tuber anemone	Forb/herb	
	<i>Aquilegia chrysantha</i>	golden columbine	Forb/herb	
	<i>Clematis ligusticifolia</i>	western white clematis	Vine	
	<i>Delphinium</i>	larkspur		
	<i>Delphinium scaposum</i>	tall mountain larkspur	Forb/herb	
	<i>Thalictrum fendleri</i>	Fendler's meadow-rue	Forb/herb	
<u>Rhamnaceae</u>	<u>Buckthorn family</u>			
	<i>Ceanothus</i>	ceanothus		
	<i>Ceanothus greggii</i>	desert ceanothus	Shrub	
	<i>Ceanothus integerrimus</i>	deerbrush	Shrub	
	<i>Rhamnus crocea</i>	redberry buckthorn	Shrub, Tree	
	<i>Ziziphus obtusifolia</i>	lotebush	Tree, Shrub	
<u>Rosaceae</u>	<u>Rose family</u>			
	<i>Cercocarpus montanus</i>	alderleaf mountain mahogany	Tree, Shrub	
	<i>Prunus virginiana</i>	chokecherry	Tree, Shrub	

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	<i>Purshia stansburiana</i>	Stansbury cliffrose	Tree, Shrub
	<i>Rubus arizonensis</i>	Arizona dewberry	Subshrub
<u>Rubiaceae</u>	<u>Madder family</u>		
	<i>Galium aparine</i>	stickywilly	Forb/herb, Vine
	<i>Galium stellatum</i>	starry bedstraw	Subshrub, Forb/herb
<u>Rutaceae</u>	<u>Rue family</u>		

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Category	Family	Scientific Name	Common Name	Growth Habit
	<i>Ptelea trifoliata</i>	common hoptree	Tree, Shrub	
<u>Salicaceae</u>	<u>Willow family</u>			
	<i>Populus fremontii</i>	Fremont cottonwood	Tree	
	<i>Salix bonplandiana</i>	Bonpland willow	Tree	
	<i>Salix exigua</i>	narrowleaf willow	Tree, Shrub	
	<i>Salix gooddingii</i>	Goodding's willow	Tree	
	<i>Salix laevigata</i>	red willow	Shrub	
<u>Santalaceae</u>	<u>Sandalwood family</u>			
	<i>Comandra umbellata</i>	bastard toadflax	Subshrub, Forb/herb	
<u>Scrophulariaceae</u>	<u>Figwort family</u>			
	<i>Cordylanthus laxiflorus</i>	nodding bird's-beak	Forb/herb	
	<i>Maurandella antirrhiniflora</i>	roving sailor	Vine, Forb/herb	
	<i>Mimulus guttatus</i>	seep monkeyflower	Forb/herb	
	<i>Mimulus rubellus</i>	little redstem monkeyflower	Forb/herb	
	<i>Verbascum thapsus</i>	common mullein	Forb/herb	
<u>Simmondsiaceae</u>	<u>Jojoba family</u>			
	<i>Simmondsia chinensis</i>	jojoba	Shrub	
<u>Solanaceae</u>	<u>Potato family</u>			
	<i>Datura wrightii</i>	sacred thorn-apple	Forb/herb, Subshrub	
	<i>Lycium pallidum</i>	pale desert-thorn	Shrub	
	<i>Solanum elaeagnifolium</i>	silverleaf nightshade	Subshrub, Forb/herb	
<u>Tamaricaceae</u>	<u>Tamarix family</u>			
	<i>Tamarix ramosissima</i>	saltcedar	Tree, Shrub	
<u>Ulmaceae</u>	<u>Elm family</u>			
	<i>Ulmus pumila</i>	Siberian elm	Tree, Shrub	
<u>Urticaceae</u>	<u>Nettle family</u>			
	<i>Parietaria hespera</i>	rillita pellitory	Forb/herb	
<u>Verbenaceae</u>	<u>Verbena family</u>			
	<i>Aloysia wrightii</i>	Wright's beebrush	Shrub	
	<i>Verbena neomexicana</i>	hillside vervain	Forb/herb	
<u>Violaceae</u>	<u>Violet family</u>			
	<i>Viola nephrophylla</i>	northern bog violet	Forb/herb	
<u>Viscaceae</u>	<u>Christmas Mistletoe family</u>			
	<i>Phoradendron coryae</i>	Cory's mistletoe	Subshrub, Shrub	
	<i>Phoradendron juniperinum</i>	juniper mistletoe	Subshrub, Shrub	
<u>Vitaceae</u>	<u>Grape family</u>			

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<i>Parthenocissus vitacea</i>	woodbine	Vine
<i>Vitis arizonica</i>	canyon grape	Vine

Birds of Greater Fossil Creek Area

Observation Type - Actual

Ducks, geese and waterfowl

Wood Duck
Mallard
Cinnamon Teal
Lesser Scaup

New World quail

Gambel's Quail

Grebes

Eared grebe

Hérons, egrets, and bitterns

Great Blue Heron

New World vultures

Turkey Vulture

Osprey

Osprey

Hawks, kites, and eagles

Golden Eagle
Cooper's Hawk
Common Black Hawk
Zone-tailed Hawk
Red-tailed Hawk
Rough-legged Hawk

Rails, gallinules and coots

American coot

Plovers

killdeer

Pigeons and doves

Rock Pigeon
Eurasian Collared-Dove
Common Ground-Dove
White-winged Dove
Mourning Dove

Cuckoos, roadrunners and anis

Greater Roadrunner

Swifts

White-throated Swift

Hummingbirds

Black-chinned Hummingbird
Anna's Hummingbird
Costa's Hummingbird
Broad-tailed Hummingbird
Rufous Hummingbird

Kingfishers

Belted Kingfisher

Woodpeckers

Acorn Woodpecker
Gila Woodpecker
Yellow-bellied sapsucker
Red-naped Sapsucker
Ladder-backed Woodpecker
Hairy Woodpecker
Northern Flicker

Caracaras and falcons

American Kestrel
Peregrine Falcon

Tyrant flycatchers

Olive-sided Flycatcher
Western Wood-Pewee
Hammond's Flycatcher
Gray Flycatcher
Cordilleran Flycatcher
Black Phoebe
Say's Phoebe
Vermilion Flycatcher
Ash-throated Flycatcher
Brown-crested Flycatcher
Sulphur-bellied Flycatcher
Cassin's Kingbird
Western Kingbird

Hutton's Vireo

Plumbeous Vireo

Warbling Vireo

Jays,crows, magpies and ravens

Pinyon Jay
Steller's Jay
Woodhouse's Scrub-Jay
Mexican Jay
Common Raven

Swallows and martins

Northern rough-winged Swallow
Tree Swallow
Violet-green Swallow
Cliff Swallow

Chickadees and titmice

Mountain Chickadee
Bridled Titmouse
Juniper Titmouse

Penduline tits

Verdin

Long-tailed tits

Bushtit

Nuthatches

White-breasted Nuthatch
Pygmy Nuthatch

Treecreepers

Brown Creeper

Wrens

Rock Wren
Canyon Wren
House Wren
Bewick's Wren
Cactus Wren

Gnatcatchers

Blue-gray Gnatcatcher

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Yellow-billed Cuckoo

Typical owls

Western Screech-Owl

Great Horned Owl

Northern saw-whet Owl

Shrikes

Loggerhead Shrike

Vireos

Bell's Vireo

Gray Vireo

Dipper

American Dipper

Kinglets

Ruby-crowned Kinglet

Thrushes

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Western Bluebird
 Mountain Bluebird
 Townsend's Solitaire
 Hermit Thrush
 American Robin
Mockingbirds and thrashers
 Crissal Thrasher
 Sage Thrasher
 Northern Mockingbird
Starlings
 European Starling
Waxwing
 Cedar Waxwing
Silky-flycatchers
 Phainopepla
Wood-warblers
 Orange-crowned Warbler
 Lucy's Warbler
 Virginia's Warbler
 MacGillivray's Warbler
 Common Yellowthroat
 Yellow Warbler
 Yellow-rumped Warbler
 Black-throated Gray Warbler
 Wilson's Warbler
 Red-faced Warbler
 Painted Redstart
Yellow-breasted chat
 Yellow-breasted Chat
New World sparrows
 Chipping Sparrow
 Black-chinned Sparrow
 Black-throated Sparrow
 Lark Sparrow
 Dark-eyed Junco
 White-crowned Sparrow
 Song Sparrow

Green-tailed Towhee
 Spotted Towhee
Cardinals and allies
 Hepatic Tanager
 Summer Tanager
 Western Tanager
 Northern Cardinal
 Pyrrhuloxia
 Black-headed Grosbeak
 Blue Grosbeak
 Lazuli Bunting
 Indigo bunting
Icterids
 Red-winged Blackbird
 Western meadowlark
 Great-tailed Grackle
 Bronzed Cowbird
 Brown-headed Cowbird
 Hooded Oriole
 Bullock's Oriole
 Scott's Oriole
Finches
 House Finch
 Cassin's Finch
 Pine Siskin
 Lesser Goldfinch
 American Goldfinch
Old World sparrows
 House Sparrow
Observation Type - Hypothetical
Ducks, geese and waterfowl
 Canada Goose
 Gadwall
 American wigeon
 Northern Shoveler
 Northern Pintail
 Green-winged Teal

Hooded Merganser
 Common Merganser
Pelicans
 American white pelican
Herons, egrets, and bitterns
 Great Egret
 Snowy egret
 Green Heron
 Black-crowned Night-Heron
Ibises and spoonbills
 White-faced Ibis
Hawks, kites, and eagles
 Northern Harrier
 Sharp-shinned Hawk
 Bald Eagle
 Swainson's Hawk
 Ferruginous Hawk
Sandpipers and allies
 Spotted Sandpiper
 Solitary Sandpiper
 Willet
Pigeons and doves
 Band-tailed Pigeon
Typical owls
 Northern Pygmy-Owl
Nightjars and allies
 Common Nighthawk
Caracaras and falcons
 Merlin
 Prairie Falcon
Tyrant flycatchers
 Greater Pewee
Swallows and martins
 Bank swallow
Nuthatches
 White-breasted Nuthatch
Wood-warblers

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Canyon Towhee
Abert's Towhee
Rufous-crowned Sparrow

Redhead
Ring-necked Duck
Common goldeneye

Townsend's Warbler
Hermit Warbler
New World sparrows

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Lincoln's Sparrow
Canyon Towhee

Mammals of Greater Fossil Creek

<u>Scientific Name</u>	<u>Common names</u>	<u>Order</u>	<u>Family</u>
<i>Antrozous pallidus</i>	Pallid Bat	Chiroptera	Vespertilionidae
<i>Corynorhinus townsendii</i>	Townsend's Big-eared bat	Chiroptera	Vespertilionidae
<i>Eptesicus fuscus</i>	Big Brown Bat	Chiroptera	Vespertilionidae
<i>Euderma maculatum</i>	Spotted Bat	Chiroptera	Vespertilionidae
<i>Lasionycteris noctivagans</i>	Silver-haired Bat	Chiroptera	Vespertilionidae
<i>Lasiurus cinereus</i>	Hoary Bat	Chiroptera	Vespertilionidae
<i>Myotis auriculus</i>	Southwestern Myotis	Chiroptera	Vespertilionidae
<i>Myotis californicus</i>	Californian Myotis	Chiroptera	Vespertilionidae
<i>Myotis ciliolabrum</i>	Western Small-footed Bat	Chiroptera	Vespertilionidae
<i>Myotis evotis</i>	Long-eared Myotis	Chiroptera	Vespertilionidae
<i>Myotis thysanodes</i>	Fringed Myotis	Chiroptera	Vespertilionidae
<i>Myotis velifer</i>	Cave Myotis	Chiroptera	Vespertilionidae
<i>Myotis volans</i>	Long-legged Myotis	Chiroptera	Vespertilionidae
<i>Myotis yumanensis</i>	Yuma Myotis	Chiroptera	Vespertilionidae
<i>Parastrellus hesperus</i>	Canyon Bat	Chiroptera	Vespertilionidae
<i>Nyctinomops femorosaccus</i>	Pocketed Free-tailed Bat	Chiroptera	Molossidae
<i>Nyctinomops macrotis</i>	Big Free-tailed Bat	Chiroptera	Molossidae
<i>Tadarida brasiliensis</i>	Brazilian/Mexican Free-	Chiroptera	Molossidae
<i>Macrotus californicus</i>	Californian Leaf-nosed Bat	Chiroptera	Phyllostomidae
<i>Lepus californicus</i>	Black-tailed Jackrabbit	Lagomorpha	Leporidae
<i>Sylvilagus audubonii</i>	Desert Rabbit	Lagomorpha	Leporidae
<i>Ammospermophilus harrisi</i>	Harris' Antelope Ground	Rodentia	Sciuridae
<i>Thomomys umbrinus</i>	Southern Pocket Gopher	Rodentia	Geomyidae
<i>Peromyscus boylii</i>	Brush Deermouse	Rodentia	Cricetidae
<i>Peromyscus maniculatus</i>	North American Deermouse	Rodentia	Cricetidae
<i>Reithrodontomys megalotis</i>	Western Harvest Mouse	Rodentia	Cricetidae
<i>Erethizon dorsatum</i>	Common Porcupine	Rodentia	Erethizontidae

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<i>Canis latrans</i>	Eastern Coyote	Carnivora	Canidae
<i>Urocyon cinereoargenteus</i>	Gray Fox	Carnivora	Canidae
<i>Bassariscus astutus</i>	Ringtail	Carnivora	Procyonidae
<i>Procyon lotor</i>	Raccoon	Carnivora	Procyonidae
<i>Taxidea taxus</i>	American Badger	Carnivora	Mustelidae
<i>Mephitis mephitis</i>	Striped Skunk	Carnivora	Mephitidae

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<u>Scientific Name</u>	<u>Common names</u>	<u>Order</u>	<u>Family</u>
<i>Lynx rufus</i>	Bobcat	Carnivora	Felidae
<i>Pecari tajacu</i>	Javelina	Artiodactyla	Tayassuidae
<i>Odocoileus hemionus</i>	Mule Deer	Artiodactyla	Cervidae

Herps in the Greater Fossil Creek

Observation Type	Common Name	Observation Location	Observer
Actual	Arizona Black Rattlesnake	Fossil Creek Riparian	Agyagos
Actual	Black-necked garter snake	Fossil Creek Riparian	AZ Public Service Co.
Actual	black-necked gartersnake	Fossil Creek Riparian	Agyagos
Actual	Black-necked gartersnake	Fossil upstream large falls	Janie Agyagos et. al.
Actual	Bullsnake	Fossil Creek Riparian	E.L.Smith
Actual	Canyon tree frog	Fossil Creek Riparian	AgyagosOverby
Actual	Canyon tree frog	Fossil Creek Riparian	Agyagos
Actual	Canyon treefrog	FC above Irving Trailhead	Agyagos
Actual	Canyon treefrog	FC above Irving Trailhead	Agyagos
Actual	Canyon Treefrog	FC below sunfish barrier	Agyagos
Actual	Canyon Treefrog	Fossil @ Irving Trailhead	Janie Agyagos et. al.
Actual	Canyon Treefrog	Fossil above large falls	Janie Agyagos et. al.
Actual	Canyon Treefrog	Fossil above large falls	Janie Agyagos et. al.
Actual	Canyon Treefrog	Fossil above large falls	Janie Agyagos et. al.
Actual	Canyon Treefrog	Fossil below Irving	Janie Agyagos et. al.
Actual	Canyon Treefrog	Fossil below Irving	Janie Agyagos et. al.
Actual	Canyon Treefrog	Fossil below sunfish barrier	Janie Agyagos et. al.
Actual	Canyon Treefrog	Fossil below trail down to sunfish	Shaula Hedwall, Susi
Actual	Canyon treefrog	Fossil Creek @ Deadman Mesa	Agyagos, Loomis
Actual	Canyon Treefrog	Fossil Creek @ Forest Boundary	AGFD
Actual	Canyon Treefrog	Fossil Creek @ Forest Boundary	AGFD
Actual	Canyon treefrog	Fossil Creek above Springs	Agyagos, Sena, Cress
Actual	Canyon treefrog	Fossil Creek above waterfall	Agyagos, Sena, Cress
Actual	Canyon treefrog	Fossil Creek Riparian	Agyagos
Actual	Canyon treefrog	Fossil Creek Riparian	AZ Public Service Co.
Actual	Canyon Treefrog	Fossil Creek Riparian	AgyagosOverby
Actual	canyon treefrog	Fossil Creek Riparian	Agyagos

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Actual

Canyon Treefrog

Fossil Dam downstream to trail

Janie Agyagos et. al.

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Observation Type	Common Name	Observation Location	Observer
Actual	Canyon Treefrog	Fossil downstream dam	Janie Agyagos et. al.
Actual	Canyon Treefrog	Fossil from below dam to above	Janie Agyagos et. al.
Actual	Canyon Treefrog	Fossil Irving to large falls	Janie Agyagos et. al.
Actual	Canyon Treefrog	Fossil Irving trailhead up to large	Janie Agyagos et. al.
Actual	Canyon Treefrog	Fossil Springs Riparian	Janie Agyagos et. al.
Actual	Canyon Treefrog	Fossil Springs Riparian	Janie Agyagos et. al.
Actual	Canyon treefrog	Fossil Springs Riparian	Janie Agyagos
Actual	Canyon Treefrog	Fossil Springs Riparian	Janie Agyagos et. al.
Actual	Canyon Treefrog	Fossil Springs Riparian	Janie Agyagos et. al.
Actual	Canyon Treefrog	Fossil upstream large falls	Janie Agyagos et. al.
Actual	Canyon Treefrog	Fossil upstream of large falls	Janie Agyagos et. al.
Actual	Canyon Treefrog	Unnamed Spring	Ken Abbott
Actual	Canyon Treefrog	Unnamed Spring	Ken Abbott
Actual	Canyon treefrog	Upper Fossil Creek Intermittent	Janie Agyagos
Actual	Collared lizard	Fossil Creek Riparian	E.L.Smith
Actual	Eastern fence lizard	Fossil Creek Riparian	E.L.Smith
Actual	Eastern fence lizard	Fossil Creek Riparian	AZ Public Service Co.
Actual	Garter snake	Fossil Springs Riparian	Janie Agyagos
Actual	Gartersnake	Fossil below Irving	Janie Agyagos et. al.
Actual	Gartersnake	Fossil below sunfish barrier	Janie Agyagos et. al.
Actual	Gartersnake	Fossil Dam downstream to trail	Janie Agyagos et. al.
Actual	Gartersnake	Fossil upstream of large falls	Janie Agyagos et. al.
Actual	Gila monster	Barrier trail	Libby Langston
Actual	Gila Monster	Fossil Creek Riparian	Janie
Actual	Greater earless lizard	Fossil Creek Riparian	E.L.Smith
Actual	Greater earless lizard	Fossil Creek Upland	LoomisDeLuca
Actual	Leopard frog	Fossil Creek Riparian	E.L.Smith
Actual	Lowland leopard frog	FC above Irving Trailhead	Agyagos
Actual	Lowland leopard frog	Fossil above large falls	Janie Agyagos et. al.

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Actual

Lowland leopard frog

Fossil above large falls

Janie Agyagos et. al.

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Observation Type	Common Name	Observation Location	Observer
Actual	Lowland leopard frog	Fossil below dam	Janie Agyagos et. al.
Actual	Lowland leopard frog	Fossil below dam	Janie Agyagos et. al.
Actual	Lowland leopard frog	Fossil below sunfish barrier	Janie Agyagos et. al.
Actual	Lowland leopard frog	Fossil Below Sunfish barrier	Janie Agyagos et. al.
Actual	Lowland leopard frog	Fossil below trail down to sunfish	Shaula Hedwall, Susi
Actual	Lowland leopard frog	Fossil Creek above Springs	Agyagos, Sena, Cress
Actual	Lowland leopard frog	Fossil Creek above waterfall	Agyagos, Sena, Cress
Actual	Lowland leopard frog	Fossil Creek below sunfish barrier	Janie Agyagos et. al.
Actual	Lowland leopard frog	Fossil Creek below sunfish barrier	Allen Haden
Actual	lowland leopard frog	Fossil Creek Riparian	Agyagos
Actual	Lowland leopard frog	Fossil Creek Riparian	Agyagos
Actual	lowland leopard frog	Fossil Creek Riparian	Agyagos
Actual	Lowland leopard frog	Fossil Creek Riparian	AZ Public Service Co.
Actual	Lowland leopard frog	Fossil Dam downstream to trail	Janie Agyagos et. al.
Actual	Lowland leopard frog	Fossil downstream dam	Janie Agyagos et. al.
Actual	Lowland leopard frog	Fossil from below dam to above	Janie Agyagos et. al.
Actual	Lowland leopard frog	Fossil Irving to large falls	Janie Agyagos et. al.
Actual	Lowland leopard frog	Fossil Irving trailhead up to large	Janie Agyagos et. al.
Actual	Lowland leopard frog	Fossil Springs Riparian	Janie Agyagos et. al.
Actual	Lowland leopard frog	Fossil Springs Riparian	Janie Agyagos et. al.
Actual	Lowland leopard frog	Fossil Springs Riparian	Janie Agyagos et. al.
Actual	Lowland leopard frog	Fossil Springs Riparian	Janie Agyagos et. al.
Actual	Lowland Leopard Frog	Fossil Springs Riparian	Janie Agyagos, Rob Gibbs
Actual	Lowland leopard frog	Fossil Springs Riparian	Janie Agyagos et. al.
Actual	Lowland leopard frog	Fossil Springs Riparian	Edwards, Lockward
Actual	Lowland leopard frog	Fossil Springs Riparian	Agyagos, Sena, Cress
Actual	Lowland leopard frog	Fossil Springs Riparian	Edwards, Lockward
Actual	Lowland leopard frog	Fossil Springs Riparian	Janie Agyagos
Actual	Lowland leopard frog	Fossil Springs Riparian	Janie Agyagos et. al.

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Actual

Lowland leopard frog

Fossil Springs Riparian

Janie Agyagos et. al.

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Observation Type	Common Name	Observation Location	Observer
Actual	Lowland leopard frog	Fossil upstream large falls	Janie Agyagos et. al.
Actual	Lowland leopard frog	Fossil upstream of large falls	Janie Agyagos et. al.
Actual	Madrean Alligator lizard	Fossil Creek Riparian	Agyagos
Actual	Mojave rattlesnake	Fossil Creek Riparian	AZ Public Service Co.
Actual	Red spotted toad	Fossil below Irving	Janie Agyagos et. al.
Actual	Red spotted toad	Fossil below Irving	Janie Agyagos et. al.
Actual	Red spotted toad	Fossil Springs Riparian	Agyagos, Sena, Cress
Actual	Red spotted toad	Fossil upstream of large falls	Janie Agyagos et. al.
Actual	Red spotted toads	Fossil above large falls	Janie Agyagos et. al.
Actual	Red spotted toads	Fossil Irving trailhead up to large	Janie Agyagos et. al.
Actual	Red-spotted Toad	Fossil Creek Riparian	Janie Agyagos, Eric
Actual	Red-spotted Toad	Fossil Creek Riparian	Janie Agyagos, Eric
Actual	Red-spotted Toad	Fossil Creek Riparian	Janie Agyagos, Eric
Actual	Red-spotted Toad	Fossil Creek Riparian	Janie Agyagos, Eric
Actual	Red-spotted Toad	Fossil Springs Riparian	Janie Agyagos, Rob Gibbs
Actual	Side-blotched lizard	Fossil Creek Riparian	AZ Public Service Co.
Actual	Sonora mud turtle	FC above Irving Trailhead	Agyagos
Actual	Sonoran Mountain	Fossil Dam downstream to trail	Janie Agyagos et. al.
Actual	Sonoran mud turtle	Fossil Creek Riparian	Agyagos
Actual	Sonoran mud turtle	Fossil Creek Riparian	Agyagos
Actual	Sonoran Mud turtle	Fossil Creek Riparian	Agyagos
Actual	Sonoran mud turtle	Fossil Creek Riparian	Agyagos
Actual	Sonoran Mud turtle	Fossil Springs Riparian	Janie Agyagos et. al.
Actual	Sonoran whipsnake	Fossil Creek Riparian	AZ Public Service Co.
Actual	Spiny lizard	Fossil Creek Riparian	Agyagos
Actual	Toad sp.	FC below sunfish barrier	Agyagos
Actual	tree lizard	Fossil Creek above Springs	Agyagos, Sena, Cress
Actual	Tree lizard	Fossil Creek above waterfall	Agyagos, Sena, Cress
Actual	Tree lizard	Fossil Creek Riparian	E.L.Smith

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Actual

Tree lizard

Fossil Creek Riparian

Agyagos

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Observation Type	Common Name	Observation Location	Observer
Actual	Tree lizard	Fossil Creek Riparian	AgyagosOverby
Actual	Tree lizard	Fossil Creek Riparian	AgyagosOverby
Actual	Tree lizard	Fossil Creek Riparian	Agyagos
Actual	Tree lizard	Fossil Springs Riparian	Agyagos, McPhail
Actual	True frog or toad	Fossil Creek @ Forest Boundary	AGFD
Actual	Whipsnake	Fossil Creek Riparian	Agyagos
Actual	Whipsnake	Fossil Creek Riparian	AgyagosOverby
Actual	Zebra-tailed lizard	Fossil Springs Riparian	Agyagos, McPhail

Invertebrates of Fossil Creek

Order or Class	Family	Scientific Name	Common Name	Observation Location	Observer
			Arizona Sister	Fossil Creek Riparian	Janie Agyagos, Eric
			Queen	Fossil Creek Riparian	Janie Agyagos, Eric
		<i>Argia plana</i>	Springwater Dancer	Fossil Springs Riparian	Janie Agyagos, Rob Gibbs
		<i>Cyllopsis pertepida</i>	Canyonland Satyr	Fossil Springs Riparian	Janie Agyagos, Rob Gibbs
		<i>Erpetogomphus</i>	Serpent Ringtail	Fossil Springs Riparian	Janie Agyagos, Rob Gibbs
		<i>Hesperagrion hexerodoxum</i>	Painted Damsel	Fossil Springs Riparian	Janie Agyagos, Rob Gibbs
		<i>Libellula croceipenis</i>	Neon Skimmer	Fossil Springs Riparian	Janie Agyagos, Rob Gibbs
			Polyphemous moth	Fossil Creek Riparian	Rich Wiggins
			green florescent beetle	Fossil Creek Riparian	Rich Wiggins
			Ten-lined june bug	Fossil Creek Riparian	Rich Wiggins
			Swallowtail	Fossil Creek Riparian	Agyagos
			Arizona sister	Fossil Creek Riparian	Agyagos
			Glover silk moth	Fossil Creek Riparian	Rich Wiggins
			Belostomatid	Fossil Creek Riparian	Agyagos
			Katydids	Fossil Creek Riparian	Rich Wiggins
			Cicada	Fossil Creek Riparian	Agyagos
			Tiger sphinx	Fossil Creek Riparian	Rich Wiggins
			Yellow sphinx species	Fossil Creek Riparian	Rich Wiggins
			Tarantula hawk	Fossil Creek Riparian	Agyagos

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Order or Class	Family	Scientific Name	Common Name	Observation Location	Observer
			Dobsonfly	Fossil Creek Riparian	Rich Wiggins
			Painted Lady	Fossil Creek Riparian	Rich Wiggins
			Cicadas	Fossil Creek Riparian	Rich Wiggins
			Mourning cloak	Fossil Creek Riparian	Agyagos
			Arizona sister	Fossil Creek Riparian	Agyagos
			Io moth	Fossil Creek Riparian	Agyagos
			Virginia sphinx moth	Fossil Creek Riparian	Rich Wiggins
			dragonfly	Fossil Creek Riparian	Agyagos
			Painted Lady	Fossil Creek Riparian	Agyagos
			Buckeye	Fossil Creek Riparian	Agyagos
			Sarah's Orangetip	Fossil Creek Riparian	Agyagos
			Queen	Fossil Creek Riparian	AgyagosOverby
			Pipevine Swallowtail	Fossil Creek Riparian	AgyagosOverby
			alder leaf flea beetle	Fossil Creek Riparian	AgyagosOverby
			alder flea beetle	Fossil Creek Riparian	Agyagos
			Pipevine Swallowtail	Fossil Creek Riparian	Rich Wiggins
			damselfly	Fossil Creek Riparian	Agyagos
			Tarantula	Fossil Creek Riparian	Agyagos
			Arizona sister	Fossil Creek Riparian	Rich Wiggins
			Skipper	Fossil Creek Riparian	Rich Wiggins
			Queen	Fossil Creek Riparian	Rich Wiggins

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Order or Class	Family	Scientific Name	Common Name	Observation Location	Observer
			Buckeye	Fossil Creek Riparian	Rich Wiggins
			Arizona sister	Fossil Creek Riparian	AgyagosOverby
			Southern Dogface	Fossil Creek Riparian	Rich Wiggins
			Arizona sister	Fossil Springs Riparian	Agyagos, Sena, Cress
			Cicadas	Fossil Creek Riparian	Rich Wiggins
			Cabbage white	Fossil Creek Riparian	Agyagos
			Pipevine swallowtail	Fossil Creek Riparian	Agyagos
	Annelidae		Aquatic earthworm	Fossil/Verde Confluence	Mark Story, Bill Burbridge
	Chironomidae	morph 1		Fossil Creek Riparian	Ken Adams
	Chironomidae	morph 2		Fossil Creek Riparian	Ken Adams
	Chironomidae	morph 3		Fossil Creek Riparian	Ken Adams
	Culicidae	Anopheles		Fossil Creek Riparian	Ken Adams
	Culicidae	Mansonia		Fossil Creek Riparian	Ken Adams
	Dixidae	Dixa		Fossil Creek Riparian	Ken Adams
	Elophidae			Fossil Creek Riparian	Ken Adams
	Empididae	Emphis		Fossil Creek Riparian	Ken Adams
	Ephydriidae			Fossil Creek Riparian	Ken Adams
	Ephydriidae			Fossil Creek Riparian	Ken Adams
	Ichneumonidae	Megarhyssa		Fossil Creek Riparian	Ken Adams
	Phoridae	morph 2		Fossil Creek Riparian	Ken Adams
	Phoridae	Plastophora		Fossil Creek Riparian	Ken Adams

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Order or Class	Family	Scientific Name	Common Name	Observation Location	Observer
	Sciaridae	Sciara		Fossil Creek Riparian	Ken Adams
	Sciaridae	Trichosa		Fossil Creek Riparian	Ken Adams
	Sciomyzidae	Dictya		Fossil Creek Riparian	Ken Adams
	Simuliidae	Cnephia		Fossil Creek Riparian	Ken Adams
	Simuliidae	Metacnephia		Fossil Creek Riparian	Ken Adams
	Tachnidae	Archytus		Fossil Creek Riparian	Ken Adams
	Tipulidae	Cryptobalis		Fossil Creek Riparian	Ken Adams
	Tipulidae	Dicranota		Fossil Creek Riparian	Ken Adams
	Tipulidae	Gonomyia		Fossil Creek Riparian	Ken Adams
	Tipulidae	Holorusia		Fossil Creek Riparian	Ken Adams
	Tipulidae	Pipunculidae		Fossil Creek Riparian	Ken Adams
	Tipulidae	Tipula		Fossil Creek Riparian	Ken Adams
Amphipoda	Gammaridae	Gammarus sp.		Confluence	Jane Marks
Amphipoda	Taltridae	Hyaella azteca		Fossil Springs	Jane Marks
Annelida	Lumbriculidae	Unknown sp.		Confluence	Jane Marks
Annelida	Lumbriculidae	Unknown spp.		Confluence	Jane Marks
Annelida	Lumbriculidae	unknown spp.		Above Fossil Springs	Jane Marks
Annelida	Lumbriculidae	unknown spp.		Below Dam	Jane Marks
Annelida	Lumbriculidae	unknown spp.		Fossil Springs	Jane Marks
Annelida	Lumbriculidae	unknown spp.		Above Dam	Jane Marks
Annelida	Lumbriculidae	Various spp.		Above Irving	Jane Marks

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Order or Class	Family	Scientific Name	Common Name	Observation Location	Observer
Annelida	Nematomophia	Paragordius sp.		Above Fossil Springs	Jane Marks
Annelida	Tubificidae (Oligochaeta)	Branchiura sowerbyi		Below Dam	Jane Marks
Annelida	Tubificidae (Oligochaeta)	Unknown spp.		Below Irving	Jane Marks
Annelida	Tubificidae (Oligochaeta)	Unknown. Spp.		Fossil Springs	Jane Marks
Arachnida	Hydracarina		Water mites	Fossil Creek Riparian	Steven Overby, Mary Ann
Bivalvia	Corbiculidae	Corbicula sp.		Confluence	Jane Marks
Bivalvia	Sphaeriidae	Pisidium sp.		Above Dam	Jane Marks
Bivalvia	Sphaeriidae	Pisidium sp.		Fossil Springs	Jane Marks
Chelicerata	Ctenizidae	Aphonopelma sp.	Tarantula	Fossil Creek Riparian	Rich Wiggins
Chelicerata	Lycosidae	Dolomedes triton	Six-spotted fishing spider	Fossil Creek Riparian	Brandon McPhail
Chelicerata	Pisauridae	Dolomedes tenebrosus	Fishing Spider	Fossil Creek Riparian	Brandon McPhail
Coleoptera		Altica ambiens	Alder Flea Beetle	Fossil Creek Riparian	Brandon McPhail
Coleoptera	Chrysomelidae			Below Dam	Ken Adams
Coleoptera	Chrysomelidae			below fish barrier	Ken Adams
Coleoptera	Chrysomelidae			Fossil Creek Riparian	Ken Adams
Coleoptera	Chrysomelidae			Above Dam	Ken Adams
Coleoptera	Chrysomelidae	cryptocephalus		below fish barrier	Ken Adams
Coleoptera	Chrysomelidae	cryptocephalus		Above Irving	Ken Adams
Coleoptera	Chrysomelidae	Donacia		Below Dam	Ken Adams
Coleoptera	Chrysomelidae	Donacia		below fish barrier	Ken Adams
Coleoptera	Chrysomelidae	Donacia		Fossil Creek Riparian	Ken Adams

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Order or Class	Family	Scientific Name	Common Name	Observation Location	Observer
Coleoptera	Chrysomelidae	Donacia		Above Irving	Ken Adams
Coleoptera	Chrysomelidae	Donacia		Purple Mountain	Ken Adams
Coleoptera	Chrysomelidae	Donacia		Above Dam	Ken Adams
Coleoptera	Chrysomelidae	prasocuris		below fish barrier	Ken Adams
Coleoptera	Dryopidae	Helichus sp.		Confluence	Jane Marks
Coleoptera	Dryopidae	Helichus sp.		Below Irving	Jane Marks
Coleoptera	Dryopidae	Helichus sp.		Above Dam	Jane Marks
Coleoptera	Dryopidae	Helichus sp.		Below Dam	Jane Marks
Coleoptera	Dryopidae	Helichus sp.		Fossil Springs	Jane Marks
Coleoptera	Dryopidae	Helichus sp.		Above Irving	Jane Marks
Coleoptera	Dryopidae	Postelichius sp.		Below Dam	Jane Marks
Coleoptera	Dryopidae	Postelichus sp.		Above Fossil Springs	Jane Marks
Coleoptera	Dryopidae	Postelichus sp.		Above Irving	Jane Marks
Coleoptera	Dytiscidae		Beetles	Fossil Creek Riparian	Steven Overby, Mary Ann
Coleoptera	Dytiscidae	Hydroporous sp.		Above Fossil Springs	Jane Marks
Coleoptera	Dytiscidae	Laccophilus sp.		Above Fossil Springs	Jane Marks
Coleoptera	Dytiscidae	Liodessus sp.		Below Irving	Jane Marks
Coleoptera	Dytiscidae	Nebrioporous/Stictotarsus		Above Fossil Springs	Jane Marks
Coleoptera	Dytiscidae	Nebrioporous/Stictotarsus		Fossil Springs	Jane Marks
Coleoptera	Dytiscidae	Nebrioporous/Stictotarsus		Below Irving	Jane Marks
Coleoptera	Dytiscidae	nr. Hydrovatus sp.		Fossil Springs	Jane Marks

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Order or Class	Family	Scientific Name	Common Name	Observation Location	Observer
Coleoptera	Dytiscidae	thermonectus		below fish barrier	Ken Adams
Coleoptera	Dytiscidae	Thermonectus		Above Fossil Springs	Jane Marks
Coleoptera	Elataridae		Two Dot Click Beetle	Fossil Creek Riparian	Rich Wiggins
Coleoptera	Elmidae	ancyronyx		Above Irving	Ken Adams
Coleoptera	Elmidae	Dubiraphia		Purple Mountain	Ken Adams
Coleoptera	Elmidae	Dubiraphia		Above Irving	Ken Adams
Coleoptera	Elmidae	Dubiraphia		Below Dam	Ken Adams
Coleoptera	Elmidae	Dubiraphia		Fossil Creek Riparian	Ken Adams
Coleoptera	Elmidae	Dubiraphia		Above Dam	Ken Adams
Coleoptera	Elmidae	Dubiraphia sp.		Above Dam	Jane Marks
Coleoptera	Elmidae	Heterelmis sp.		Confluence	Jane Marks
Coleoptera	Elmidae	Heterelmis sp.		Below Dam	Jane Marks
Coleoptera	Elmidae	Heterelmis sp.		Below Irving	Jane Marks
Coleoptera	Elmidae	Heterelmis sp.		Fossil Springs	Jane Marks
Coleoptera	Elmidae	Heterelmis sp.		Above Dam	Jane Marks
Coleoptera	Elmidae	Heterelmis sp.		Above Dam	Jane Marks
Coleoptera	Elmidae	Heterlmis sp.		Confluence	Jane Marks
Coleoptera	Elmidae	Hexacylloepus sp.		Below Dam	Jane Marks
Coleoptera	Elmidae	Hexacylloepus sp.		Above Dam	Jane Marks
Coleoptera	Elmidae	Hexacylloepus sp.		Below Irving	Jane Marks
Coleoptera	Elmidae	Hexacylloepus sp.		Confluence	Jane Marks

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Order or Class	Family	Scientific Name	Common Name	Observation Location	Observer
Coleoptera	Elmidae	Hexacylloepus sp.		Fossil Springs	Jane Marks
Coleoptera	Elmidae	Hexacylloepus sp.		Above Irving	Jane Marks
Coleoptera	Elmidae	Huleechius sp.		Confluence	Jane Marks
Coleoptera	Elmidae	Huleechius sp.		Below Irving	Jane Marks
Coleoptera	Elmidae	Huleechius sp.		Above Dam	Jane Marks
Coleoptera	Elmidae	Huleechius sp.		Above Irving	Jane Marks
Coleoptera	Elmidae	Huleechius sp.		Below Dam	Jane Marks
Coleoptera	Elmidae	Huleechius sp.		Fossil Springs	Jane Marks
Coleoptera	Elmidae	Macrelmis sp.		Fossil Springs	Jane Marks
Coleoptera	Elmidae	Macrelmis sp.		Above Dam	Jane Marks
Coleoptera	Elmidae	Microcyloepus sp.		Confluence	Jane Marks
Coleoptera	Elmidae	Microcyloepus sp.		Above Dam	Jane Marks
Coleoptera	Elmidae	Microcyloepus sp.		Above Irving	Jane Marks
Coleoptera	Elmidae	Microcyloepus sp.		Below Dam	Jane Marks
Coleoptera	Elmidae	Microcyloepus sp.		Below Irving	Jane Marks
Coleoptera	Elmidae	narpus		Above Irving	Ken Adams
Coleoptera	Elmidae	narpus		below fish barrier	Ken Adams
Coleoptera	Elmidae	Neocyloepus sp.		Below Dam	Jane Marks
Coleoptera	Elmidae	Neoelmis sp.		Above Dam	Jane Marks
Coleoptera	Elmidae	Neoelmis sp.		Below Irving	Jane Marks
Coleoptera	Elmidae	Neoelmis sp.		Above Irving	Jane Marks

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Order or Class	Family	Scientific Name	Common Name	Observation Location	Observer
Coleoptera	Elmidae	Phanocerus sp.	Beetle	Fossil Springs Riparian	Bill Burbridge, Mark Story
Coleoptera	Gyrinidae	Dineutus sp.		Above Fossil Springs	Jane Marks
Coleoptera	Gyrinidae	Gyrinus sp.		Above Fossil Springs	Jane Marks
Coleoptera	Haliplidae	Pelodytes sp.		Fossil Springs	Jane Marks
Coleoptera	Haliplidae	Pelodytes sp.		Above Fossil Springs	Jane Marks
Coleoptera	Haliplidae	Pelodytes sp.		Below Irving	Jane Marks
Coleoptera	Hydraenidae	Othebius sp.		Below Dam	Jane Marks
Coleoptera	Hydrophilidae	berosus		Purple Mountain	Ken Adams
Coleoptera	Hydrophilidae	Berosus sp.		Above Fossil Springs	Jane Marks
Coleoptera	Hydrophilidae	Berosus sp.		Below Irving	Jane Marks
Coleoptera	Hydrophilidae	Berosus sp.		Fossil Springs	Jane Marks
Coleoptera	Hydrophilidae	Enochrus fucatus		Below Irving	Jane Marks
Coleoptera	Hydrophilidae	Enochrus fucatus		Above Dam	Jane Marks
Coleoptera	Hydrophilidae	Tropisternus lateralis		Above Fossil Springs	Jane Marks
Coleoptera	Hydrophilidae	Tropisternus sp.		Above Irving	Jane Marks
Coleoptera	Hydrophilidae	Tropisternus sp.		Above Fossil Springs	Jane Marks
Coleoptera	Lutrochidae	Lutrochus sp.		Below Dam	Jane Marks
Coleoptera	Lutrochidae	Lutrochus sp.		Confluence	Jane Marks
Coleoptera	Psephenidae	Psephenus		Below Dam	Ken Adams
Coleoptera	Psephenidae	Psephenus		Confluence	Jane Marks
Coleoptera	Psephenidae	Psephenus		below fish barrier	Ken Adams

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Order or Class	Family	Scientific Name	Common Name	Observation Location	Observer
Coleoptera	Psephenidae	Psephenus		Fossil Creek Riparian	Ken Adams
Coleoptera	Psephenidae	Psephenus		Above Dam	Ken Adams
Coleoptera	Scarab	Chrysina gloriosa	Glorious Scarab	Fossil Creek Riparian	Rich Wiggins
Coleoptera	Scarab	Polyphyla decemlineata	Ten lined June Bug	Fossil Creek Riparian	Rich Wiggins
Coleoptera	Scirtidae	Scirtes		Below Dam	Ken Adams
Coleoptera	Scirtidae	Scirtes		Fossil Creek Riparian	Ken Adams
Coleoptera	Scirtidae	Scirtes		Above Dam	Ken Adams
Coleoptera	Staphylinidae	bledius		Above Irving	Ken Adams
Coleoptera	Staphylinidae	bledius		Purple Mountain	Ken Adams
Coleoptera	Staphylinidae	bledius		below fish barrier	Ken Adams
Coleoptera	Staphylinidae	charhyphus		below fish barrier	Ken Adams
Coleoptera	Staphylinidae	charhyphus		Above Irving	Ken Adams
Coleoptera	Staphylinidae	Stenus sp.		Below Dam	Jane Marks
Decapoda	Cambaridae	Orconectes virilis		Below Irving	Jane Marks
Decapoda	Cambaridae	Orconectes virilis		Confluence	Jane Marks
Decapoda	Cambaridae	unknown spp.		Below Dam	Jane Marks
Diptera	Ceratopogonidae			Above Irving	Ken Adams
Diptera	Ceratopogonidae			Fossil Creek Riparian	Ken Adams
Diptera	Ceratopogonidae			Below Dam	Ken Adams
Diptera	Ceratopogonidae			below fish barrier	Ken Adams
Diptera	Ceratopogonidae			Above Dam	Ken Adams

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Order or Class	Family	Scientific Name	Common Name	Observation Location	Observer
Diptera	Ceratopogonidae	Atrichopogon		Above Dam	Ken Adams
Diptera	Ceratopogonidae	Atrichopogon		Above Irving	Ken Adams
Diptera	Ceratopogonidae	Atrichopogon		Below Dam	Ken Adams
Diptera	Ceratopogonidae	Atrichopogon		Fossil Creek Riparian	Ken Adams
Diptera	Ceratopogonidae	Atrichopogon		below fish barrier	Ken Adams
Diptera	Ceratopogonidae	Bezzia/Palpomyia		Above Fossil Springs	Jane Marks
Diptera	Ceratopogonidae	Bezzia/Palpomyia sp.		Below Dam	Jane Marks
Diptera	Ceratopogonidae	Bezzia/Palpomyia sp.		Above Irving	Jane Marks
Diptera	Ceratopogonidae	Bezzia/Palpomyia sp.		Below Irving	Jane Marks
Diptera	Ceratopogonidae	Culicoides sp.		Below Dam	Jane Marks
Diptera	Ceratopogonidae	Culicoides		Above Dam	Ken Adams
Diptera	Ceratopogonidae	Culicoides		Above Dam	Ken Adams
Diptera	Ceratopogonidae	Culicoides		Below Dam	Ken Adams
Diptera	Ceratopogonidae	Culicoides		Below Dam	Ken Adams
Diptera	Ceratopogonidae	Culicoides		Fossil Creek Riparian	Ken Adams
Diptera	Ceratopogonidae	Culicoides		Fossil Creek Riparian	Ken Adams
Diptera	Ceratopogonidae	Culicoides		Above Irving	Ken Adams
Diptera	Ceratopogonidae	Culicoides		below fish barrier	Ken Adams
Diptera	Ceratopogonidae	Culicoides		Purple Mountain	Ken Adams
Diptera	Ceratopogonidae	Culicoides		Above Irving	Ken Adams
Diptera	Ceratopogonidae	Culicoides		Purple Mountain	Ken Adams

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Order or Class	Family	Scientific Name	Common Name	Observation Location	Observer
Diptera	Ceratopogonidae	Culicoides		below fish barrier	Ken Adams
Diptera	Ceratopogonidae	Culicoides sp.		Above Dam	Jane Marks
Diptera	Ceratopogonidae	Culicoides sp.		Fossil Springs	Jane Marks
Diptera	Ceratopogonidae	Culicoides sp.		Above Irving	Jane Marks
Diptera	Ceratopogonidae	Culicoides sp.		Below Irving	Jane Marks
Diptera	Ceratopogonidae	Forcipomyia sp.		Below Dam	Jane Marks
Diptera	Ceratopogonidae	Forcipomyia sp.		Above Irving	Jane Marks
Diptera	Ceratopogonidae	leptoconops		Above Irving	Ken Adams
Diptera	Ceratopogonidae	Leptoconops		Purple Mountain	Ken Adams
Diptera	Ceratopogonidae	morphortype 1		Above Irving	Ken Adams
Diptera	Ceratopogonidae	morphortype 1		below fish barrier	Ken Adams
Diptera	Ceratopogonidae	Nilobezzia		Above Dam	Ken Adams
Diptera	Ceratopogonidae	Nilobezzia		Above Irving	Ken Adams
Diptera	Ceratopogonidae	Nilobezzia		Purple Mountain	Ken Adams
Diptera	Ceratopogonidae	Nilobezzia		Fossil Creek Riparian	Ken Adams
Diptera	Ceratopogonidae	Nilobezzia		Below Dam	Ken Adams
Diptera	Ceratopogonidae	Nilobezzia		below fish barrier	Ken Adams
Diptera	Ceratopogonidae	Bezzia/Palpomyia sp.		Fossil Springs	Jane Marks
Diptera	Chironomidae		Bloodworms	Fossil Creek Riparian	Steven Overby, Mary Ann
Diptera	Chironomidae			Fossil Creek Riparian	Dr. Dean Blinn
Diptera	Chironomidae			Fossil Springs Riparian	Greg Goodwin

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Order or Class	Family	Scientific Name	Common Name	Observation Location	Observer
Diptera	Chironomidae			Above Irving	Ken Adams
Diptera	Chironomidae	Chironomus sp.	Midge larvae	Fossil/Verde Confluence	Mark Story, Bill Burbridge
Diptera	Chironomidae	Chironomus sp.		Fossil Springs Riparian	Bill Burbridge, Mark Story
Diptera	Chironomidae	Corynoneyrini		Fossil Creek Riparian	Ken Adams
Diptera	Chironomidae	Corynoneyrini		Below Dam	Ken Adams
Diptera	Chironomidae	Corynoneyrini		Above Dam	Ken Adams
Diptera	Chironomidae	morph 1		below fish barrier	Ken Adams
Diptera	Chironomidae	morph 1		below fish barrier	Ken Adams
Diptera	Chironomidae	morph 1		Above Irving	Ken Adams
Diptera	Chironomidae	morph 1		Above Dam	Ken Adams
Diptera	Chironomidae	morph 1		Purple Mountain	Ken Adams
Diptera	Chironomidae	morph 1		Above Irving	Ken Adams
Diptera	Chironomidae	morph 1		Above Dam	Ken Adams
Diptera	Chironomidae	morph 1		Purple Mountain	Ken Adams
Diptera	Chironomidae	morph 1		Below Dam	Ken Adams
Diptera	Chironomidae	morph 1		Fossil Creek Riparian	Ken Adams
Diptera	Chironomidae	morph 1		below fish barrier	Ken Adams
Diptera	Chironomidae	morph 1		Below Dam	Ken Adams
Diptera	Chironomidae	morph 1		Above Irving	Ken Adams
Diptera	Chironomidae	morph 1		Below Dam	Ken Adams
Diptera	Chironomidae	morph 1		Purple Mountain	Ken Adams

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Order or Class	Family	Scientific Name	Common Name	Observation Location	Observer
Diptera	Chironomidae	morph 1		Above Dam	Ken Adams
Diptera	Chironomidae	morph 1		Above Dam	Ken Adams
Diptera	Chironomidae	morph 1		Below Dam	Ken Adams
Diptera	Chironomidae	morph 1		Above Irving	Ken Adams
Diptera	Chironomidae	morph 1		Fossil Creek Riparian	Ken Adams
Diptera	Chironomidae	morph 1		below fish barrier	Ken Adams
Diptera	Chironomidae	morph 1		Fossil Creek Riparian	Ken Adams
Diptera	Chironomidae	morph 1		Purple Mountain	Ken Adams
Diptera	Chironomidae	morph 2		Above Dam	Ken Adams
Diptera	Chironomidae	morph 2		Above Dam	Ken Adams
Diptera	Chironomidae	morph 2		Above Dam	Ken Adams
Diptera	Chironomidae	morph 2		Purple Mountain	Ken Adams
Diptera	Chironomidae	morph 2		Purple Mountain	Ken Adams
Diptera	Chironomidae	morph 2		Above Dam	Ken Adams
Diptera	Chironomidae	morph 2		Purple Mountain	Ken Adams
Diptera	Chironomidae	morph 2		Purple Mountain	Ken Adams
Diptera	Chironomidae	morph 2		below fish barrier	Ken Adams
Diptera	Chironomidae	morph 2		Fossil Creek Riparian	Ken Adams
Diptera	Chironomidae	morph 2		Below Dam	Ken Adams
Diptera	Chironomidae	morph 2		Below Dam	Ken Adams
Diptera	Chironomidae	morph 2		Above Irving	Ken Adams

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Order or Class	Family	Scientific Name	Common Name	Observation Location	Observer
Diptera	Chironomidae	morph 2		Fossil Creek Riparian	Ken Adams
Diptera	Chironomidae	morph 2		Below Dam	Ken Adams
Diptera	Chironomidae	morph 2		Above Irving	Ken Adams
Diptera	Chironomidae	morph 2		Below Dam	Ken Adams
Diptera	Chironomidae	morph 2		Above Irving	Ken Adams
Diptera	Chironomidae	morph 2		below fish barrier	Ken Adams
Diptera	Chironomidae	morph 2		below fish barrier	Ken Adams
Diptera	Chironomidae	morph 2		Fossil Creek Riparian	Ken Adams
Diptera	Chironomidae	morph 3		Fossil Creek Riparian	Ken Adams
Diptera	Chironomidae	morph 3		Above Dam	Ken Adams
Diptera	Chironomidae	morph 3		Above Irving	Ken Adams
Diptera	Chironomidae	morph 3		Fossil Creek Riparian	Ken Adams
Diptera	Chironomidae	morph 3		Above Dam	Ken Adams
Diptera	Chironomidae	morph 3		Above Dam	Ken Adams
Diptera	Chironomidae	morph 3		Below Dam	Ken Adams
Diptera	Chironomidae	morph 3		Above Irving	Ken Adams
Diptera	Chironomidae	morph 3		below fish barrier	Ken Adams
Diptera	Chironomidae	morph 3		Below Dam	Ken Adams
Diptera	Chironomidae	morph 3		Below Dam	Ken Adams
Diptera	Chironomidae	morph 4		Above Irving	Ken Adams
Diptera	Chironomidae	morph 4		Below Dam	Ken Adams

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Order or Class	Family	Scientific Name	Common Name	Observation Location	Observer
Diptera	Chironomidae	morph 4		below fish barrier	Ken Adams
Diptera	Chironomidae	morph 4		Fossil Creek Riparian	Ken Adams
Diptera	Chironomidae	morph 4		Above Dam	Ken Adams
Diptera	Chironomidae	morph 4		Purple Mountain	Ken Adams
Diptera	Chironomidae	morph 5		Purple Mountain	Ken Adams
Diptera	Chironomidae	morph 5		Above Irving	Ken Adams
Diptera	Chironomidae	tanypus		Above Irving	Ken Adams
Diptera	Chironomidae	Various spp.		Above Dam	Jane Marks
Diptera	Chironomidae	Various spp.		Above Fossil Springs	Jane Marks
Diptera	Chironomidae	Various spp.		Below Dam	Jane Marks
Diptera	Chironomidae	Various spp.		Fossil Springs	Jane Marks
Diptera	Chironomidae	Various spp.		Above Irving	Jane Marks
Diptera	Chironomidae	Various spp.		Below Irving	Jane Marks
Diptera	Chironomidae	Various spp.		Confluence	Jane Marks
Diptera	Chironomidae	Various spp.		Confluence	Jane Marks
Diptera	Culicidae	Anopheles		below fish barrier	Ken Adams
Diptera	Culicidae	Anopheles		Above Dam	Ken Adams
Diptera	Culicidae	Anopheles		Above Irving	Ken Adams
Diptera	Culicidae	Anopheles		Below Dam	Ken Adams
Diptera	Culicidae	Anophles sp.		Above Fossil Springs	Jane Marks
Diptera	Culicidae	Anophles sp.		Below Dam	Jane Marks

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Order or Class	Family	Scientific Name	Common Name	Observation Location	Observer
Diptera	Culicidae	Culex sp.		Above Dam	Jane Marks
Diptera	Culicidae	Mansonia		Above Dam	Ken Adams
Diptera	Culicidae	Mansonia		Below Dam	Ken Adams
Diptera	Culicidae	Mansonia		Above Irving	Ken Adams
Diptera	Dixidae	Dixa		below fish barrier	Ken Adams
Diptera	Dixidae	Dixa		Above Dam	Ken Adams
Diptera	Dixidae	Dixa		Above Irving	Ken Adams
Diptera	Dixidae	Dixa		Below Dam	Ken Adams
Diptera	Dixidae	Dixa sp.		Below Dam	Jane Marks
Diptera	Empididae	Chelifera		Purple Mountain	Ken Adams
Diptera	Empididae	Chelifera sp.		Below Dam	Jane Marks
Diptera	Empididae	Chelifera sp.		Above Irving	Jane Marks
Diptera	Empididae	Emphis		Above Dam	Ken Adams
Diptera	Empididae	Emphis		Below Dam	Ken Adams
Diptera	Empididae	Hemerodromia sp.		Confluence	Jane Marks
Diptera	Empididae	Hemerodromia sp.		Below Dam	Jane Marks
Diptera	Empididae	Hemerodromia sp.		Above Dam	Jane Marks
Diptera	Empididae	morphortype 1		Above Irving	Ken Adams
Diptera	Ephydriidae			Below Dam	Ken Adams
Diptera	Ephydriidae			Above Irving	Ken Adams
Diptera	Ephydriidae			Above Irving	Ken Adams

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Order or Class	Family	Scientific Name	Common Name	Observation Location	Observer
Diptera	Ephydriidae			Below Dam	Ken Adams
Diptera	Ephydriidae			Above Irving	Ken Adams
Diptera	Ephydriidae			Purple Mountain	Ken Adams
Diptera	Ephydriidae			Above Dam	Ken Adams
Diptera	Ephydriidae			Above Dam	Ken Adams
Diptera	Lauxaniidae	Prosopomyia		Above Irving	Ken Adams
Diptera	Muscidae			below fish barrier	Ken Adams
Diptera	Muscidae	Haematobia		Above Irving	Ken Adams
Diptera	Muscidae	nr. Limnophora sp.		Below Dam	Jane Marks
Diptera	Muscidae	nr. Limnophora sp.		Above Irving	Jane Marks
Diptera	Phoridae	Dorniphora		Above Irving	Ken Adams
Diptera	Phoridae	morph 2		Above Dam	Ken Adams
Diptera	Phoridae	morph 2		Above Irving	Ken Adams
Diptera	Phoridae	morph 2		below fish barrier	Ken Adams
Diptera	Phoridae	morph 2		Below Dam	Ken Adams
Diptera	Phoridae	Plastophora		Below Dam	Ken Adams
Diptera	Phoridae	Plastophora		Above Irving	Ken Adams
Diptera	Phoridae	Plastophora		Above Dam	Ken Adams
Diptera	Psychodidae			Above Irving	Ken Adams
Diptera	Sarcophagidae	morphortype 1		Above Irving	Ken Adams
Diptera	Sarcophagidae	morphortype 2		Above Irving	Ken Adams

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Order or Class	Family	Scientific Name	Common Name	Observation Location	Observer
Diptera	Sciaridae	Sciara		Below Dam	Ken Adams
Diptera	Sciaridae	Sciara		Above Dam	Ken Adams
Diptera	Sciaridae	Sciara		Above Irving	Ken Adams
Diptera	Sciaridae	Sciara		below fish barrier	Ken Adams
Diptera	Sciaridae	Sciara		Purple Mountain	Ken Adams
Diptera	Sciaridae	Trichosa		below fish barrier	Ken Adams
Diptera	Sciaridae	Trichosa		Above Irving	Ken Adams
Diptera	Sciaridae	Trichosa		Below Dam	Ken Adams
Diptera	Sciaridae	Trichosa		Purple Mountain	Ken Adams
Diptera	Sciaridae	Trichosa		Above Dam	Ken Adams
Diptera	Sciomyzidae			Purple Mountain	Ken Adams
Diptera	Sciomyzidae			Above Irving	Ken Adams
Diptera	Sciomyzidae	Dictya		Above Dam	Ken Adams
Diptera	Sciomyzidae	Dictya		Above Irving	Ken Adams
Diptera	Sciomyzidae	Dictya		Below Dam	Ken Adams
Diptera	Simuliidae		Black Flies	Fossil Creek Riparian	Steven Overby, Mary Ann
Diptera	Simuliidae	Cnephia		below fish barrier	Ken Adams
Diptera	Simuliidae	Cnephia		Above Irving	Ken Adams
Diptera	Simuliidae	Cnephia		Below Dam	Ken Adams
Diptera	Simuliidae	Cnephia		Purple Mountain	Ken Adams
Diptera	Simuliidae	Cnephia		Above Dam	Ken Adams

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Order or Class	Family	Scientific Name	Common Name	Observation Location	Observer
Diptera	Simuliidae	Metacnephia		Above Irving	Ken Adams
Diptera	Simuliidae	Metacnephia		below fish barrier	Ken Adams
Diptera	Simuliidae	Metacnephia		Below Dam	Ken Adams
Diptera	Simuliidae	Metacnephia		Above Dam	Ken Adams
Diptera	Simuliidae	Metacnephia		Purple Mountain	Ken Adams
Diptera	Simuliidae	Simulium		Purple Mountain	Ken Adams
Diptera	Simuliidae	Simulium		Above Irving	Ken Adams
Diptera	Simuliidae	Simulium sp.		Confluence	Jane Marks
Diptera	Simuliidae	Simulium sp.		Confluence	Jane Marks
Diptera	Simuliidae	Simulium sp.		Below Dam	Jane Marks
Diptera	Simuliidae	Simulium sp.		Below Irving	Jane Marks
Diptera	Simuliidae	Simulium sp.		Above Irving	Jane Marks
Diptera	Simuliidae	Simulium sp.	Black fly	Fossil Creek Riparian	Jane Marks
Diptera	Simuliidae	Simulium sp.		Above Dam	Jane Marks
Diptera	Stratiomyidae	Caloparyphus sp.		Below Dam	Jane Marks
Diptera	Stratiomyidae	Caloparyphus sp.		Confluence	Jane Marks
Diptera	Stratiomyidae	Caloparyphus sp.		Above Dam	Jane Marks
Diptera	Stratiomyidae	Caloparyphus sp.		Below Irving	Jane Marks
Diptera	Stratiomyidae	Caloparyphus sp.		Above Irving	Jane Marks
Diptera	Stratiomyidae	Caloparyphus sp.		Fossil Springs	Jane Marks
Diptera	Stratiomyidae	Euparyphus sp.		Below Irving	Jane Marks

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Order or Class	Family	Scientific Name	Common Name	Observation Location	Observer
Diptera	Stratiomyidae	Euparyphus sp.		Below Dam	Jane Marks
Diptera	Stratiomyidae	Euparyphus sp.		Above Irving	Jane Marks
Diptera	Stratiomyidae	Stratiomys sp.		Above Dam	Jane Marks
Diptera	Tabanidae	Tabanus sp.		Confluence	Jane Marks
Diptera	Tabanidae	Tabanus sp.		Confluence	Jane Marks
Diptera	Tabanidae	Tabanus sp.		Above Dam	Jane Marks
Diptera	Tabanidae	Tabanus sp.		Below Dam	Jane Marks
Diptera	Tabanidae	Tabanus sp.		Above Irving	Jane Marks
Diptera	Tachnididae	Archytus		Above Dam	Ken Adams
Diptera	Tachnididae	Archytus		Below Dam	Ken Adams
Diptera	Tanyderidae			Above Irving	Ken Adams
Diptera	Tipulidae	Antocha sp.		Below Irving	Jane Marks
Diptera	Tipulidae	Antocha sp.		Below Dam	Jane Marks
Diptera	Tipulidae	Cryptobalis		Purple Mountain	Ken Adams
Diptera	Tipulidae	Cryptobalis		Below Dam	Ken Adams
Diptera	Tipulidae	Cryptobalis		below fish barrier	Ken Adams
Diptera	Tipulidae	Cryptobalis		Above Dam	Ken Adams
Diptera	Tipulidae	Cryptobalis		Above Irving	Ken Adams
Diptera	Tipulidae	Dicranota		below fish barrier	Ken Adams
Diptera	Tipulidae	Dicranota		Below Dam	Ken Adams
Diptera	Tipulidae	Dicranota		Above Dam	Ken Adams

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Order or Class	Family	Scientific Name	Common Name	Observation Location	Observer
Diptera	Tipulidae	Dicranota sp.		Above Irving	Jane Marks
Diptera	Tipulidae	Dicranota sp.		Below Dam	Jane Marks
Diptera	Tipulidae	Gonomyia		Purple Mountain	Ken Adams
Diptera	Tipulidae	Gonomyia		below fish barrier	Ken Adams
Diptera	Tipulidae	Gonomyia		Below Dam	Ken Adams
Diptera	Tipulidae	Gonomyia		Above Irving	Ken Adams
Diptera	Tipulidae	Gonomyia		Above Dam	Ken Adams
Diptera	Tipulidae	Holorusia		Below Dam	Ken Adams
Diptera	Tipulidae	Holorusia		Above Dam	Ken Adams
Diptera	Tipulidae	nr. Paradelphomyia sp.		Above Irving	Jane Marks
Diptera	Tipulidae	nr. Paradelphomyia sp.		Above Dam	Jane Marks
Diptera	Tipulidae	nr. Paradelphomyia sp.		Below Dam	Jane Marks
Diptera	Tipulidae	ormosia		Purple Mountain	Ken Adams
Diptera	Tipulidae	Ormosia		Above Irving	Ken Adams
Diptera	Tipulidae	ormosia		below fish barrier	Ken Adams
Diptera	Tipulidae	Pipunculidae		Below Dam	Ken Adams
Diptera	Tipulidae	Pipunculidae		Above Dam	Ken Adams
Diptera	Tipulidae	Tipula		Above Dam	Ken Adams
Diptera	Tipulidae	Tipula		Below Dam	Ken Adams
Diptera	Tipulidae	Tipula		Purple Mountain	Ken Adams
Diptera	Tipulidae	Tipula sp.		Below Dam	Jane Marks

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Order or Class	Family	Scientific Name	Common Name	Observation Location	Observer
Diptera	Tipulidae	Tipula sp.		Fossil Springs	Jane Marks
Diptera	Tipulidae	Ula		Fossil Creek Riparian	Ken Adams
Diptera	Tipulidae	Ula		Below Dam	Ken Adams
Diptera	Tipulidae	Ula		Above Dam	Ken Adams
Diptera	Various	Various spp.		Above Dam	Jane Marks
Ephemeroptera	Baetidae			Fossil Creek Riparian	Dr. Dean Blinn
Ephemeroptera	Baetidae			Fossil Springs Riparian	Greg Goodwin
Ephemeroptera	Baetidae		Mayfly	Fossil Creek Riparian	Steven Overby, Mary Ann
Ephemeroptera	Baetidae	Acentrella		Fossil Creek Riparian	Ken Adams
Ephemeroptera	Baetidae	Acentrella		below fish barrier	Ken Adams
Ephemeroptera	Baetidae	Acentrella		Below Dam	Ken Adams
Ephemeroptera	Baetidae	Acentrella		Above Dam	Ken Adams
Ephemeroptera	Baetidae	Baetis		Above Dam	Ken Adams
Ephemeroptera	Baetidae	Baetis		below fish barrier	Ken Adams
Ephemeroptera	Baetidae	Baetis		Fossil Creek Riparian	Ken Adams
Ephemeroptera	Baetidae	Baetis sp.		Above Dam	Jane Marks
Ephemeroptera	Baetidae	Baetis sp.		Confluence	Jane Marks
Ephemeroptera	Baetidae	Baetis sp.		Below Dam	Jane Marks
Ephemeroptera	Baetidae	Baetis sp.		Above Irving	Jane Marks
Ephemeroptera	Baetidae	Baetis sp.		Confluence	Jane Marks
Ephemeroptera	Baetidae	Baetis sp.		Below Irving	Jane Marks

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Order or Class	Family	Scientific Name	Common Name	Observation Location	Observer
Ephemeroptera	Baetidae	Baetis sp.		Fossil Springs	Jane Marks
Ephemeroptera	Baetidae	Baetodes sp.		Confluence	Jane Marks
Ephemeroptera	Baetidae	Baetodes sp.		Above Irving	Jane Marks
Ephemeroptera	Baetidae	Baetodes sp.		Below Irving	Jane Marks
Ephemeroptera	Baetidae	Baetodes sp.		Confluence	Jane Marks
Ephemeroptera	Baetidae	Callibaetis sp.		Below Irving	Jane Marks
Ephemeroptera	Baetidae	Callibaetis sp.		Below Dam	Jane Marks
Ephemeroptera	Baetidae	Callibaetis sp.		Fossil Springs	Jane Marks
Ephemeroptera	Baetidae	Callibaetis sp.		Above Dam	Jane Marks
Ephemeroptera	Baetidae	Callibaetis sp.		Above Fossil Springs	Jane Marks
Ephemeroptera	Baetidae	Camelobaetidius		Above Dam	Ken Adams
Ephemeroptera	Baetidae	Camelobaetidius		Below Dam	Ken Adams
Ephemeroptera	Baetidae	Camelobaetidius		Fossil Creek Riparian	Ken Adams
Ephemeroptera	Baetidae	Fallceon		Below Dam	Ken Adams
Ephemeroptera	Baetidae	Fallceon		Above Dam	Ken Adams
Ephemeroptera	Baetidae	Fallceon		Fossil Creek Riparian	Ken Adams
Ephemeroptera	Baetidae	Fallceon		Above Irving	Ken Adams
Ephemeroptera	Baetidae	Paralaptophlebia sp.		Fossil Springs Riparian	Bill Burbridge, Mark Story
Ephemeroptera	Baetidae	Pseudocleon sp.	Mayfly nymph	Fossil Springs Riparian	Bill Burbridge, Mark Story
Ephemeroptera	Caenidae	Caenis sp.		Below Dam	Jane Marks
Ephemeroptera	Caenidae	Caenis sp.		Fossil Springs	Jane Marks

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Order or Class	Family	Scientific Name	Common Name	Observation Location	Observer
Ephemeroptera	Caenidae	Caenis sp.		Above Fossil Springs	Jane Marks
Ephemeroptera	Caenidae	Caenis sp.		Below Irving	Jane Marks
Ephemeroptera	Caenidae	Caenis sp.		Confluence	Jane Marks
Ephemeroptera	Caenidae	Caenis sp.		Above Irving	Jane Marks
Ephemeroptera	Caenidae	Caenis sp.		Confluence	Jane Marks
Ephemeroptera	Caenidae	Caenis sp.		Above Dam	Jane Marks
Ephemeroptera	Ephemerellinae	Ephemerella sp.		Fossil Springs Riparian	Bill Burbridge, Mark Story
Ephemeroptera	Heptageniidae			Fossil Creek Riparian	Dr. Dean Blinn
Ephemeroptera	Heptageniidae			Fossil Springs Riparian	Greg Goodwin
Ephemeroptera	Leptohyphidae	Tricorythodes		Above Dam	Ken Adams
Ephemeroptera	Leptohyphidae	Tricorythodes		Purple Mountain	Ken Adams
Ephemeroptera	Leptohyphidae	Tricorythodes		Above Irving	Ken Adams
Ephemeroptera	Leptohyphidae	Tricorythodes		Fossil Creek Riparian	Ken Adams
Ephemeroptera	Leptohyphidae	Tricorythodes		below fish barrier	Ken Adams
Ephemeroptera	Leptohyphidae	Tricorythodes		Below Dam	Ken Adams
Ephemeroptera	Leptophlebiae	Thraulodes		Above Dam	Ken Adams
Ephemeroptera	Leptophlebiae	Thraulodes		Fossil Creek Riparian	Ken Adams
Ephemeroptera	Leptophlebiae	Thraulodes		Below Dam	Ken Adams
Ephemeroptera	Leptophlebiae	Thraulodes sp.		Fossil Springs	Jane Marks
Ephemeroptera	Leptophlebiae	Thraulodes sp.		Below Irving	Jane Marks
Ephemeroptera	Leptophlebiae	Thraulodes sp.		Above Dam	Jane Marks

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Order or Class	Family	Scientific Name	Common Name	Observation Location	Observer
Ephemeroptera	Leptophlebiidae	Thraulodes sp.		Above Fossil Springs	Jane Marks
Ephemeroptera	Leptophlebiidae	Thraulodes sp.		Below Dam	Jane Marks
Ephemeroptera	Leptophlebiidae	Thraulodes sp.		Above Irving	Jane Marks
Ephemeroptera	Leptophlebiidae	Traverella edmunds	Mayfly nymphs	Fossil/Verde Confluence	Mark Story, Bill Burbridge
Ephemeroptera	Leptophlebiidae	Traverella sp.		Fossil Springs Riparian	Bill Burbridge, Mark Story
Ephemeroptera	Tricorythidae			Fossil Creek Riparian	Dr. Dean Blinn
Ephemeroptera	Tricorythidae	Leptohypes sp.		Confluence	Jane Marks
Ephemeroptera	Tricorythidae	Leptohypes sp.		Below Irving	Jane Marks
Ephemeroptera	Tricorythidae	Tricorythodes sp.		Above Irving	Jane Marks
Ephemeroptera	Tricorythidae	Tricorythodes sp.		Below Dam	Jane Marks
ephemeroptera	Tricorythidae	Tricorythodes sp.		Above Dam	Jane Marks
Ephemeroptera	Tricorythidae	Tricorythodes sp.		Fossil Springs	Jane Marks
Gastropoda			Snails	Fossil Creek Riparian	Steven Overby, Mary Ann
Gastropoda	Hydrobiidae	Pyrgulopsis simplex		Above Dam	Jane Marks
Gastropoda	Hydrobiidae	Pyrgulopsis simplex		Fossil Springs	Jane Marks
Gastropoda	Physidae	Physella sp.		Below Dam	Jane Marks
Gastropoda	Physidae	Physella sp.		Above Fossil Springs	Jane Marks
Gastropoda	Physidae	Physella sp.		Fossil Springs	Jane Marks
Gastropoda	Physidae	Physella sp.		Below Irving	Jane Marks
Gastropoda	Planorbidae	Gyrulus sp.		Below Irving	Jane Marks
Gastropoda	Planorbidae	Gyrulus sp.		Above Fossil Springs	Jane Marks

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Order or Class	Family	Scientific Name	Common Name	Observation Location	Observer
Gastropoda	Planorbidae	Gyrulus sp.		Fossil Springs	Jane Marks
Gastropoda	Planorbidae	Heliosoma sp.		Above Fossil Springs	Jane Marks
Gastropoda	Sphaeridae			Fossil/Verde Confluence	Mark Story, Bill Burbridge
Hemiptera	Belostomatidae	Abedus		Above Fossil Springs	Jane Marks
Hemiptera	Belostomatidae	Abedus sp.		Above Dam	Jane Marks
Hemiptera	Belostomatidae	Abedus sp.		Below Irving	Jane Marks
Hemiptera	Belostomatidae	Abedus sp.		Below Dam	Jane Marks
Hemiptera	Cicadidae		Cicada	Fossil Creek Riparian	Rich Wiggins
Hemiptera	Corixidae	Early instars		Above Fossil Springs	Jane Marks
Hemiptera	Corixidae	Graptocorixa abdominalis		Above Fossil Springs	Jane Marks
Hemiptera	Corixidae	Neocorixa sp.		Above Fossil Springs	Jane Marks
Hemiptera	Corixidae	Trichocorixa sp.		Above Fossil Springs	Jane Marks
Hemiptera	Gelastocoridae	Gelastocoris rotundatus		Confluence	Jane Marks
Hemiptera	Gerridae	Trepobates sp.		Below Dam	Jane Marks
Hemiptera	Gerridae	Trepobates sp.		Confluence	Jane Marks
Hemiptera	Gerridae	Trepobates sp.		Below Irving	Jane Marks
Hemiptera	Hebridae	Hebrus sobrinus		Above Irving	Jane Marks
Hemiptera	Hebridae	Hebrus sobrinus		Below Dam	Jane Marks
Hemiptera	Mesoveliidae	mesovelia		Above Irving	Ken Adams
Hemiptera	Naucoridae	Ambrysus occidentalis		Above Dam	Jane Marks
Hemiptera	Naucoridae	Ambrysus occidentalis		Fossil Springs	Jane Marks

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Order or Class	Family	Scientific Name	Common Name	Observation Location	Observer
Hemiptera	Naucoridae	Ambrysus occidentalis		Above Fossil Springs	Jane Marks
Hemiptera	Naucoridae	Ambrysus occidentalis		Above Dam	Jane Marks
Hemiptera	Naucoridae	Ambrysus occidentalis		Confluence	Jane Marks
Hemiptera	Naucoridae	Ambrysus occidentalis		Confluence	Jane Marks
Hemiptera	Naucoridae	Ambrysus occidentalis		Below Dam	Jane Marks
Hemiptera	Naucoridae	Ambrysus sp.	Creeping Water Bug	Fossil Springs Riparian	Bill Burbridge, Mark Story
Hemiptera	Nepidae	Ranatra brevicollis		Above Fossil Springs	Jane Marks
Hemiptera	Notonectidae	Buenoa sp.		Above Fossil Springs	Jane Marks
Hemiptera	Notonectidae	Notonecta nr.hoffmani		Above Fossil Springs	Jane Marks
Hemiptera	Veliidae	Microvelia sp.		Below Irving	Jane Marks
Hemiptera	Veliidae	Microvelia sp.		Below Dam	Jane Marks
Hemiptera	Veliidae	Microvelia sp.		Above Dam	Jane Marks
Hemiptera	Veliidae	Rhagovelia distincta		Fossil Springs	Jane Marks
Hemiptera	Veliidae	Rhagovelia distincta		Above Irving	Jane Marks
Hemiptera	Veliidae	Rhagovelia distincta		Below Irving	Jane Marks
Hemiptera	Veliidae	Rhagovelia distincta		Confluence	Jane Marks
Hemiptera	Veliidae	Rhagovelia distincta		Below Dam	Jane Marks
Hirudinea			Leeches	Fossil Creek Riparian	Steven Overby, Mary Ann
Hydracarina	Unknown	Unknown spp.		Confluence	Jane Marks
Hydracarina	Unknown	Unknown spp.		Confluence	Jane Marks
Hydracarina	Various	Various		Fossil Springs	Jane Marks

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Order or Class	Family	Scientific Name	Common Name	Observation Location	Observer
Hydracarina	Various	Various		Above Dam	Jane Marks
Hydracarina	Various	Various spp.		Below Dam	Jane Marks
Hydracarina	Various	Various spp.		Above Irving	Jane Marks
Hydracarina	Various	Various spp.		Below Irving	Jane Marks
Hymenoptera	Braconidae			Below Dam	Ken Adams
Hymenoptera	Braconidae			below fish barrier	Ken Adams
Hymenoptera	Braconidae			below fish barrier	Ken Adams
Hymenoptera	Braconidae			Below Dam	Ken Adams
Hymenoptera	Braconidae			Above Irving	Ken Adams
Hymenoptera	Braconidae			Above Irving	Ken Adams
Hymenoptera	Braconidae			Above Dam	Ken Adams
Hymenoptera	Braconidae			Purple Mountain	Ken Adams
Hymenoptera	Braconidae			Purple Mountain	Ken Adams
Hymenoptera	Braconidae			Fossil Creek Riparian	Ken Adams
Hymenoptera	Braconidae			Above Dam	Ken Adams
Hymenoptera	Braconidae			Fossil Creek Riparian	Ken Adams
Hymenoptera	Elophidae			Below Dam	Ken Adams
Hymenoptera	Elophidae			Above Dam	Ken Adams
Hymenoptera	Ichneumonidae	Megarhyssa		below fish barrier	Ken Adams
Hymenoptera	Ichneumonidae	Megarhyssa		Above Dam	Ken Adams
Hymenoptera	Ichneumonidae	Megarhyssa		Above Irving	Ken Adams

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Order or Class	Family	Scientific Name	Common Name	Observation Location	Observer
Hymenoptera	Ichneumonidae	Megarhyssa		Purple Mountain	Ken Adams
Hymenoptera	Ichneumonidae	Megarhyssa		Below Dam	Ken Adams
Hymenoptera	Mymaridae			Above Irving	Ken Adams
Hymenoptera	Pompilidae	Pepsis	Trantula hawk	Fossil Creek Riparian	Rich Wiggins
Lepidoptera	Coliadinae		Yellow Sulfur	Fossil Creek Riparian	Rich Wiggins
Lepidoptera	Coliadinae		Yellow Sulfur	Above Irving	Janie Agyagos
Lepidoptera	Crambidae	Eoparagyraetis		Purple Mountain	Ken Adams
Lepidoptera	Crambidae	Eoparagyraetis		Above Irving	Ken Adams
Lepidoptera	Crambidae	Eudonia		Below Dam	Ken Adams
Lepidoptera	Crambidae	Eudonia		Purple Mountain	Ken Adams
Lepidoptera	Crambidae	Eudonia		Above Dam	Ken Adams
Lepidoptera	Crambidae	Eudonia		Above Irving	Ken Adams
Lepidoptera	Crambidae	Eudonia		below fish barrier	Ken Adams
Lepidoptera	Crambidae	Hahncappsia		Purple Mountain	Ken Adams
Lepidoptera	Crambidae	Hahncappsia		Above Dam	Ken Adams
Lepidoptera	Crambidae	Hahncappsia		Below Dam	Ken Adams
Lepidoptera	Crambidae	Herpetogramma		below fish barrier	Ken Adams
Lepidoptera	Crambidae	Herpetogramma		Above Dam	Ken Adams
Lepidoptera	Crambidae	Herpetogramma		Below Dam	Ken Adams
Lepidoptera	Crambidae	Herpetogramma		Above Irving	Ken Adams
Lepidoptera	Crambidae	Herpetogramma		Purple Mountain	Ken Adams

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Order or Class	Family	Scientific Name	Common Name	Observation Location	Observer
Lepidoptera	Crambidae	langessa		below fish barrier	Ken Adams
Lepidoptera	Crambidae	Nascia		Above Irving	Ken Adams
Lepidoptera	Crambidae	Nascia		below fish barrier	Ken Adams
Lepidoptera	Crambidae	Nymphula		Above Irving	Ken Adams
Lepidoptera	Crambidae	Nymphula		Above Dam	Ken Adams
Lepidoptera	Crambidae	Nymphula		below fish barrier	Ken Adams
Lepidoptera	Crambidae	Nymphula		Below Dam	Ken Adams
Lepidoptera	Crambidae	Petrophilia		Below Dam	Ken Adams
Lepidoptera	Crambidae	Petrophilia		Above Irving	Ken Adams
Lepidoptera	Crambidae	Petrophilia		below fish barrier	Ken Adams
Lepidoptera	Crambidae	Petrophilia		Purple Mountain	Ken Adams
Lepidoptera	Crambidae	Petrophilia		Above Dam	Ken Adams
Lepidoptera	Crambidae	Scybalistodes		below fish barrier	Ken Adams
Lepidoptera	Crambidae	Scybalistodes		Above Dam	Ken Adams
Lepidoptera	Crambidae	Scybalistodes		Below Dam	Ken Adams
Lepidoptera	Crambidae	Scybalistodes		Purple Mountain	Ken Adams
Lepidoptera	Crambidae	Scybalistodes		Above Irving	Ken Adams
Lepidoptera	Hesperiidae		Skipper sp.	Fossil Creek Riparian	Rich Wiggins
Lepidoptera	Nymphalidae	Adelpha bredowii	Arizona Sister	Fossil Creek Riparian	Rich Wiggins
Lepidoptera	Nymphalidae	Adelpha bredowii	Arizona Sister	Irving to Sally May	Janie Agyagos
Lepidoptera	Nymphalidae	Danaus gilippus	Queen	Fossil Creek Riparian	Rich Wiggins

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Order or Class	Family	Scientific Name	Common Name	Observation Location	Observer
Lepidoptera	Nymphalidae	Danaus gilippus	Queen	Irving to Sally May	Janie Agyagos
Lepidoptera	Nymphalidae	Juonia coenia	Common Buckeye	Fossil Creek Riparian	Rich Wiggins
Lepidoptera	Nymphalidae	Nymphalis antiopa	Mourning Cloak	Salvage Reach 3 and 4	Janie Agyagos
Lepidoptera	Nymphalidae	Vanessa cardui	Painted Lady	Fossil Creek Riparian	Rich Wiggins
Lepidoptera	Papilionidae	Battus philenor	Pipevine Swallowtail	Irving to Sally May	Janie Agyagos
Lepidoptera	Papilionidae	Battus philenor	Pipevine Swallowtail	Fossil Creek Riparian	Rich Wiggins
Lepidoptera	Pieridae	Colias cesonia	Southern Dogface	Fossil Creek Riparian	Rich Wiggins
Lepidoptera	Pyalidae			Fossil Creek Riparian	Dr. Dean Blinn
Lepidoptera	Pyalidae			Fossil Springs Riparian	Greg Goodwin
Lepidoptera	Pyalidae	Hahncappsia		Above Irving	Ken Adams
Lepidoptera	Pyalidae	Hahncappsia		below fish barrier	Ken Adams
Lepidoptera	Pyalidae	Petrarchila		Below Dam	Jane Marks
Lepidoptera	Pyalidae	Petrarchila		Confluence	Jane Marks
Lepidoptera	Pyalidae	Petrarchila		Above Irving	Jane Marks
Lepidoptera	Pyalidae	Petrophila		Below Irving	Jane Marks
Lepidoptera	Pyalidae	Petrophila		Confluence	Jane Marks
Lepidoptera	Pyalidae	Petrophila		Fossil Springs	Jane Marks
Lepidoptera	Pyalidae	Petrophila		Above Dam	Jane Marks
Lepidoptera	Pyalidae	Pyrausta		Above Irving	Ken Adams
Lepidoptera	Pyalidae	Pyrausta		below fish barrier	Ken Adams
Lepidoptera	Pyalidae	Spoladea		below fish barrier	Ken Adams

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Order or Class	Family	Scientific Name	Common Name	Observation Location	Observer
Lepidoptera	Pyralidae	Spoladea		Above Irving	Ken Adams
Lepidoptera	Pyralididae	Elophila	Caterpillar larvae	Fossil Springs Riparian	Bill Burbridge, Mark Story
Lepidoptera	Saturniidae	Antheraea polyphemous	Glover silk moth	Fossil Creek Riparian	Rich Wiggins
Lepidoptera	Saturniidae	Automeris	Io Moth	Salvage Reach 3 and 4	Janie Agyagos
Lepidoptera	Sphingidae		Tiger sphinx	Fossil Creek Riparian	Rich Wiggins
Lepidoptera	Sphingidae		Virginia sphinx moth	Fossil Creek Riparian	Rich Wiggins
Megaloptera				Fossil Creek Riparian	Steven Overby, Mary Ann
Megaloptera	Corydalidae	Corydalus		Above Dam	Ken Adams
Megaloptera	Corydalidae	Corydalus		below fish barrier	Ken Adams
Megaloptera	Corydalidae	Corydalus		Above Irving	Ken Adams
Megaloptera	Corydalidae	Corydalus		Purple Mountain	Ken Adams
Megaloptera	Corydalidae	Corydalus		Below Dam	Ken Adams
Megaloptera	Corydalidae	Corydalus		Confluence	Jane Marks
Megaloptera	Corydalidae	Corydalus cornutus	Dobsonfly	Fossil Creek Riparian	Jane Marks
Megaloptera	Corydalidae	Corydalus cornutus	Dobsonfly	Fossil Creek Riparian	Rich Wiggins
Megaloptera	Corydalidae	Corydalus texanus		Fossil Springs	Jane Marks
Megaloptera	Corydalidae	Corydalus texanus		Below Irving	Jane Marks
Megaloptera	Corydalidae	Corydalus texanus		Above Dam	Jane Marks
Megaloptera	Corydalidae	Corydalus texanus		Confluence	Jane Marks
Megaloptera	Corydalidae	Corydalus texanus		Below Dam	Jane Marks
Megaloptera	Corydalidae	Corydalus texanus		Above Irving	Jane Marks

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Order or Class	Family	Scientific Name	Common Name	Observation Location	Observer
Neuroptera	Myrmeleontidae	Myrmeleon sp.	Antlion sp.	Fossil Reach 2	Janie Agyagos
Neuroptera	Sisyridae	Climacia		Above Irving	Ken Adams
Odonata		Early Instar		Below Dam	Jane Marks
Odonata		Libellula saturata	Flame Skimmer	Fossil Creek Riparian	Brandon McPhail
Odonata	Anisoptera	Palto thermias	Damsel Fly nymphs	Fossil/Verde Confluence	Mark Story, Bill Burbridge
Odonata	Anisoptera	Paltothermis sp.	Dragonfly Nymph	Fossil Springs Riparian	Bill Burbridge, Mark Story
Odonata	Calopterygidae	Hetaerina americana	American Rubyspot	Fossil Springs Riparian	Janie Agyagos
Odonata	Calopterygidae	Hetaerina americana		Fossil Springs	Jane Marks
Odonata	Calopterygidae	Hetaerina americana		Above Dam	Jane Marks
Odonata	Calopterygidae	Hetaerina americana		Below Irving	Jane Marks
Odonata	Calopterygidae	Hetaerina americana		Below Dam	Jane Marks
Odonata	Calopterygidae	Hetaerina vulnerata		Below Irving	Jane Marks
Odonata	Calopterygidae	Hetaerina vulnerata		Above Dam	Jane Marks
Odonata	Calopterygidae	Hetaerina vulnerata		Below Dam	Jane Marks
Odonata	Calopterygidae	Hetaerina vulnerata		Above Irving	Jane Marks
Odonata	Ceonagrionidae	Agria sp.		Above Dam	Jane Marks
Odonata	Coenagrionidae	Agria lugens		Below Dam	Jane Marks
Odonata	Coenagrionidae	Agria lugens		Fossil Springs	Jane Marks
Odonata	Coenagrionidae	Agria nr. Tibialis		Above Fossil Springs	Jane Marks
Odonata	Coenagrionidae	Agria oenea		Above Dam	Jane Marks
Odonata	Coenagrionidae	Agria oenea		Fossil Springs	Jane Marks

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Order or Class	Family	Scientific Name	Common Name	Observation Location	Observer
Odonata	Coenagrionidae	Agria plana		Above Irving	Jane Marks
Odonata	Coenagrionidae	Agria sedula		Above Fossil Springs	Jane Marks
Odonata	Coenagrionidae	Agria sp.		Confluence	Jane Marks
Odonata	Coenagrionidae	Agria sp.		Fossil Springs	Jane Marks
Odonata	Coenagrionidae	Agria sp.		Above Irving	Jane Marks
Odonata	Coenagrionidae	Agria sp.		Above Dam	Jane Marks
Odonata	Coenagrionidae	Agria sp.		Below Dam	Jane Marks
Odonata	Coenagrionidae	Agria sp.		Above Fossil Springs	Jane Marks
Odonata	Coenagrionidae	Argia lugens		Below Irving	Jane Marks
Odonata	Coenagrionidae	Argia oenea		Confluence	Jane Marks
Odonata	Coenagrionidae	Argia sp.		Below Irving	Jane Marks
Odonata	Coenagrionidae	Enallagma sp.		Above Dam	Jane Marks
Odonata	Coenagrionidae	Enallagma sp.		Below Irving	Jane Marks
Odonata	Coenagrionidae	nehalennia		below fish barrier	Ken Adams
Odonata	Coenagrionidae	nehalennia		Above Dam	Ken Adams
Odonata	Coenagrionidae	nehalennia		Above Irving	Ken Adams
Odonata	Coenagrionidae	nehalennia		Below Dam	Ken Adams
Odonata	Gomphidae	Erpetogomphus designatus		Fossil Springs	Jane Marks
Odonata	Lestidae	Archilestes grandis		Above Fossil Springs	Jane Marks
Odonata	Lestidae	Archilestes grandis		Above Dam	Jane Marks
Odonata	Libellulidae		Damselfly sp.	Fossil Creek Riparian	Rich Wiggins

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Order or Class	Family	Scientific Name	Common Name	Observation Location	Observer
Odonata	Libellulidae	Brechmorhaga mendax		Confluence	Jane Marks
Odonata	Libellulidae	Brechmorhaga mendax		Above Irving	Jane Marks
Odonata	Libellulidae	Brechmorhaga mendax		Above Dam	Jane Marks
Odonata	Libellulidae	Libellula	Skimmer sp.	Fossil Creek Riparian	Rich Wiggins
Odonata	Libellulidae	Libellula pantala		Above Fossil Springs	Jane Marks
Odonata	Libellulidae	Libellula saturata		Above Fossil Springs	Jane Marks
Odonata	Libellulidae	nr.Macromiinae		Above Fossil Springs	Jane Marks
Odonata	Libellulidae	Pseudoleon superbus		Above Fossil Springs	Jane Marks
Odonata	Unknown	Early Instar		Confluence	Jane Marks
Odonata	Unknown	Early Instar		Below Irving	Jane Marks
Odonata	Zygoptera		Damselflies	Fossil Creek Riparian	Steven Overby, Mary Ann
Oligochaeta			Segmented worms	Fossil Creek Riparian	Steven Overby, Mary Ann
Orthoptera	Tettigoniidae		Katydid	Fossil Creek Riparian	Rich Wiggins
Ostracoda		Various spp.		Below Dam	Jane Marks
Ostracoda	hyalella			Fossil Creek Riparian	Dr. Dean Blinn
Ostracoda	hyalella			Fossil Springs Riparian	Greg Goodwin
Ostracoda	Various	Various sp.		Above Irving	Jane Marks
Ostracoda	Various	Various spp.		Fossil Springs	Jane Marks
Ostracoda	Various	Various spp.		Above Dam	Jane Marks
Plecoptera	Capniidae			below fish barrier	Ken Adams
Plecoptera	Capniidae	Capnia sp.		Above Fossil Springs	Jane Marks

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Order or Class	Family	Scientific Name	Common Name	Observation Location	Observer
Plecoptera	Perlodidae	Early Instar		Above Irving	Jane Marks
Trichoptera			Caddisflies	Fossil Creek Riparian	Steven Overby, Mary Ann
Trichoptera	Calamatoceridae	Phylloicus sp.		Fossil Springs	Jane Marks
Trichoptera	Calamatoceridae	Phylloicus sp.		Below Irving	Jane Marks
Trichoptera	Calamatoceridae	Phylloicus sp.		Above Dam	Jane Marks
Trichoptera	Helicipsychiidae	Helicopsyche mexicana		Above Fossil Springs	Jane Marks
Trichoptera	Helicopsychidae	Helicopsyche		Fossil Springs Riparian	Greg Goodwin
Trichoptera	Helicopsychidae	Helicopsyche		Fossil Creek Riparian	Dr. Dean Blinn
Trichoptera	Helicopsychidae	Helicopsyche		below fish barrier	Ken Adams
Trichoptera	Helicopsychidae	Helicopsyche		Above Irving	Ken Adams
Trichoptera	Helicopsychidae	Helicopsyche		Purple Mountain	Ken Adams
Trichoptera	Helicopsychidae	Helicopsyche		Above Dam	Ken Adams
Trichoptera	Helicopsychidae	Helicopsyche		Below Dam	Ken Adams
Trichoptera	Helicipsychiidae	Helicopsyche mexicana		Below Dam	Jane Marks
Trichoptera	Helicipsychiidae	Helicopsyche mexicana		Fossil Springs	Jane Marks
Trichoptera	Hydropsychidae	Ceratopsyche venada		Fossil Springs	Jane Marks
Trichoptera	Hydropsychidae	Ceratopsyche venada		Above Dam	Jane Marks
Trichoptera	Hydropsychidae	Ceratopsyche venada		Above Irving	Jane Marks
Trichoptera	Hydropsychidae	Ceratopsyche venada		Below Dam	Jane Marks
Trichoptera	Hydropsychidae	Ceratopsyche venada		Below Irving	Jane Marks
Trichoptera	Hydropsychidae	Ceratopsyche venada		Confluence	Jane Marks

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Order or Class	Family	Scientific Name	Common Name	Observation Location	Observer
Trichoptera	Hydropsychidae	Cheumatopschye sp.		Below Irving	Jane Marks
Trichoptera	Hydropsychidae	Cheumatopschye sp.		Above Dam	Jane Marks
Trichoptera	Hydropsychidae	Cheumatopschye		Purple Mountain	Ken Adams
Trichoptera	Hydropsychidae	Cheumatopschye		Below Dam	Ken Adams
Trichoptera	Hydropsychidae	Cheumatopschye		Above Dam	Ken Adams
Trichoptera	Hydropsychidae	Cheumatopschye sp.		Confluence	Jane Marks
Trichoptera	Hydropsychidae	Hydropsyche		below fish barrier	Ken Adams
Trichoptera	Hydropsychidae	Hydropsyche		Below Dam	Ken Adams
Trichoptera	Hydropsychidae	Hydropsyche		Above Irving	Ken Adams
Trichoptera	Hydropsychidae	Hydropsyche		Purple Mountain	Ken Adams
Trichoptera	Hydropsychidae	Hydropsyche		Above Dam	Ken Adams
Trichoptera	Hydropsychidae	Hydropsyche	Caddis fly larvae	Fossil/Verde Confluence	Mark Story, Bill Burbridge
Trichoptera	Hydropsychidae	Hydropsyche sp.	Caddisfly larvae	Fossil Springs Riparian	Bill Burbridge, Mark Story
Trichoptera	Hydropsychidae	Leucotrichia limpia		Above Dam	Jane Marks
Trichoptera	Hydropsychidae	Smicridea		Below Dam	Ken Adams
Trichoptera	Hydropsychidae	Smicridea		below fish barrier	Ken Adams
Trichoptera	Hydropsychidae	Smicridea		Above Irving	Ken Adams
Trichoptera	Hydropsychidae	Smicridea		Purple Mountain	Ken Adams
Trichoptera	Hydropsychidae	Smicridea		Above Dam	Ken Adams
Trichoptera	Hydroptilidae	hydroptila		Below Dam	Ken Adams
Trichoptera	Hydroptilidae	hydroptila		Purple Mountain	Ken Adams

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Order or Class	Family	Scientific Name	Common Name	Observation Location	Observer
Trichoptera	Hydroptilidae	hydroptila		below fish barrier	Ken Adams
Trichoptera	Hydroptilidae	hydroptila		Above Dam	Ken Adams
Trichoptera	Hydroptilidae	hydroptila		Above Irving	Ken Adams
Trichoptera	Hydroptilidae	Hydroptila ajax		Below Dam	Jane Marks
Trichoptera	Hydroptilidae	Hydroptila ajax		Fossil Springs	Jane Marks
Trichoptera	Hydroptilidae	Hydroptila ajax		Above Irving	Jane Marks
Trichoptera	Hydroptilidae	Hydroptila ajax		Confluence	Jane Marks
Trichoptera	Hydroptilidae	Hydroptila ajax		Confluence	Jane Marks
Trichoptera	Hydroptilidae	Hydroptila ajax		Below Irving	Jane Marks
Trichoptera	Hydroptilidae	Hydroptila arctia		Above Irving	Jane Marks
Trichoptera	Hydroptilidae	Hydroptila arctia		Below Dam	Jane Marks
Trichoptera	Hydroptilidae	Hydroptila arctia		Confluence	Jane Marks
Trichoptera	Hydroptilidae	Hydroptila arctia		Below Irving	Jane Marks
Trichoptera	Hydroptilidae	Hydroptila arctia		Confluence	Jane Marks
Trichoptera	Hydroptilidae	Hydroptila arctia		Fossil Springs	Jane Marks
Trichoptera	Hydroptilidae	Leucotrichia limpia		Below Dam	Jane Marks
Trichoptera	Hydroptilidae	Mayatrichia sp.		Above Irving	Jane Marks
Trichoptera	Hydroptilidae	Metrichia		Below Dam	Ken Adams
Trichoptera	Hydroptilidae	Metrichia		Above Dam	Ken Adams
Trichoptera	Hydroptilidae	Metrichia		Above Irving	Ken Adams
Trichoptera	Hydroptilidae	metrichia		below fish barrier	Ken Adams

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Order or Class	Family	Scientific Name	Common Name	Observation Location	Observer
Trichoptera	Hydroptilidae	Metrichia nigrutta		Fossil Springs	Jane Marks
Trichoptera	Hydroptilidae	Metrichia nigrutta		Above Dam	Jane Marks
Trichoptera	Hydroptilidae	Metrichia nigrutta		Below Dam	Jane Marks
Trichoptera	Hydroptilidae	Metrichia nigrutta		Confluence	Jane Marks
Trichoptera	Hydroptilidae	Neotrichia		Below Dam	Ken Adams
Trichoptera	Hydroptilidae	Neotrichia		Above Irving	Ken Adams
Trichoptera	Hydroptilidae	Neotrichia		Above Dam	Ken Adams
Trichoptera	Hydroptilidae	Neotrichia		Purple Mountain	Ken Adams
Trichoptera	Hydroptilidae	Neotrichia		below fish barrier	Ken Adams
Trichoptera	Hydroptilidae	Ochrotrichia stylata		Below Dam	Jane Marks
Trichoptera	Leptoceridae	Nectopsyche		Purple Mountain	Ken Adams
Trichoptera	Leptoceridae	Nectopsyche		Above Dam	Ken Adams
Trichoptera	Leptoceridae	Nectopsyche		Below Dam	Ken Adams
Trichoptera	Leptoceridae	Nectopsyche sp.		Below Irving	Jane Marks
Trichoptera	Leptoceridae	Nectopsyche sp.		Below Dam	Jane Marks
Trichoptera	Leptoceridae	Nectopsyche sp.		Confluence	Jane Marks
Trichoptera	Leptoceridae	Oecetis 1		Above Dam	Ken Adams
Trichoptera	Leptoceridae	Oecetis 1		Purple Mountain	Ken Adams
Trichoptera	Leptoceridae	Oecetis 1		Above Irving	Ken Adams
Trichoptera	Leptoceridae	Oecetis 1		Below Dam	Ken Adams
Trichoptera	Leptoceridae	Oecetis 2		Above Irving	Ken Adams

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Trichoptera	Leptoceridae	Oecetis 2		Above Dam	Ken Adams
Trichoptera	Leptoceridae	Oecetis 2		Below Dam	Ken Adams
Trichoptera	Leptoceridae	Oecetis 2		Purple Mountain	Ken Adams
Trichoptera	Limnephilidae	Limnephilus sp.		Above Irving	Jane Marks
Trichoptera	Limnephilidae	Limnephilus sp.		Above Fossil Springs	Jane Marks
Trichoptera	Philopotamidae	Chimarra		below fish barrier	Ken Adams
Trichoptera	Philopotamidae	Chimarra		Below Dam	Ken Adams
Trichoptera	Philopotamidae	Chimarra		Above Irving	Ken Adams
Trichoptera	Philopotamidae	Chimarra		Above Dam	Ken Adams
Trichoptera	Philopotamidae	Chimarra		Purple Mountain	Ken Adams
Trichoptera	Philopotamidae	Chimarra utahensis		Above Dam	Jane Marks
Trichoptera	Philopotamidae	Chimarra utahensis		Above Irving	Jane Marks
Trichoptera	Philopotamidae	Chimarra utahensis		Above Fossil Springs	Jane Marks
Trichoptera	Philopotamidae	Chimarra utahensis		Confluence	Jane Marks
Trichoptera	Philopotamidae	Chimarra utahensis		Confluence	Jane Marks
Trichoptera	Philopotamidae	Chimarra utahensis		Below Dam	Jane Marks
Trichoptera	Philopotamidae	Chimarra utahensis		Below Irving	Jane Marks
Trichoptera	Philopotamidae	Wormaldia		Purple Mountain	Ken Adams
Trichoptera	Philopotamidae	Wormaldia		Above Dam	Ken Adams
Trichoptera	Philopotamidae	Wormaldia		Above Irving	Ken Adams
Trichoptera	Philopotamidae	Wormaldia		Below Dam	Ken Adams

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Order or Class	Family	Scientific Name	Common Name	Observation Location	Observer
Trichoptera	Philopotamidae	Wormaldia		below fish barrier	Ken Adams
Trichoptera	Philopotamidae	Wormaldia sp.		Below Irving	Jane Marks
Trichoptera	Philopotamidae	Wormaldia sp.		Above Dam	Jane Marks
Trichoptera	Phyganeidae	Ptilostomis		Above Irving	Ken Adams
Trichoptera	Polycentropodidae			Fossil Creek Riparian	Dr. Dean Blinn
Trichoptera	Polycentropodidae			Fossil Springs Riparian	Greg Goodwin
Trichoptera	Polycentropodidae	Polycentropus		Purple Mountain	Ken Adams
Trichoptera	Polycentropodidae	Polycentropus		Above Irving	Ken Adams
Trichoptera	Polycentropodidae	Polycentropus		below fish barrier	Ken Adams
Trichoptera	Polycentropodidae	Polycentropus		Below Dam	Ken Adams
Trichoptera	Polycentropodidae	Polycentropus		Above Dam	Ken Adams
Trichoptera	Polycentropodidae	Polycentropus halidus		Above Irving	Jane Marks
Trichoptera	Polycentropodidae	Polycentropus halidus		Below Irving	Jane Marks
Trichoptera	Polycentropodidae	Polycentropus halidus		Above Dam	Jane Marks
Trichoptera	Polycentropodidae	Polycentropus halidus		Below Dam	Jane Marks
Trichoptera	Polycentropodidae	Polypsectropus		Above Dam	Jane Marks
Trichoptera	Psychomyiidae	Tinodes		Above Dam	Jane Marks
Trichoptera	Psychomyiidae	Tinodes		Below Dam	Jane Marks
Trichoptera	Psychomyiidae	Tinodes		Below Dam	Ken Adams
Trichoptera	Psychomyiidae	Tinodes		Above Dam	Ken Adams
Trichoptera	Psychomyiidae	Tinodes		Above Irving	Ken Adams

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Order or Class	Family	Scientific Name	Common Name	Observation Location	Observer
Trichoptera	Tricladia	Dugesia tigrina		Above Dam	Jane Marks
Trichoptera	Tricladia	Dugesia tigrina		Below Dam	Jane Marks
Turbellaria			planaria spp1	Fossil Creek Riparian	Steven Overby, Mary Ann
Turbellaria			Planaria spp2	Fossil Creek Riparian	Steven Overby, Mary Ann
Turbellaria	Tricladia	Dugesia tigrina		Confluence	Jane Marks
Turbellaria	Tricladia	Dugesia tigrina		Fossil Springs	Jane Marks
Turbellaria	Tricladia	Dugesia tigrina		Above Irving	Jane Marks
Zygoptera				Fossil Springs Riparian	Greg Goodwin
			Zygoptera Fossil Creek Riparian Dr. Dean Blinn		

Appendix D: 2003 List of Invasive Species in Fossil Corridor

Scientific Name	Common Name
<i>Aegilops cylindrica</i>	Jointed goatgrass
<i>Ailanthus altissima</i>	Tree-of-heaven
<i>Arundo donax</i>	Giant reed
<i>Avena fatua</i>	Wild Oats
<i>Bromus japonicus</i>	Japanese brome
<i>Bromus madritensis</i>	Foxtail chess
<i>Bromus rigidus</i> , <i>Bromus diandrus</i>	Ripgut brome
<i>Bromus tectorum</i>	Cheatgrass
<i>Capsella bursa-pastoris</i>	Shepherdspurse
<i>Centaurea solstitialis</i>	Yellow starthistle
<i>Chorispora tenella</i>	Blue mustard
<i>Cirsium vulgare</i>	Bull thistle
<i>Cortaderia selloana</i>	Pampas grass
<i>Cynodon dactylon</i>	Bermuda grass
<i>Eragrostis lehmanniana</i>	Lehmann's lovegrass
<i>Erodium cicutarium</i>	Redstem filaree
<i>Festuca arundinacea</i>	Tall fescue
<i>Gleditsia triacanthos</i>	Honeylocust
<i>Hordeum (leporinum) marinum</i>	Mediterranean barley (Hare barley)
<i>Iris</i>	Iris
<i>Lactuca serriola</i>	Prickly lettuce
<i>Lamium amplexicaule</i>	Dead nettle, henbit
<i>Lathyrus latifolius</i>	Perennial sweetpea
<i>Malva parviflora</i>	Cheeseweed, little mallow
<i>Marrubium vulgare</i>	Horehound
<i>Medicago polymorpha</i>	Burclover
<i>Melilotus officinalis</i>	Sweetclover
<i>Phalaris minor</i>	Littleseed canarygrass
<i>Plantago major</i>	Common plantain, broadleaf plantain
<i>Prunella vulgaris</i>	Selfheal
<i>Rubus procerus</i>	Himalayan Blackberry
<i>Salsola kali</i>	Russian thistle
<i>Silverleaf nightshade</i>	<i>Solanum eleagnifolium</i>
<i>Sisymbrium altissimum</i>	Tumble mustard
<i>Sisymbrium irio</i>	London rocket
<i>Sonchus asper</i>	Spiny sowthistle
<i>Sonchus oleraceus</i>	Sowthistle
<i>Sorghum halepense</i>	Johnson grass
<i>Tamarix ramosissima</i>	Tamarisk, Salt cedar
<i>Tragopogon dubius</i>	Western salsify
<i>Ulmus pumila</i>	Siberian elm
<i>Vinca major</i>	Greater periwinkle

Appendix E Threatened, Endangered, and Sensitive Species List for the Fossil Creek Wild and Scenic River Corridor

Species Name	Species Status			No Suitable Habitat	Suitable Habitat Present	Suitable Habitat Occupied
	Federal	State	Forest Service			
Mammals						
Western Red Bat, <i>Lasiurus blossevillii</i>	--	1B	Sen			X
Spotted Bat, <i>Euderma maculatum</i>	--	1B	Sen		X	
Allen's lappet-browed Bat, <i>Idionycteris phyllotis</i>	--	1B	Sen			X
Pale Townsend's Big-eared Bat, <i>Corynorhinus townsendii pallescens</i>	--	1B	Sen			X
Birds						
Southwestern willow flycatcher, <i>Empidonax traillii extimus</i>	E	1A	--		N,F,M	
Mexican Spotted Owl, <i>Strix occidentalis lucida</i>	T	1A	--	N	F, W, M	
Yuma Clapper Rail, <i>Rallus longirostris yumanensis</i>	E	1A	--	X		
Western Yellow-billed Cuckoo, <i>Coccyzus americanus occidentalis</i>	T	1A	Sen		N,F,M	
Bald Eagle, <i>Haliaeetus leucocephalus</i>	--	1A	Sen		N,F,W	
American Peregrine Falcon, <i>Falco peregrinus anatum</i>	--	1A	Sen			N,F,W
Northern Goshawk, <i>Accipiter gentilis</i>	--	1B	Sen	X		
Burrowing Owl, <i>Athene cunicularia</i>	--	1B	Sen	X		
Yellow-eyed Junco, <i>Juno phaeonotus</i>	--	1B	Sen	X		
Reptiles and Amphibians						
Chiricahua Leopard Frog, <i>Rana chiricauhuensis</i>	T	1A	--			Out of corridor, but in 5 th code watershed
Lowland Leopard Frog, <i>Rana yavapaiensis</i>	--	1A	Sen			X
Northern Leopard Frog, <i>Rana pipiens</i>	--	1A	Sen	X		
Western Barking Frog, <i>Eleutherodactylus augusti cactorum</i>	--	1B	Sen	X		
Narrow-headed Gartersnake, <i>Thamnophis rufipunctatus</i>	T	1A	Sen		X	
Northern Mexican Gartersnake, <i>Thamnophis eques megalops</i>	T	1A	Sen		X	
Bezy's Night Lizard, <i>Xantusia bezyi</i>	--	1B	Sen	X		
Morafka's Desert Tortoise, (<i>Gopherus morafkai</i>)	C	1A	Sen	X		
Fish						
Colorado Pikeminnow, <i>Ptychocheilus lucius</i>	E	1A	--			X
Razorback sucker, <i>Xyrauchen texanus</i>	E	1A	--			X, CH
Loach Minnow, <i>Tiaroga cobitis</i>	E	1A	--			X, CH
Spikedace, <i>Meda fulgida</i>	E	1A	--			X, CH
Gila Chub, <i>Gila intermedia</i>	E	1A	--	X		
Gila Trout, <i>Oncorhynchus gilae gilae</i>	T	1A	--	X		
Gila Topminnow, <i>Poeciliopsis occidentalis</i>	E	1A	--			X
Headwater Chub, <i>Gila nigra</i>	C	1A	Sen			X

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Roundtail Chub, <i>Gila robusta</i>	C	1A	Sen			X
Sonora Sucker, <i>Catostomus insignis</i>	--	1B	Sen			X
Desert Sucker, <i>Catostomus clarki</i>	--	1B	Sen			X
Invertebrates						
A Mayfly, <i>Moribaetis mimbresaurus</i>	--	--	Sen	X		
A Mayfly, <i>Fallceon eatoni</i>	--	--	Sen	X		
A Caddisfly, <i>Lepidostoma knulli</i>	--	--	Sen	X		
Netwing Midge, <i>Agathon arizonicus</i>	--	--	Sen	X		
Balmorhea Saddle-case Caddisfly, <i>Protoptila balmorhea</i>	--	--	Sen			X
A Caddisfly, <i>Wormaldia planae</i>	--	--	Sen			X
Parker's Cylloepus Riffle Beetle, <i>Cylloepus parkeri</i>	--	--	Sen	X		
Snails						
Fossil Springsnail, <i>Pyrgulopsis simplex</i>	--	1A	Sen			X
Page Springsnail, <i>Pyrgulopsis morrisoni</i>	C	1A	Sen	X		
Clams						
California Floater, <i>Anodonta californiensis</i>	--	1A	Sen		X	H
Plants						
Arizona Cliffrose, <i>Purshia subintegra</i>	T	--	--	X		
Tonto Basin Agave, <i>Agave delamateri</i>	--	--	Sen	X		
Phillips' Agave, <i>Agave phillipsiana</i>	--	--	Sen	X		
Sacred Mountain Agave, <i>Agave verdensis</i>	--	--	Sen	X		
Page Springs Agave, <i>Agave yavapaiensis</i>	--	--	Sen	X		
Mt. Dellenbaugh Sandwort, <i>Arenaria aberrans</i>	--	--	Sen	X		
Rusby's Milkvetch, <i>Astragalus rusbyi</i>	--	--	Sen	X		
Cochise Sedge, <i>Carex ultra</i>	--	--	Sen			X
Arizona Bugbane, <i>Cimicifuga arizonica</i>	--	--	Sen	X		
Metcalfe's Tick-trefoil, <i>Desmodium metcalfei</i>	--	--	Sen			X
Rock Fleabane, <i>Erigeron saxatilis</i>	--	--	Sen		X	
Heathleaf Wild Buckwheat, <i>Eriogonum ericifolium</i> var. <i>ericifolium</i>	--	--	Sen	X		
Ripley Wild Buckwheat, <i>Eriogonum ripleyi</i>	--	--	Sen	X		
Flagstaff Pennyroyal, <i>Hedeoma diffusum</i>	--	--	Sen	X		
Eastwood Alum Root, <i>Heuchera eastwoodiae</i>	--	--	Sen	X		
Verde Breadroot, <i>Pedimelum verdiensis</i>	--	--	Sen	X		
Lyngholm's Brakefern, <i>Pellaea lyngholmii</i>	--	--	Sen	X		
Arizona Phlox, <i>Phlox amabilis</i>	--	--	Sen		X	
Alcove Bog Orchid, <i>Platanthera zothecina</i>	--	--	Sen	X		
Hualapai Milkwort, <i>Polygala rusbyi</i>	--	--	Sen	X		
Erter's Rose, <i>Rosa woodsii</i> var. <i>erterae</i>	--	--	Sen	X		
Mearns Sage, <i>Salvia dorrii</i> spp. <i>mearnsii</i>	--	--	Sen	X		
Blumer's Dock, <i>Rumex orthoneurus</i>	--	--	Sen	X		
Fish Creek Fleabane, <i>Erigeron piscaticus</i>	--	--	Sen	X		

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Mogollon Fleabane, <i>Erigeron anchana</i>	--	--	Sen	X		
Toumey Groundsel, <i>Packera neomexicana</i> var. <i>toumeyii</i>	--	--	Sen	X		
Pima Indian Mallow, <i>Abutilon parishii</i>	--	--	Sen	X		
Fish Creek Rockdaisy, <i>Perityle saxicola</i>	--	--	Sen	X		
Salt River Rockdaisy, <i>Perityle gilensis</i> var. <i>salensis</i>	--	--	Sen	X		
Arizona Alumroost, <i>Heuchera glomerulata</i>	--	--	Sen	X		
Galiuro Sage, <i>Salvia amissa</i>	--	--	Sen	X		
Chihuahuan Sedge, <i>Carex chihuahuensis</i>	--	--	Sen	X		
Mapleleaf False Snapdragon, <i>Mabrya acerifolia</i>	--	--	Sen	X		
Horseshoe Deer Vetch, <i>Lotus mearnsii</i> var. <i>equisolensis</i>	--	--	Sen	X		
Aravaipa Woodfern, <i>Thelypteris puberula</i> var. <i>sonorensis</i>	--	--	Sen	X		

Table Legend:

E = Federally Endangered **T** = Federally Threatened **C** = Federal Candidate **P** = Proposed Candidate **Tier 1A** = State Species of Greatest Conservation Need
Tier 1B = State Species of Greatest Conservation Need **Sen** = Forest Service Sensitive **F** = Foraging **N** = Nesting
H = Historic **S** = Spawning **M** = Migration **R** = Roosting **W** = Wintering **O** = Occupied **X** = Suitable
Habitat Not Present/Present **CR** = Critical habitat

Appendix F: Comprehensive River Management Plan Management Direction

Desired conditions (or goals) set forth the desired social, economic, and ecological goals of Fossil Creek. They attempt to paint a picture of what we (the public and the Forest Service) desire the WSR corridor to look like or the goods and services we desire it to provide. Desired conditions are generally expressed in broad, general terms; however, more specificity may be added to clarify the intent. Desired conditions are timeless in that there is no specific date by which they are to be completed. They are aspirations and not commitments or final decisions that approve projects or activities, and they may only be achievable over a long timeframe. In some cases, a desired condition matches the current condition, so the goal is to maintain the current condition.

Projects and site-specific activities must be consistent with desired conditions. Project documentation should explain how the project or activity is consistent with desired conditions and describe any short-term or negligible long-term adverse effects the project may have concerning the maintenance or attainment of any desired condition. Projects that conflict with desired conditions would require a plan amendment.

To be consistent with the desired conditions outlined in the CRMP, a project or activity, when assessed at the appropriate spatial scale, must be designed to meet one or more of the following conditions:

- Maintain or make progress toward one or more of the desired conditions of a plan without adversely affecting progress toward, or maintenance of, other desired conditions; or
- Be neutral with regard to progress toward plan desired conditions; or
- Maintain or make progress toward one or more of the desired conditions over the long term, even if the project or activity would adversely affect progress toward or maintenance of one or more desired conditions in the short term; or
- Maintain or make progress toward one or more of the desired conditions over the long term, even if the project or activity would adversely affect progress toward other desired conditions in a negligible way over the long term.

Standards are constraints upon project and activity design. A standard is an absolute requirement to be met in the design of projects and activities. A project or activity is consistent with a standard when its design is in accord with the explicit provisions of the standard; variance from a standard is not allowed except by plan amendment.

Guidelines are sideboards that guide management activities and provide specifications that a project or activity would adopt unless there is a compelling or defensible reason to vary from the guideline. Unlike a standard, deviation from the explicit provisions of the guideline is permitted without a plan amendment, as long as the intent of a guideline is met. Deviation from the explicit provisions of a guideline, if it is meeting the intent of the guideline, must be documented in the project record. Projects that deviate from a guideline's intent must be accompanied by a plan amendment that would allow for the deviation.

Objectives are concise, time-specific statements of measurable, anticipated results that help achieve or move toward desired conditions over the life of the plan. Objectives are projections based on recent trends, current and anticipated staffing levels, and anticipated budgets. Activities specified in objectives are intended to help make progress toward achieving desired conditions and represent just some of the outcomes or actions expected to accomplish movement toward desired conditions. Not every action or objective the Forest Service may undertake is identified in the plan, just the primary ones.

Objectives may be exceeded or not fully achieved based on changes in environmental conditions, budgets, and other factors during the plan period, which may result in a need to re-evaluate plan objectives. Objectives are not decisions that authorize specific actions in specific locations; project-level planning and decisions are used to authorize specific actions in specific locations. Objectives are not targets, nor are objectives intended to be

limitations on management activities. For example, an objective would not restrict the amount of treatment that can occur or the type of treatment that can be used.

To support plan components, **management approaches** help clarify how plan direction may be applied and identify probable management actions that are designed to maintain or make progress toward desired conditions and objectives. Management approaches describe the priorities and expectations for future program coordination. Partnerships and collaborative arrangements may also be included as part of the management approaches for accomplishing desired conditions. Management approaches are strongly influenced by recent trends, past experiences, anticipated staffing levels, and short-term budgets. Decisions about what projects are actually proposed and approved, as well as details of project design, are determined by public involvement, science, and professional experience at the project or activity level.

Management Direction for the Fossil Creek Wild and Scenic River

This section provides management direction for the Fossil Creek Wild and Scenic River. While some direction applies generally across the corridor, most is organized by resource area or use. Management direction is common to all action alternatives (B through F), unless noted otherwise in **bold text**. Most management direction applies both to the recreational segment and the two wild segments that comprise the Fossil Creek corridor. When direction applies only to the wild segments or recreational segment, this is noted in **bold text**.

Interpretation and Education

Desired Conditions for Interpretation and Education

Environmental education and interpretation enhance public enjoyment of Fossil Creek, help visitors learn first-hand about the natural processes and cultural features that make Fossil Creek special, and support protection and enhancement of river values. Well-designed environmental messaging instills in visitors an active stewardship ethic, builds a connection between visitors and the natural world, and instills the importance of natural areas for present and future generations.

The Fossil Creek corridor provides a setting for tribal youth education related to culture, history, and land stewardship, and for the exchange of information between tribal elders and youth.

Interpretive information in multiple languages is available at recreation sites, with topics that may include:

- The native plants, wildlife, fish, and aquatic species and their habitats present in and around Fossil Creek, particularly special-status species such as black-hawks, lowland leopard frogs, native fish, and Fossil springsnail. This knowledge encourages visitors to minimize disturbance of native species.
- The impacts of disease and non-native plant, fish, and aquatic species on ecosystems and how to prevent their introduction and spread.
- The prehistory, history, and contemporary tribal values associated with Fossil Creek. Information about archaeological site etiquette is readily available, and visitors gain an understanding of the tribal cultural history of the area, learning about tribal values and the importance of the corridor to living tribes and the need to approach Fossil Creek with respect. Information is available about the development, use, and decommissioning of the Childs/Irving power system, including how the Apache/Yavapai people were part of, and affected by, the power system.
- Resource protection related to visitor behavior, such as wilderness self-reliance; minimizing unauthorized trails; tree protection; not feeding wildlife; Leave No Trace; Pack-It-In, Pack-It-Out; and proper disposal of trash, human waste, ant killer, food remains, soap, oil, and other cooking wastes.
- The Wild and Scenic Rivers Act and national wild and scenic rivers system.

- Other topics related to Fossil Creek’s river values and regionally-unique features, such as the Fossil Springs Botanical Area, geology/travertine, water processes, night sky, nocturnal species, wilderness, wild and scenic rivers, and Fossil Creek’s designation as an Outstanding Arizona Water.
- Restoration activities and their role in promoting ecosystem function.

Guidelines for Interpretation and Education

Any commercial uses (such as tours) of heritage-based sites should be limited to activities that are consistent with tribal interests, enhance the public’s understanding of the resource, and protect or enhance the resource.

Management Approach for Interpretation and Education

Develop an interpretive plan for the Fossil Creek corridor as soon as possible after plan approval.

Use interpretative signage near the travertine dam formation reaches of Fossil Creek to describe the travertine dam depositional processes and explain how travertine dams have shaped the geomorphology and biology of Fossil Creek. Travertine interpretation is meant to protect and enhance travertine as a key component of the geology river value. Collaborative relationships for stewardship, protection, user community learning, and site design planning (such as for kayak put in/take out) can be used to protect and enhance travertine formations.

Environmental education activities related to biological resources may include snorkeling/snooping, wading, fishing, scenery viewing, hiking, wildlife viewing, bird watching, plant identification, and boating.

Interpret cultural resources in partnership with the Yavapai-Apache Nation.

Provide interpretation related to Forest Service-supported and citizen science projects by youth and adults.

Outfitter and guide services may augment Forest Service and tribal public education efforts.

Provide interpretation using various types of media and in multiple languages. Emphasize portable components and adaptability to allow for maximum flexibility of use and location. Focus interpretation and education programs around facilities such as interpretive trails, viewing platforms, displays, signs, and audio hiking tours. Scheduled public tours and outreach programs may serve as methods of public engagement.