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Draft Environmental Assessment

Fossil Creek Range Allotment

Red Rock Ranger District, Coconino National Forest
Yavapai and Coconino County, Arizona

Township 11North, Range 6 East, Sections 1-4; 11-12
Township 11½ North, Range 7 East Sections 20-21
Township 12 North, Range 6 East, Sections13-14; 22-27; 33-36
Township 12North, Range 6½ East, Sections 1; 13; 24-25; 36
Township 12 North, Range 7 East, Sections 1-22; 28-31
Township 12 North, Range 8 East, Sections 6-7
Township 12½ North, Range 6 East, Sections 34-35
Township 13 North, Range 6 East, Sections 17-21; 23-29; 32-36
Township 13 North, Range 7 East, Sections 14-15; 19-36
Township 13 North, Range 8 East, Sections 18-20; 29-32

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Chapter 1 – Purpose and Need for Action

Introduction

This Environmental Assessment (EA) describes a Forest Service proposal to authorize grazing on the Fossil Creek Range Allotment located on the Red Rock Ranger District of the Coconino National Forest. The Forest Service has prepared this EA in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This EA discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives.

Federal actions such as the authorization of grazing must be analyzed to determine potential environmental consequences pursuant to the National Environmental Policy Act of 1969 (NEPA) and the Rescission Act (P.L 104-19, 1995). The Council on Environmental Quality regulations define an environmental assessment as a "concise public document" that "shall include brief discussions" of the need for the proposal, alternatives to the proposal, discussion of environmental effects based on the substantive issues, and a listing of agencies and persons consulted (40 CFR 1508.9). In order to meet the intent of the regulations with respect to "concise" and "brief", the text of this environmental assessment will contain references to the contents of the analysis record whenever possible. Throughout this EA, references to supporting documentation are shown in parentheses. For example, a reference "(PR# 21)" would indicate that a specific passage in the EA is linked to information contained in document No. 21 in the project record. Supporting documentation, including more detailed analyses of project-area resources, may be found in the project planning record located at the Blue Ridge Ranger Station on the Mogollon Rim Ranger District in Happy Jack, Arizona.

Document Structure

The environmental analysis document is organized into four parts:

- *Chapter 1. Purpose and Need for Action:* The section includes information on the history of the project proposal, the purpose of and need for the project, and the agency's proposal for achieving that purpose and need. This section also details how the Forest Service informed the public of the proposal and how the public responded.
- *Chapter 2. Proposed Action and Alternatives:* This section provides a more detailed description of the agency's proposed action as well as alternative methods for achieving the stated purpose. These alternatives were developed based on significant issues raised during scoping. This discussion includes possible mitigation measures and provides a comparison of the alternatives.
- *Chapter 3. Affected Environment and Environmental Consequences:* This chapter describes the environmental consequences or effects of implementing the proposed action and other alternatives.
- *Chapter 4. Monitoring and Adaptive Management:* This chapter describes the type of monitoring that would occur under all action alternatives during the life of the decision.

- *Chapter 5. Consultation and Coordination:* This section provides a list of preparers and agencies consulted during the development of the environmental assessment.
- *Appendices:* The appendices provide more detailed information to support the analyses presented in the environmental assessment.

Project Background

Location and Setting

The Fossil Creek Allotment is located on the Red Rock Ranger District approximately 5 to 15 miles southeast of Camp Verde and is roughly bounded by Highway 260 on the north and Fossil Creek on the east (Figures 1 and 2). Elevations range from approximately 3,000 feet to 6,300 feet and vegetation adheres to typical elevation regimes; ponderosa pine stringers are present at the highest elevations, pinyon/juniper woodlands and chaparral dominate the mid-elevations, and semi-desert grassland/desert scrub vegetation types are typical at the lower elevations. The legal location of the project area is listed on the cover of the EA. The area within the allotment boundary is referred to as the *project area* in the EA.

Grazing Management

The Fossil Creek Allotment is approximately 42,200 acres in size, divided into 31 main grazing pastures (Table 1, and Figure 2). The allotment also contains 26 small livestock management pastures and water lots (Table 2). Most of the main grazing pastures are separated by either barbed wire or electric fences; however some pastures are not fenced and location of livestock in these pastures depends on herding. (PR#15, 143)

Table 1. Fossil Creek Range Allotment Pastures

Pasture	Acres	Pasture	Acres	Pasture	Acres	Pasture	Acres
13 Mile Ridge	554	Funnel	846	Mud Tank	2202	Stehr Lake	1605
Barry	157	Grass Patch	1173	Natural North	393	Surge	1382
Basin	1465	Heifer	580	Natural South	331	Sycamore Canyon	2208
Boulder	2681	Hog Back	1531	Pine	1745	Tanque Aloma	801
Bull	2169	House	1537	Sally Mae	3646	Tin Can	1634
Chalk Springs	2690	Lower Eds Point	815	Salmon Lake North	280	Upper Eds Point	1400
Doe Skin	393	Lower Wilderness	1218	Salmon Lake South	524	Upper Wilderness	2680
Dorens Defeat	1504	Manzanita	1049	Shipping 1	715		

Figure 2. Fossil Creek Range Allotment Location Map

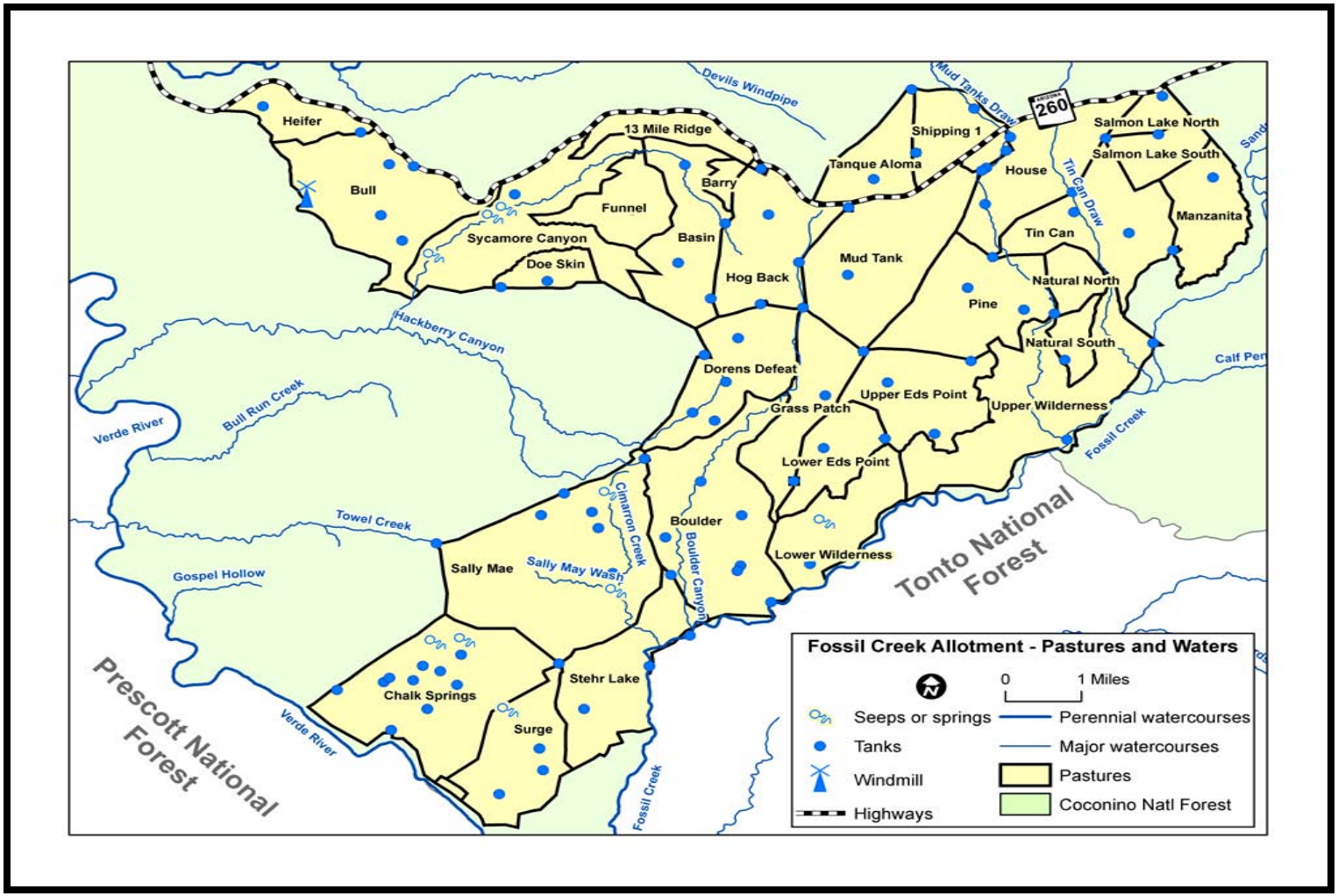


Table 2. Fossil Creek Range Allotment Waterlots

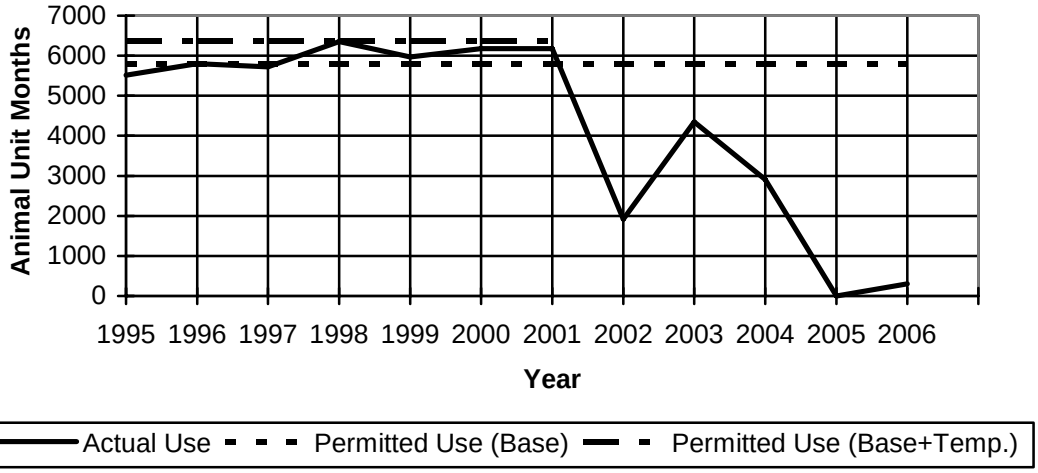
Waterlot	Acres	Waterlot	Acres	Waterlot	Acres
Buckskin Waterlot	1	Gnat Waterlot	3	Ninemile Waterlot	1
Buzzard Waterlot	2	Good Enough Waterlot	2	Oak Waterlot	2
Cedar Waterlot	4	Herbies Waterlot	2	Peak Waterlot	4
Charleys Waterlot	4	Hogback Waterlot	18	Petes Waterlot	2
Childs Holding	38	Middle Waterlot	3	Rafter Holding	126
Divide Waterlot	6	Mud Waterlot	6	Road Waterlot	4
Doe Skin Waterlot	2	Natural Waterlot	3	Sheep Corral Waterlot	1
Eds Waterlot	7	Needed Waterlot	3	Sycamore Basin Waterlot	2
Ernies Waterlot	2				

Permitted livestock are typically run in four separate herds: a cow herd; two heifer herds (yearlings and 2-year olds); and a bull herd. Fall round-up and shipping of stock to market occurs annually in late October. (PR#143)

The grazing system currently used is an intensive deferred-rest rotation management strategy and has been in place on the allotment since 1991. The current season of use is yearlong and the current permitted livestock numbers are 477 head of adult livestock and 6 horses. This permitted use equates to 5,796 Animal Unit Months (AUM's). From 1984 to 2002, annual temporary grazing permits were issued to increase the permitted use by 48 head; this resulted in a permitted use of 6,372 AUM's. Actual use on the Fossil Creek Allotment over the past twelve years is shown in Figure 3. Actual use averaged 93.5% of permitted numbers from 1995 to 2001 with reductions in stocking level primarily in response to operational requirements and dry years. In response to drought conditions, actual use was reduced from 2002 to 2006 and livestock were completely removed from the allotment from June 20, 2002 to February 28, 2003 and from October 31, 2004 to October 31, 2006. (PR#143)

Trailing of livestock across the Fossil Creek allotment has occurred historically. The adjacent Hackberry and Pivot Rock allotments are operated as a yearlong permit with the Hackberry allotment used for winter grazing and the Pivot Rock allotment used during the summer. The Fossil Creek allotment lies between these two allotments and livestock from the Hackberry and Pivot Rock allotments have been trailed across the Fossil Creek in the spring and fall. The livestock are typically trailed from Pivot Rock Allotment to the Hackberry Allotment through the Fossil Creek Allotment in one day. However, there have been occurrences of remnant Hackberry/Pivot Rock livestock remaining on the Fossil Creek allotment for several weeks. (PR#143)

Figure 3: Fossil Creek Allotment Actual Use and Permitted Use; 1995 to 2006. Data table is below graph. (PR#143)



Animal Unit Months	Year											
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Actual Use	5515	5801	5724	6354	5973	6179	6179	1915	4350	2912	0	300
Permitted Use (Base)	5796	5796	5796	5796	5796	5796	5796	5796	5796	5796	5796	5796
Permitted Use (Base +Temp)	6372	6372	6372	6372	6372	6372	6372	6372	NA	NA	NA	NA

Following Forest Service Handbook 2209.13 92.31, current management will not be analyzed in detail as a separate alternative because the current management does not meet the Purpose and Need for Action and Forest Plan Standards and guidelines[1].

Purpose and Need for Action

The Fossil Creek Allotment is scheduled for an environmental analysis of grazing use on the Coconino National Forest, as required by the Burns Amendment (1995). This analysis is required in order to ensure that livestock grazing is consistent with goals, objectives, and the standards and guidelines of the Coconino National Forest Plan[2] (1987, as amended).

[1] FSH 2209.13 92.31 – "Current management should also be analyzed in detail as an alternative to the proposed action if current management meets the stated purpose and need for action."
[2] Where consistent with the goals, objectives, standards and guidelines of Forest Plans, it is Forest Service policy to make forage from lands suitable for grazing available to qualified livestock operators Authority to manage National Forest System (NFS) rangeland resources is derived from laws enacted by Congress that authorize the Secretary of Agriculture to administer NFS lands and issue necessary regulations. Summaries of these laws and regulations are found in the Forest Service Manual (FSM) Chapter 2201. Forest Service objectives and policies for rangeland management are found in FSM 2202 and 2203.

The purpose of this project is to authorize livestock grazing in a manner that maintains and/or moves the area toward Forest Plan objectives and desired conditions. There is a need for change from the current management as the allotment is not meeting or moving toward desired conditions in an acceptable timeframe. Specific desired conditions that are not being met include: vegetation condition, soil condition and riparian and wildlife habitat conditions at certain earthen tanks, springs, and creeks.

There is a need to improve vegetative conditions and trends on the allotment. Vegetative conditions have declined at 60% of the permanent vegetation monitoring plots and a downward trend is indicated at 87% of the plots. This is evidenced by a reduction in ground cover (vegetation and litter), a reduction in perennial grasses (primarily cool-season grass species), and an increase in unpalatable shrub species. In some areas, the reduction in ground cover and perennial grasses is due to encroachment of pinyon-juniper. Impacts from the drought period from 1998 to the present, coupled with current management of livestock grazing, are believed to be the significant factors in the decline in vegetation conditions. (PR#143)

There is a need to improve soil conditions towards satisfactory conditions on the allotment. Soil conditions on the allotment have declined to where about 56% of the allotment is in impaired or unsatisfactory condition. (PR#133).

Soil and vegetative conditions are interrelated. Soil conditions vary and are directly related to the amount of protective litter and vegetative basal area cover present and the vegetative composition which in turn, affects erosion and nutrient cycling. Improving soil and vegetation conditions therefore would also reduce erosion and improve nutrient cycling. (PR#133).

There is a need to improve about 2.7 miles of riparian streams toward proper functioning conditions, and to improve riparian conditions at springs in the allotment. Grazing pressure and trampling have reduced the amounts of woody vegetation and other riparian plant species along several stream reaches and springs such as Sally May Wash and Sally May Springs. Several stock tanks that are important to wildlife are similarly affected. (PR#31, 34, 47, 115, 133)

There is a need to improve the habitat conditions for various wildlife, leopard frogs and other threatened and endangered species at several stock tanks and at other springs or riparian areas in the allotment. Livestock grazing at stock tanks, springs, and creeks can cause trampling and removal of aquatic and riparian vegetation, disturbance to the active stream and channel banks, increased sedimentation, decreased water quality and quantity, and disturbance to riparian dependent wildlife and their habitat requirements. (PR# 139)

Desired Conditions

Soil and Vegetative Conditions:

- Soil stability is satisfactory with soil loss below tolerance, and no visible signs of accelerated erosion

- Surface hydrologic soil condition in satisfactory condition
- Soil nutrient cycling in satisfactory condition
- Vegetative ground cover improving and moving toward potential natural conditions
- Vegetative composition improving and moving towards Potential Plant Community.

Leopard frogs and other important wildlife that occupy or use habitat at earthen tanks, springs and other riparian areas

- Upland condition around tanks: Grass cover, soil litter, and residual forage will be maintained in the immediate uplands around occupied and recently occupied sites.
- Aquatic habitat: Emergent, submergent, and floating aquatic vegetation as well as bank side vegetation is present to provide substrate for egg masses to adhere to and hiding cover for all frog life stages.
- Diseases: Avoid the spread of chytrid to aquatic systems.
- Drought: Water in specific tanks will be retained for wildlife during periods of drought.

Objectives and Measures

The following objectives and measures would meet the desired conditions for soil and vegetative conditions on the allotment:

- Improve vegetative composition towards 2/3 of Potential Plant Community by Terrestrial Ecosystem Survey (TES) map unit. The number of species present at any one time will be variable depending on moisture conditions within next 10 years.
- Improve vegetative cover to a minimum of 2/3 of potential as defined by TES map unit, as evidenced by an effective ground cover (where achievable) averaging between a minimum of 13% to 20% within the next 10 years.

The following objectives and measures would meet the desired conditions for leopard frogs and other important wildlife that occupy or use habitat at earthen tanks, springs and other riparian areas.

- Improve forage conditions around sites that have occupied or potential habitat for wildlife at tanks, springs and riparian areas.
- Improve habitat conditions at tanks, springs and riparian areas.
- Strict adherence to disease prevention protocol.
- Identify critical water tanks for wildlife and leave water in stock tanks for wildlife use after livestock have been removed from the grazing unit.

Proposed Action

The Red Rock Ranger District proposes to authorize year-long grazing on the Fossil Creek Allotment with a maximum of 5,800 Animal Unit Months (AUMs) which is the equivalent of 483 Animal Units (AUs) for a 12 month period. This is the maximum number of AUMs that can be supported during times of favorable climate once the desired conditions for vegetation and soil have been reached. Current conditions will not

support this level of grazing. Livestock numbers will be permitted and authorized at a lower level until such time as conditions improve. Grazing will occur through a rotational management system (either deferred or rest-rotation grazing) which will allow for plant growth and recovery. A management guideline of conservative use (30-40% forage utilization as measured at the end of the growing season) will be employed to maintain or improve rangeland vegetation and long term soil productivity.

The five components of the Proposed Action: authorization, improvements, monitoring, adaptive management, and resource protection measures, are described in detail in Chapter 2 of the EA.

Management Direction

This action responds to the goals and objectives outlined in the 1987 Coconino National Forest Plan (Forest Plan) and all subsequent amendments. The Forest Plan provides direction for all resource management programs, practices, uses, and protection measures on the Forest. Management Areas 1, 2, 4, 6, 7, 8, 10, 11, and 12 are included within the analysis area (PR#33, 65). Range management and livestock grazing are a management emphasis on 98% of the acres within the allotment/project area. The proposed action and alternatives are consistent with the Forest Plan as amended and management direction contained in it (PR#196).

Table 3. Management Areas within the Fossil Creek Range Allotment, and Forest Plan Emphasis

Management Area	Acres	Coconino Forest Plan Emphasis
MA 1: Wilderness	3,399	Fossil Springs Wilderness Emphasize wilderness recreation and watershed condition while maintaining wilderness resource values. Manage grazing under Congressional guidelines for grazing in wilderness. Livestock grazing presently occurs in portions of all the wildernesses except Strawberry Crater. (FP Amendment 3, page 105)
MA 2: Verde Scenic River	293	Maintain the Wild & Scenic River outstandingly remarkable values (ORV's) for scenic, fish, wildlife, and historic and cultural values, while also protecting the river's free-flowing character. The CRMP describes in further detail the Wild and Scenic Rivers legislation and the details of the ORV's for this River. The Act also requires that the Wild & Scenic River must first be administered in such a manner as to protect and enhance the river's values, and second to allow other uses that do not interfere with public use and enjoyment of those river values. Protection and enhancement of the specific outstandingly remarkable values and water quality within the VWSR provides the foundation upon which all management actions and authorizations of uses are based. (FP Amendment 19, page 113-114)
MA 4: Timber lands on greater than 40% slope	133	Emphasize wildlife habitat, watershed condition, and dispersed recreation. Management intensity is low. (FP Amendment 15, replacement page 139)
MA 6: Unsuitable timber lands	135	Emphasize a combination of wildlife habitat, watershed condition, and livestock grazing. Other resources are managed in harmony with the emphasized resources. (FP Amendment 12, replacement page 145)
MA 7: Pinyon-juniper lands on less than 40% slope	11,081	Emphasize firewood production, watershed condition, wildlife habitat, and livestock grazing. Other resources are managed in harmony with the emphasized resources. (FP Amendment 12, replacement page 148)
MA 8: Pinyon-juniper lands on greater than 40% slope	143	Emphasize wildlife habitat, watershed condition, and dispersed recreation. Management intensity is low. (FP Amendment 15, replacement page 139)
MA 10: Transition grassland and pinyon-juniper above	5,727	Emphasize range management, watershed condition, and wildlife habitat. Other resources are managed to improve outputs and quality. Emphasis is on prescribed burning to achieve management objectives. (FP Amendment 11, replacement page 162)

Management Area	Acres	Coconino Forest Plan Emphasis
the Mogollon Rim		
MA 11: Verde Valley	21,162	Emphasize watershed condition, range management, wildlife habitat for upland game birds, and dispersed recreation. FP Amendment 12, replacement page 166
MA 12: Riparian Areas	72	Emphasize wildlife habitat, visual quality, fish habitat, and watershed condition on the wetlands, riparian forest, and riparian scrub. Emphasize dispersed recreation, including wildlife and fish recreation, on the open water portion. (FP Amendment 11, replacement page 172)
Mazatzal Wilderness on the Tonto National Forest	12	N/A
Total Acres	*42,158*	

This project is also consistent with the following:

- Congressional intent to allow grazing on suitable lands (Multiple Use-Sustained Yield Act of 1960, Forest and Rangeland Renewable Resources Planning Act of 1974, Federal Land Policy and Management Act of 1976, National Forest Management Act of 1976).
- Forest Service direction on rangeland management (FSM 2202.1, FSM 2203.1, FSH 2209.13).
- Federal regulation (36 CFR 222.2 (c)) which states that National Forest System lands would be allocated for livestock grazing and allotment management plans (AMP) would be prepared consistent with land management plans.
- Authorization of livestock grazing permits for a 10-year period is required by law (FLPMA Sec. 402 (a)&(b) (3) and 36 CFR 222.3), unless there is pending disposal, or it would be devoted to other uses prior to the end of 10 years, or it would be in best interest of sound land management to specify a shorter term.

Decision Framework

This EA documents the environmental analysis of the Proposed Action and alternatives. The Red Rock District Ranger is the Responsible Official for this project. The decision to be made is whether or not to authorize livestock grazing and if so, in what manner, as described in the Proposed Action or alternatives to it. Elements of this decision include: number of livestock, utilization level, season of use, grazing management system, structural improvements, monitoring, adaptive management, and resource protection measures. The decision is based on a consideration of the area's existing resource conditions, desired conditions, environmental issues, and the environmental effects of implementing the various alternatives. The District Ranger may select any of the alternatives analyzed in detail, or may modify an alternative, as long as the resulting effects are within the range of effects disclosed in the EA.

This document is not a decision document. Rather, it discloses the environmental consequences which may occur if the Proposed Action or alternatives to that action are implemented. If a finding of no significant impact can be reached based on this analysis, a decision notice (DN) and finding of no significant impact (FONSI), signed by the Red Rock District Ranger, will document the decisions made as a result of this analysis. If the decision is to authorize livestock grazing, any and all grazing practices adopted and

within the scope of this analysis would be further detailed in the terms and conditions of a new Term Grazing Permit and a new Allotment Management Plan (AMP).

Public Involvement

The proposal was first listed in the Coconino National Forest Schedule of Proposed Actions (SOPA) on January 1, 2007. The permittee as well as other agency representatives have been involved early on in the development of the project proposal (PRD#13, 50, 86, 116, 125, 126). The Proposed Action was mailed out on March 21, 2007 to 50 individuals and organizations who have expressed interest in similar past projects or who were otherwise determined to be affected (adjacent landowners, interest groups and agencies). The Proposed Action was also listed on the Coconino National Forest internet site. Eight comment letters were received during and after the public scoping period (March 21 – April 23, 2007) and one significant issue was identified that led to the development of an additional alternative (PR# 84, 87, 90, 99, 100, 103, 106,123).

Issues

The Forest Service separated the issues into two groups: significant and non-significant issues. Significant issues were defined as those directly or indirectly caused by implementing the proposed action. Non-significant issues were identified as those: 1) outside the scope of the proposed action; 2) already decided by law, regulation, Forest Plan, or other higher level decision; 3) irrelevant to the decision to be made; or 4) conjectural and not supported by scientific or factual evidence. The Council on Environmental Quality (CEQ) NEPA regulations require this delineation in Sec. 1501.7, "…identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec. 1506.3)…" A list of non-significant issues and reasons regarding their categorization as non-significant may be found in the project record (PR# 110).

One significant issue was identified during public scoping. The issue is as follows:

- Livestock grazing under the intensity and utilization rates of the proposed action would not adequately improve soil conditions in the short term (10 years or less) and would negatively affect soil productivity, vegetation conditions and aquatic conditions.

This issue was brought forward by the Arizona Game and Fish Department and resulted in the development of a second action alternative, the "**Reduced Utilization and Grazing Intensity Alternative**" (PR# 140, 191, 92, 117, 118, 121, 124, 127, and 130).

The Arizona Game and Fish Department recommended an alternative that would initially reduce grazing utilization to an average of 20% (from 30-40% in the Proposed Action), reduce the grazing intensity to an average of 20% (from 40-50% in the late spring/early summer and 30-40% during the remainder of the year in the Proposed Action), and set the initial stocking level of the allotment at 200 cattle yearlong. When soil and

vegetation conditions improve, this alternative would allow for an increase in authorized livestock numbers, grazing utilization and grazing intensity.

There was a specific concern that a majority of the allotment is in an impaired or unsatisfactory soil condition, and that soil stability conditions are currently on a downward trend. If more plant material is left on site after grazing, as would occur if the utilization level is decreased, then more litter would be available for soil condition improvement and therefore soil condition should improve more rapidly. A second concern was that the proposed permitted utilization level and livestock numbers would not lead to improvements in seed production and survival and consequently would not lead to increases in plant diversity which is important for wildlife. A third concern was that riparian areas within the Fossil Creek Allotment deserve special consideration because of their high value as ecological sites and in providing habitat for wildlife. The specific details of the Reduced Utilization and Intensity Alternative are described in Chapter 2 of the EA.

Units of Measure Used to Analyze the Issue

The following indicators or units of measure were used in Chapter 3 of the EA to analyzed this issue for the Range Resource, Soils Resource, Water and Riparian Resources, and Fisheries Resource:

- Vegetation diversity and density, vegetation height and canopy cover, and vegetation production
- Production of effective ground cover and litter;
- Proper Functioning Condition of riparian stream reaches and water quality;
- Watershed conditions.

Chapter 2 – Proposed Action and Alternatives

This chapter describes and compares the alternatives considered for the management of grazing on the Fossil Creek Range Allotment. This section also presents the alternatives in comparative form, sharply defining the differences between each alternative and providing a clear basis for choice among options by the decision maker and the public. Some of the information used to compare the alternatives is based upon the design of the alternative (such as variations in grazing utilization, or livestock numbers) and some of the information is based upon the environmental, social and economic effects of implementing each alternative (i.e., authorizing or not authorizing livestock grazing). Mitigation and monitoring measures incorporated into the alternatives are also described.

Alternatives Eliminated from Detailed Analysis

The Interdisciplinary Team evaluated the current grazing management system following guidance in FSH 2209.13 92.31, the Grazing Permit Administration Handbook: "Current management would also be analyzed in detail as an alternative to the proposed action if current management meets the stated purpose and need for action."

The grazing system currently used is an intensive deferred-rest rotation management strategy and has been in place on the allotment since 1991. The current season of use is yearlong and the current permitted livestock numbers are 477 head of adult cattle and 6 horses. The forage utilization guideline under current management is 50% (combined livestock and/or wildlife as measured at the end of the growing season). Adjustments in livestock numbers, livestock use periods, and the sequence of pasture use periods are made annually through annual operating instructions (AOI). Under current management, existing structural improvements, including fences, stock tanks and cattle guards, would be maintained by the permittee, but no new structural improvements would be developed.

Current management was not analyzed in detail as an alternative for the following reasons.

- Under the current management, soil conditions on the allotment have declined to about 56% of the allotment in less than satisfactory condition (49% impaired and 7% unsatisfactory).
- Under current management, vegetative conditions on the allotment have declined; approximately 60% of permanent vegetation plots have declined in condition and 87% of the plots are indicating a downward trend.
- Under current management, there has been a reduction in the amount of riparian vegetation along several stream reaches and springs.
- Under current management, habitat conditions for wildlife and threatened/endangered species at several stock tanks or other riparian areas have declined.

Continuation of current management is not expected to improve soil condition, vegetative condition, or riparian and wildlife habitat conditions. As a result, a current management alternative would not meet the purpose and need of the project and should not be analyzed in detail (PR#25, 120, 140, 143, 191).

Alternatives Analyzed in Detail

No Action Alternative

The Forest Service is required to analyze the "No Action" alternative under the provisions of NEPA (40 CFR 1502.14). For livestock grazing projects, this is considered to be equivalent to No Grazing.

Livestock grazing would not be authorized on the Fossil Creek Allotment under the No Action Alternative. This alternative does not preclude livestock grazing or livestock management on this allotment in the future if a decision is made through another comprehensive analysis to resume these actions.

Under this alternative, all livestock would be removed from the allotment. A term grazing permit also would not be issued. Since no grazing would occur, there would be no livestock capacity determinations, no utilization or grazing intensity guidelines, no grazing management system, and no implementation or effectiveness monitoring.

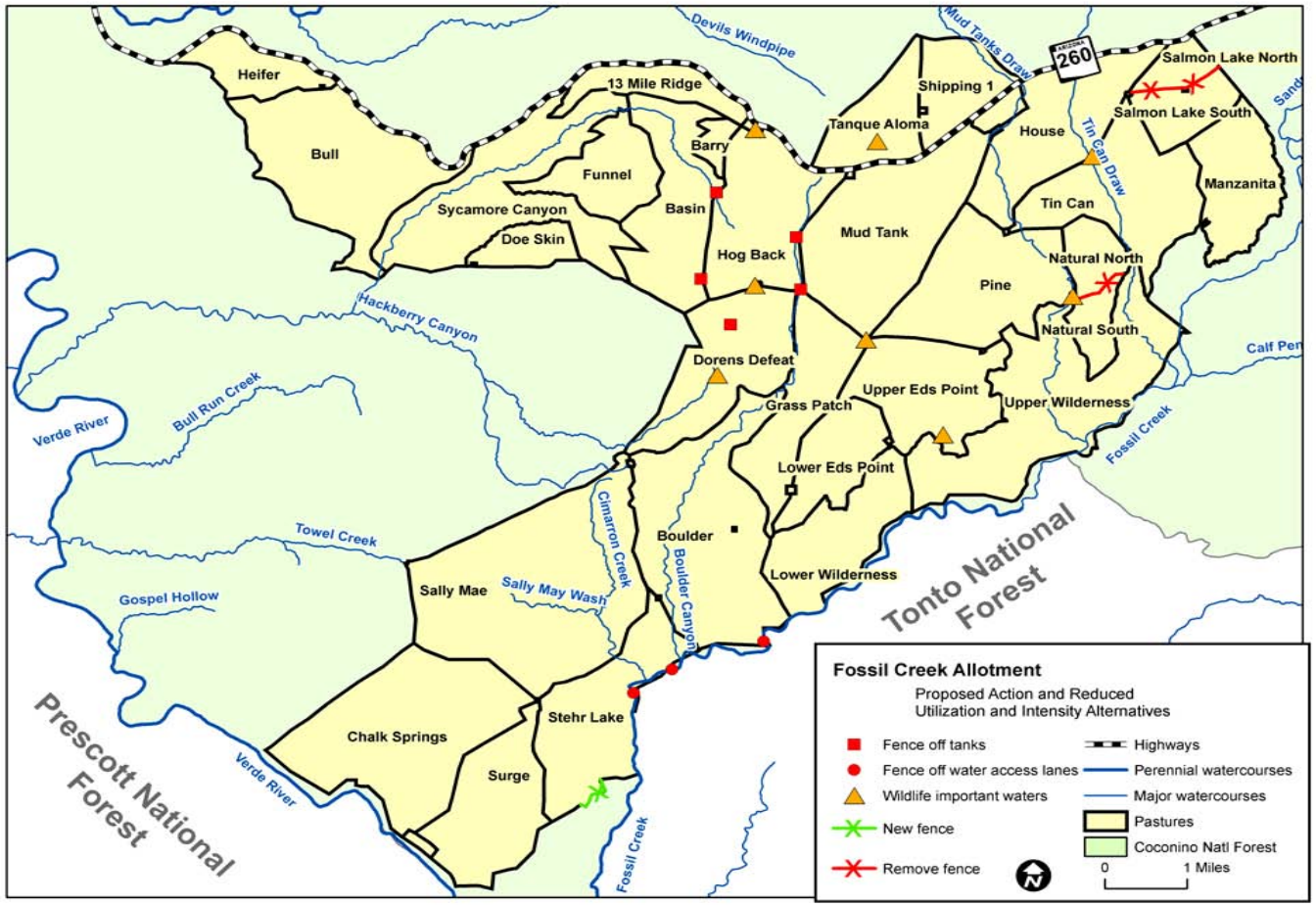
Under this alternative, no new structural improvements would be built. Existing structural range improvements would require a separate analysis and coordination with other agencies to determine whether or not to maintain or remove these improvements.

The No Action Alternative meets the purpose and need of maintaining and improving rangeland vegetation conditions because it eliminates livestock grazing impacts on forage species. The No Action Alternative also meets the need of maintaining and improving soil conditions, again by eliminating livestock grazing impacts. The No Action Alternative would also meet the need of improving riparian conditions along streams and springs because livestock would not be trampling the ground or consuming woody vegetation and other riparian plant species.

Proposed Action Alternative

A Proposed Action has been developed to meet the project's purpose and need. The Proposed Action consists of five components: **Authorization, Improvements, Monitoring, Adaptive Management,** and **Resource Protection Measures.** The proposed action follows current guidance from Forest Service Handbook 2209.13, Chapter 90 (Grazing Permit Administration; Rangeland Management Decisionmaking, February 2004) (PR#5).. Features of the alternative are shown in Figure 4.

Figure 4. Proposed Action and Reduced Utilization and Intensity Alternative Map, Fossil Creek Range Allotment



Authorization

Permitted Livestock

Permitted livestock numbers will be a maximum of 5,800 AUMs (483 AUs yearlong). This is the maximum number of AUMs that can be supported during times of favorable climate once the desired conditions for vegetation and soil have been reached. Current conditions will not support this level of grazing. Initial permitted livestock numbers will be a maximum of 3,600 AUMs (300 AUs yearlong) until soil and vegetation conditions improve.

Annual Authorized Livestock Numbers

Annual authorized livestock numbers will be based on existing conditions, available water and forage, and predicted forage production for the year. Adjustments to the annual authorized livestock numbers (increase or decrease) may occur during the grazing year, based on conditions and/or range inspections.

Season of Use

Season of use will be year long.

Management System

Grazing will occur through a rotational management system (either deferred or rest-rotation grazing) which will allow for plant growth and recovery.

Grazing Utilization

A management guideline of conservative use (30-40% forage utilization as measured at the end of the growing season) will be employed to maintain or improve rangeland vegetation and long term soil productivity. Within riparian areas (Management Area 12), allowable use will not exceed 20% on the woody vegetation.

Grazing Intensity

Grazing intensity is defined as the amount of herbage removed through grazing or trampling during the grazing period. Grazing intensity will be managed to allow for the physiological needs of plants. Generally, moderate grazing intensity (40-50%) will be managed for in the late spring to early summer months when sufficient opportunity exists for plant regrowth. During the remainder of the year, grazing intensity will be managed at conservative levels (30-40%) when the potential for plant regrowth is limited.

Pasture Grazing Period

The grazing period within each pasture will be based upon weather/climate conditions, current growing conditions and the need to provide for plant regrowth following grazing. The length of the grazing period within each pasture will also consider and manage for

desired grazing intensity and utilization guidelines. The grazing period per pasture will generally not exceed 30 days.

Pasture Grazing Frequency

Generally pastures will be grazed only once during the grazing year. However, if the need arises to provide rest (or deferment) for other pastures, a pasture may be used twice provided there has been sufficient vegetative growth/regrowth and grazing is managed within the intensity and utilization guidelines.

Riparian Areas

To protect and enhance woody riparian vegetation, pastures with riparian areas (Management Area 12, perennial and intermittent streams, springs and seeps, perennial pools) that are grazed during the critical growth period for woody riparian species (3/1-4/30) one year will not be grazed during the critical growth period the following year (Figure 4).

If livestock exclosure fences are constructed at spring/seep riparian areas (as identified in the Structural Improvements section below), alternate year livestock deferment during the critical growth period will no longer be necessary in pastures that have only spring/seep types of riparian areas.

Stock Tank Water and Wildlife Use

Water will be left in stock tanks for wildlife use after domestic livestock have been removed from the grazing unit. Critical water tanks for wildlife include: Doren's Defeat, Herbies, Hogback, Natural, Needed, Mail Trail Tank #2, Middle, Pine, Tanque Aloma, and others (Figure 4).

Structural Improvements

1. Build fences at five stock tanks to improve wildlife habitat. Livestock will be allowed access into the stock tanks via fenced lanes (Figure 4). (PR# 139, 56).
2. Improvements and erosion control measures that have been previously implemented to improve soil and vegetative conditions around stock tanks will be maintained or upgraded with fencing to exclude livestock as needed. (PR# 139, 56)
3. Remove unneeded electric fences that divide North and South Salmon Lake pastures and North and South Natural pastures (Figure 4).
4. Construct three fenced, livestock water access lanes along Fossil Creek: two locations in the Stehr Lake pasture and one location in the Boulder pasture (Figure 4). Livestock currently have unrestricted access to Fossil Creek at the two locations in Stehr Lake pasture. The proposed livestock watering access lane in the Boulder pasture would be a new watering location. Livestock grazing in Boulder and Stehr Pastures will not be authorized until these improvements are constructed. (PR# 144).
5. Construct about 0.75 miles of new allotment boundary fence along the eastern edge of the recently decommissioned Stehr Lake (Figure 4). This fence is necessary to keep livestock out of the adjacent grazing allotment.

6. Livestock exclosure fencing may be constructed at spring/seep riparian areas if desired conditions are not achieved through the control of livestock grazing. Exclosure fencing will be designed and constructed to protect the important riparian vegetation while still providing for livestock watering. Pastures with springs or seeps include: Chalk Springs, Sally Mae, Surge, Sycamore Canyon, and Lower Wilderness (Figure 4)

Monitoring

Two types of rangeland monitoring will be used, implementation and effectiveness monitoring. Implementation monitoring will be conducted on an annual basis and will include: livestock actual use data, grazing intensity evaluations during the grazing season (within key areas), utilization at the end of the growing season (within key areas), and visual observation of vegetation and ground cover trends.

Effectiveness monitoring to evaluate the success of management in achieving the desired objectives will occur within key areas on permanent transects at an interval of 10 years or less. Effectiveness monitoring may also be conducted if data and observations from implementation monitoring (annual monitoring) indicate a need. Initial baseline monitoring will occur.

Both qualitative and quantitative monitoring methods will be used in accordance with the Interagency Technical References, and the Region 3 Rangeland Analysis and Management Training Guide, and the Region 3 Allotment Analysis Handbook (USDA – Forest Service 1997).

See Chapter 4, Monitoring and Adaptive Management for further information on rangeland monitoring. Additional monitoring required for other resources is described in this chapter.

Adaptive Management

The Proposed Action includes adaptive management, which provides a menu of management options that may be needed to adjust management decisions and actions to meet desired conditions as determined through monitoring. If monitoring indicates that desired conditions are not being achieved, management will be modified in cooperation with the permittee. Adaptive management allows the Forest Service to adjust: the timing, intensity, frequency and duration of grazing; the grazing management system, and livestock numbers. An example of a situation that could call for adaptive management adjustments is drought conditions. If adjustments are needed, they are implemented through the Annual Operating Instructions. Adaptive management will also allow for the construction of rangeland improvements if they have been identified and are determined, through monitoring, to be necessary for achieving desired conditions.

See Chapter 4, Monitoring and Adaptive Management for further information.

Reduced Utilization and Grazing Intensity Alternative

Under the Reduced Utilization and Grazing Intensity Alternative, changes would be made to the initial permitted and authorized livestock numbers, the initial grazing utilization guideline and the initial grazing intensity guideline. All other actions listed under "Authorization," "Improvements," "Monitoring," "Adaptive Management," "Resource Protection Measures," as described in the Proposed Action Alternative, would be implemented similarly to the Proposed Action Alternative (Figure 4). The changes are as follows:

Permitted Livestock

Permitted livestock numbers will be a maximum of 5,800 AUMs (483 AUs yearlong). This is the maximum number of AUMs that can be supported during times of favorable climate once the desired conditions for vegetation and soil have been reached. Current conditions will not support this level of grazing. Initial permitted livestock numbers will be a maximum of 2,400 AUMs (200 AUs yearlong) until soil and vegetation conditions improve.

Grazing Utilization

A management guideline of light use (15-25% forage utilization as measured at the end of the growing season) will be employed to improve rangeland vegetation and long term soil productivity. Once conditions have improved, a management guideline of conservative use (30-40% forage utilization as measured at the end of the growing season) will be employed to maintain or improve rangeland vegetation and long term soil productivity. Within riparian areas (Management Area 12), allowable use will not exceed 20% on the woody vegetation.

Grazing Intensity

Grazing intensity is defined as the amount of herbage removed through grazing or trampling during the grazing period. A management guideline of light grazing intensity (15-25%) will be employed to improve rangeland vegetation and long term soil productivity. Once conditions have improved, a moderate grazing intensity (40-50%) will be managed for in the late spring to early summer months when sufficient opportunity exists for plant regrowth. During the remainder of the year, grazing intensity will be managed at conservative levels (30-40%) when the potential for plant regrowth is limited.

Resource Protection Measures Applicable to Action Alternatives

The proposed action is designed to comply with Forest Plan standards and guidelines, as amended. Design features are incorporated into the project to protect forest resources of rangelands, soil, water, scenery values, wildlife and aquatic habitat, and rare plants.

Mitigation measures and Best Management Practices (BMPs) will be implemented to reduce nonpoint source pollution into connected waters, prevent the introduction and spread of invasive plants, to retain water in stock tanks for wildlife, to protect heritage resources, to maintain and improve soil conditions, soil productivity and water quality, and to protect public health and safety during project implementation.

The following design features are incorporated into both the Proposed Action Alternative and the Reduced Grazing Utilization and Intensity Alternative. The design features include standard operating procedures and best management practices

Design Features

Range Management

The following actions will be implemented to provide resource information to make adjustments in management and to achieve, maintain or improve the long-term diversity, density, and production of upland vegetation, and achieve the objective of improving and/or maintaining long-term soil productivity and enhancing water quality. (PR#143)

Permit Compliance

- The District Range Staff will monitor permittee compliance with the Term Grazing Permit, Allotment Management Plan, and Annual Operating Instructions throughout the grazing period of each year for the life of the Permit. Compliance with the terms and conditions of the livestock grazing permit will be strictly enforced including livestock grazing scheme, contingencies for drought conditions, monitoring agreements and any cost sharing for structural range improvements.
- Manage livestock grazing intensity and utilization to improve vegetative ground cover and to improve the quality and quantity of desirable vegetation.
- Design and implement a planned grazing system that will provide for adequate rest during the plants growing season. Monitoring and adaptive management will be used to modify the grazing system to account for the continually changing effects of resource conditions and climate.
- Key grazing areas will be monitored for grazing intensity, utilization, production, and vegetation condition and trend. Areas other than key areas may be monitored to obtain resource information necessary for management decisions.
- To avoid unintentional grazing, ensure that fences (allotment boundary, pasture boundary, exclosure, etc.) are functional prior to moving livestock into a pasture.

Salt

- Utilize salt to improve livestock distribution. Salt at a reasonable distance away from waters or natural congregating areas such as swales, drainages, riparian areas and meadows. Move salt when livestock distribution objectives are not being achieved or to correct localized over use by livestock grazing.

Structural Improvements

- Existing range structural improvements are to be maintained. New range structural improvements are to be constructed to standard and maintained as necessary. New structural range improvements such as corrals, troughs, storage tanks, should not be located in areas such as swales, drainages, riparian areas and meadows. Installation and maintenance of approved range structural improvements will allow for the implementation of proper livestock control and distribution, shorter graze periods and longer rest periods, and other livestock management techniques.

Soil and Watershed Resources

The following measures and BMPs are designed to achieve the objectives of improving or maintaining long-term soil productivity and enhancing water quality. (PR#133).

Soil Condition Objectives

- Manage livestock grazing to move towards satisfactory soil conditions through ground cover objectives listed below.
- Manage livestock grazing to improve vegetative ground cover on inherently unstable soils.

Ground cover

- Manage livestock grazing at an intensity that will maintain and improve vegetative ground cover (primarily the litter component) to enhance soil function (minimizes soil erosion, promotes water infiltration and enhances nutrient recycling) and to improve the quality and quantity of desirable vegetation. Each pasture is grazed in a planned sequence. Adequate rest during the plants' growing season allows plants to become established and grow undisturbed. Adequate rest during the plant's dormant season allows for the accumulation of plant litter. Key grazing areas will be monitored to determine when livestock should be moved to prevent over use. A planned grazing system is designed to promote flexibility in the grazing program and to buffer the adverse effects of drought.
- Manage livestock grazing at an intensity that will improve effective ground cover (effective ground cover is defined as the % litter greater than 1.25 cm in size and % total plant basal area) to enhance soil function (minimizes soil erosion, promotes water infiltration and enhances nutrient recycling) and to improve the quality and quantity of desirable vegetation. Target effective ground covers for each Terrestrial Ecosystem Survey (TES) Map Unit should be at a minimum 2/3 of maximum effective ground cover as described in the table below.

Table 4. Ground Cover Objectives by Map Unit for Fossil Creek Range Allotment

MAP UNIT	2/3 of natural ground cover (%)	max % natural ground cover		MAP UNIT	2/3 of natural ground cover (%)	max % natural ground cover
33	20	30		45	40	60
34	17	25		457	17	25
350	13	20		458	17	25
382	20	30		46	50	75
383	20	30		462	17	25

MAP UNIT	2/3 of natural ground cover (%)	max % natural ground cover		MAP UNIT	2/3 of natural ground cover (%)	max % natural ground cover
401	13	20		463	20	30
402	13	20		466	13	20
403	17	25		492	17	25
404	20	30		493	20	30
417	13	20		520	44	65
420	13	20		530	50	75
430	13	20		555	57	85
				572	54	80

- Livestock grazing will be designed to move towards these effective ground cover goals or to be maintained at the effective ground cover goals. During drought, these effective ground covers will be difficult to attain, but livestock grazing should not decrease existing effective ground cover.
- To filter sediments and maintain bank stability, leave a minimum 10 centimeter residual stubble height of hydrophilic vegetation (sedge/rush) to improve conditions in riparian areas. (Clary and Leininger, 2000)

Noxious and Invasive Weeds

The following Best Management Practices are listed to prevent and control weeds during range management, minimize transport of weed seed into and within allotments, maintain healthy desirable vegetation that is resistant to weed establishment, minimize ground disturbances, and encourage permittees to prevent the introduction and spread of weeds (PR#122). They are taken from the Range Management BMPs in the "Final Environmental Impact Statement for Integrated Treatment of Noxious or Invasive Weeds" (USDA-Forest Service, 2005a).

Weed BMPs for Range Management

- Include weed prevention practices, inspection and reporting direction, and provisions for inspection of livestock concentration areas in allotment management plans and annual operating instructions for active grazing allotments.
- For each grazing allotment containing existing weed infestations, include prevention practices focused on preventing weed spread and cooperative management of weeds in the annual operating instructions. Prevention practices may include, but are not limited to:
  - Maintaining healthy vegetation
  - Preventing weed seed transportation
  - Minimize potential ground disturbance - altering season of use or exclusion
  - Weed control methods
  - Revegetation
  - Inspection and Monitoring
  - Reporting
  - Education
- If livestock are potentially a contributing factor to seed spread, schedule units with existing weed infestations to be treated prior to seed set before allowing livestock on those units. Schedule these infested units to be the last in the rotation.
- If livestock were transported from a weed-infested area, corral livestock with

weed-free feed, and annually inspect and treat allotment entry units for new weed infestations.

- Designate pastures as unsuitable range to livestock grazing when infested to the degree that livestock grazing will continue to either exacerbate the condition on site or contribute to weed seed spread.
- Through the allotment management plan or annual operating instructions, manage the timing, intensity (utilization), duration, and frequency of livestock activities associated with harvest of forage and browse resources to maintain the vigor of desirable plant species and retain live plant cover and litter.
- Manage livestock grazing on restoration areas to ensure that vegetation is well established. This may involve exclusion for a period of time consistent with site objectives and conditions. Consider practices to minimize wildlife grazing on the areas if needed.
- Include weed prevention practices that reduce ground disturbance in allotment management plans and annual operating instructions. Consider for example: changes in the timing, intensity, duration, or frequency of livestock use; location and changes in salt grounds; restoration or protection of watering sites; and restoration of yarding/loafing areas, corrals, and other areas of concentrated livestock use.
- Inspect known areas of concentrated livestock use for weed invasion. Inventory and manage new infestations.
- Use education programs or annual operating instructions to increase weed awareness and prevent weed spread associated with permittees' livestock management practices.
- To aid in their participation in allotment weed control programs, encourage permittees to become certified pesticide use applicators.

General Practices for All Site-Disturbing Projects and Maintenance Programs

- Remove mud, dirt, and plant parts from project equipment before moving it into a project area. Determine the need for, and when appropriate, identify sites where equipment can be cleaned. Clean all equipment before entering National Forest System lands; a forest officer, in coordination with the unit invasive species coordinator, needs to approve use of on-forest cleaning sites in advance. This practice does not apply to service vehicles traveling frequently in and out of the project area that will remain on a clean roadway. Seeds and plant parts need to be collected when practical and incinerated.

- If operating in areas infested with weeds, clean all equipment before leaving the project site. To minimize time spent cleaning equipment, time all work in infested areas last and concurrently, designate a "contaminated" parking lot where project vehicles working in the infested area may be parked for the duration of the project. This area should be monitored in followup mitigation and should be near a "clean" vehicle/equipment lot. Identify sites where equipment and vehicles can be cleaned before leaving the site at the end of the project. Seeds and plant parts need to be collected when practical and incinerated.

- Workers need to inspect, remove, and properly dispose of weed seed and plant parts found on their clothing and equipment after being trained to recognize the priority species in the area. Proper disposal means bagging the seeds and plant parts and incinerating them.

Mitigation Measures

The following mitigation measures would be implemented under all action alternatives. They have been used on previous projects and are considered to be effective at reducing environmental impacts. They are consistent with applicable Forest Plan standards and guidelines, and the terms, conditions and conservation measures of existing biological opinions. Implementation of the mitigation measures in combination with project design features will avoid the occurrence of potentially significant environmental impacts.

Range Management

- During drought conditions, and in periods of drought recovery, adjust grazing timing, intensity, frequency, numbers, and the management system as necessary to protect the upland vegetation resource. (PR#143)

Soil, Watershed and Fisheries Resources

- If woody riparian vegetation utilization exceeds 20% for two consecutive graze periods, fence riparian sites before next graze period. Fencing would better maintain riparian vegetation and maintain age-class distribution of woody riparian vegetation. (PR#133)
- Utilize the Forest Drought policy to manage utilization levels and stocking during and immediately following drought. When implemented, this would minimize the effects of drought thereby reducing soil erosion and maintaining soil productivity and water quality and improving plant production.

Noxious and Invasive Weeds

- A weeds assessment and inventory was completed for this analysis (PR#122). Weeds species of concern in the allotment would be treated as necessary following guidelines in the “Final Environmental Impact Statement for Integrated Treatment of Noxious or Invasive Weeds” (USDA, 2005a).
- Identify and treat noxious or invasive weed populations that may occur in areas of proposed structural improvements and mitigate impacts to threatened, endangered and R3 Regional Forester’s sensitive (TES) plants by reducing the risk of noxious or invasive weed infestations in populations or habitats. (PR#122, 83)

Wildlife, Fisheries and Rare Plants

- Survey areas containing proposed structural improvements before construction for TES plants and noxious or invasive weeds before construction of improvement. Identify populations and mitigate impacts of management actions if needed.
- Avoid TES plants (if found during survey) during the construction of structural improvements.

- All open storage tanks and drinkers will be constructed with entry and escape ramps for wildlife (PR#139).
- In order to minimize the risk for introducing and spreading disease among aquatic systems, approved protocols will be followed when conducting work in earthen livestock tanks. This protocol will be attached to the AOI.
- Biologists will be given at least 60 days notice prior to conducting work in earthen tanks. This notice will allow for surveys, if needed, and/or mitigation to reduce adverse affects to amphibians.
- Fences will be constructed to meet wildlife standards (PR#139).

Heritage Resources

- Activities associated with allotment improvements and maintenance will be managed to avoid cultural resource sites and ensure no adverse effect to cultural resources. All of the new ground disturbing activities that are planned to be implemented within two years and can be identified on the ground have been surveyed and will be cleared prior to authorizing grazing on the allotment as per Section 93.2 of the Region 3 Issuance Forest Service Handbook 2209.13, Grazing Permit Administration Handbook, Chapter 90, Rangeland Management Decisionmaking (PR#5), and following the First Amended U.S.D.A., Forest Service, Region 3 Programmatic Agreement Regarding Cultural Property Protection and Responsibilities (PR#4), dated December 24, 2003.
- Before initiating any of the ground disturbing activities that are part of this project, the District Archaeologist will be notified to ensure the proposed activities have cultural resource clearance and project personnel are aware of the conditions specified in the final Fossil Creek Range Allotment Cultural Resource Clearance Report. Any additional ground disturbing activities that are proposed in the future must receive archaeological clearance prior to implementation.
- Located sites will be marked for avoidance and will be avoided during construction. If any new sites are discovered during construction activities, they are to be reported to the district or forest archeologist and ground-disturbing work halted.
- Management practices that tend to concentrate livestock, such as placement of salt, construction of fences, etc., will be located away from cultural resources.

Monitoring

Range Resources

- The following would be monitored for all action alternatives: permit compliance; actual livestock use, grazing intensity, grazing utilization, forage production and vegetative ground cover, vegetation condition and trend, noxious weeds and precipitation. See Chapter 4, “Monitoring and Adaptive Management”, for more specific information.

Soil, Watershed and Fisheries Resources

- Soil condition assessments will be conducted at least once every ten years, with the exception of unsatisfactory soils in the Boulder and Stehr Lake pastures. In these pastures, baseline soil condition data will be collected along established transects prior to implementing the first years authorized grazing. After the baseline data has been collected, soil condition will be monitored every 2 years to determine extent of soil improvement, if any. If monitoring indicates soil conditions are not improving towards satisfactory, current livestock grazing utilization and intensity will be immediately adjusted and may include pasture deferral or reduced grazing utilization and intensity. In all other pastures, transects will be read at least every 10 years by Forest Service personnel to assess the effects of grazing. If monitoring indicates that soil conditions are not improving towards satisfactory conditions, the current livestock grazing strategy will be adjusted using the adaptive management strategy.
- Vegetation transects using 20 meter transects with a 30 x 50 cm hoop read every two meters for a total of 10 readings per 20 meter transect within each Terrestrial Ecosystem Map Unit. Monitoring will occur at least once every ten years. Species composition, effective ground cover, and species diversity will be read from each 30 x 50 cm hoop. Monitoring sites will be placed in key areas representative of the map unit. Key areas will be more than ¼ mile from water.
- Riparian areas within the allotment will continue to be monitored for Proper Functioning Condition (PFC). Sycamore Canyon and Mud Tanks Draw will be done in the first year, all other reaches at least once every ten years.
- Aquatic habitat monitoring will be conducted on all perennial streams in the allotment using established regional protocols. This monitoring will establish the condition and trends of the aquatic habitat in response to grazed riparian and upland areas.
- Vegetation conditions at livestock water access points along Fossil Creek will be monitored using established regional protocols which may include a combination of measurements, observations and photo points.

Wildlife

- The Forest will periodically monitor water quality in water bodies (especially tanks and springs) where livestock have access. Parameters that may be monitored include (but are not limited to) nitrates, nitrites, ammonium, colliform, pH, dissolved oxygen, and the presence of Chytrid (bd).

Wild and Scenic Rivers

- Monitor effects to bank stability and riparian vegetation at existing and proposed livestock water access points on Fossil Creek.

Heritage Resources

- The District will periodically monitor known archaeological sites to ensure they have been avoided.

Noxious and Invasive Weeds

- Noxious and invasive weeds will be monitored during regular range allotment monitoring. As noxious weed populations are found they will be mapped and entered into the Invasive Plants database. Control or treatment options would be considered and implemented depending on class and priority of weeds and funding.

Future Review of the Decision

In accordance with Forest Service Handbook direction (FSH 1909.15(18) and 2209.13(96)) an interdisciplinary review of the decision will occur periodically every 3-5 years, or sooner if conditions warrant. If this review indicates that management is meeting standards and achieving desired condition, the initial management activities would be allowed to continue. If monitoring demonstrates that management options beyond the scope of the analysis are warranted, or if new information demonstrates significant effects not previously considered, further analysis under NEPA would occur.

Comparison of Alternatives

This section provides a summary of the effects of implementing each alternative. Information in the table is focused on activities and effects where different levels of effects or outputs can be distinguished among alternatives.

Table 5. Livestock Grazing Permit Authorizations by Alternative

Grazing Authorizations	No Action Alternative	Proposed Action Alternative	Reduced Utilization and Grazing Intensity Alternative
Maximum Permitted Animal Unit Months (AUMs)	0	5,800	5,800
Maximum Permitted Animal Units (AUs) or Number of Livestock	0	483	483
Percent reduction from current permitted use	100%	0%	0%
Initial Permitted AUMs	0	3,600	2,400
Initial Permitted AUs	0	300	200
Percent change from current management at initial stocking	100% reduction	38% reduction	59% reduction
Season of Use	0	Yearlong, 12 months	Yearlong, 12 months
Grazing Management System	0	Deferred Rotation Or Deferred, Rest-Rotation	Deferred Rotation Or Deferred, Rest-Rotation
Maximum Grazing Utilization Guideline	0	30-40%	30-40%
Percent change in grazing utilization guideline from current management	100% reduction	20-40% reduction	20-40% reduction
Initial Utilization Guideline	0	30-40% Reductions as needed	15-25%

Grazing Authorizations	No Action Alternative	Proposed Action Alternative	Reduced Utilization and Grazing Intensity Alternative
Grazing Utilization within Riparian Areas	0	20% woody vegetation	20% woody vegetation
Maximum Grazing Intensity	0	Late Spring/Early Summer: 40-50% Remainder of the Year: 30-40%	Late Spring/Early Summer: 40-50% Remainder of the Year: 30-40%
Percent change in grazing intensity guideline from current management	NA	Grazing Intensity limits not established in current management	Grazing Intensity limits not established in current management
Initial Grazing Intensity Guideline	0	Late Spring/Early Summer: 40-50% Remainder of the Year: 30-40% Reductions as needed	15-25%
Frequency of Pasture Use	0	Pastures will generally only be grazed once during a grazing year	Pastures will generally only be grazed once during a grazing year
Pasture Grazing Period (maximum days)	0	Generally not to exceed 30 days	Generally not to exceed 30 days
Utilizes Monitoring and Adaptive Management	No	Yes	Yes

Table 6. Proposed Structural Improvements by Alternative

New Structural Improvements	No Action Alternative	Proposed Action Alternative	Reduced Utilization and Grazing Intensity Alternative
Fences – livestock exclosure (wedge) fences at stock tanks	0	5 tanks	5 tanks
Maintenance or upgrading with fencing of improvements and erosion control measures	0	2 sites	2 sites
Electric fence removal North & South Salmon Lake Pasture North & South Natural Pasture	0	2 fences About 1.75 miles total	2 fences About 1.75 miles total
Fenced livestock water access lanes on Fossil Creek in Boulder and Stehr Pasture	0	3 sites	3 sites
New Allotment boundary fence at Stehr Lake	0	1 fence 0.75 miles	1 fence 0.75 miles
Livestock exclosure fences at springs and seeps as needed	0	Chalk Springs, Sally Mae, Surge, Sycamore Canyon and lower Wilderness Pastures, others 9 springs	Chalk Springs, Sally Mae, Surge, Sycamore Canyon and lower Wilderness Pastures, others 9 springs

Table 7. Alternative Comparison by Purpose and Need

Purpose and Need	No Action Alternative	Proposed Action Alternative	Reduced Utilization and Grazing Intensity Alternative
Authorizes livestock grazing (purpose of project)	No	Yes	Yes
Consistent with National Forest System Objectives, Policy, and Rangeland Management Planning[3]	Consistent	Consistent	Consistent
Consistent with the Coconino Forest Plan	Consistent	Consistent	Consistent
Improve soil conditions on the allotment towards a satisfactory level	Yes	Yes	Yes
Improve vegetative conditions and trends	Yes	Yes	Yes
Improve riparian streams to proper functioning conditions	Yes	Yes	Yes
Improve wildlife and TES species habitat conditions at stock tanks, springs and seeps.	Yes	Yes	Yes

Summary of Environmental Effects by Resource Area or Issue

Vegetation Condition and Trend

No Action Alternative, Proposed Action Alternative and Reduced Utilization and Intensity Alternative: Vegetation condition and trend is expected to remain static or move upward, except in areas where overstory species limit improvement potential. The ability for improvement in vegetation condition and trend will be most affected by climatic conditions. Measurable differences in vegetation condition and trend between any of the alternatives is not expected.

Vegetation Height and Canopy Cover

No Action Alternative: Short term reductions in the height and canopy cover of herbaceous vegetation would not occur. Long-term measurable differences between any of the alternatives are not expected.

Proposed Action Alternative and Reduced Utilization and Intensity Alternative: There will be short term reductions in the height and canopy cover of herbaceous vegetation from livestock grazing. The reduction in plant height and cover, as a result of grazing, does recover with favorable climatic conditions. Measurable differences between the two action alternatives are not expected.

Vegetation Production

No Action Alternative: Forage production and forage quality are expected to have a short-term increase (1-3 years), followed by a period of stabilization and then declining (years 5+).

[3] FSM 2202.1 Range Management, Objectives, National Forest System; FSM2203.1 Range Management, Policy, National Forest System; FSH 2209.13_90 Rangeland Management Decisionmaking

Proposed Action Alternative and Reduced Utilization and Intensity Alternative: Forage production and forage quality is expected to be maintained and enhanced by light to moderate grazing. Measurable differences between the two action alternatives are not expected.

Soil Conditions

No Action Alternative: Standing crop of biomass would increase as would litter. Soil compaction from livestock grazing would discontinue. Current soil conditions would be maintained and would improve over time. Soil conditions in the Fossil Creek 5th HUC watershed would be variable but remain inherently unstable on steep slopes and impaired and satisfactory soil condition would improve towards satisfactory on Coconino National Forest administered lands. This action would improve conditions faster than all other alternatives and move towards Forest Plan Standards and Guidelines of satisfactory soil condition by the year 2020.

Proposed Action Alternative: Improvements would occur in amount of standing crop of biomass and litter over the current condition. A higher grazing intensity during the early part of the year would decrease seed heads and damage young plants as compared to the Reduced alternative. Slightly less standing crop and litter would be left under this Alternative than the Reduced Alternative; however the amount is difficult to quantify or measure. Under an adpative management scenario, utilization and intensity can vary from 0 up to the maximum range of 30-40%. This alternative would improve soil condition which will result in improved watershed condition. This alternative will move towards the Forest Plan standard and guideline for improving watershed condition slower than the No Action and Reduced Utiization alternative by the year 2020, although it may not be fully attained by this time if drought conditions persist.

Reduced Utilization and Intensity Alternative: Possible for a slight amount of increased standing crop and litter remaining on-site if utilization and intensity is less than the Proposed Action, especially during the early growing season. The amount of improvement over the Proposed Action is difficult to quantify or measure. The difference between 15-25% and 30-40% utilization is difficult to measure or quantify. Under an adaptive management scenario, utilization levels of 0% up to the maximum of 15-25% can occur. Utilization and livestock numbers can be adjusted similar to the Proposed Action during drought. Ground cover goals, improved soil conditions and improved watershed conditions can be achieved similar to the Proposed Action Alternative. This alternative will move towards the Forest Plan standard and guideline for improving watershed condition slower than the No Action Alternative but faster than the Proposed Action alternative by the year 2020, although it may not be fully attained by this time if drought conditions persist.

Riparian Condition and Water Quality

No Action Alternative: Proper Functioning Condition of streams would maintain stream PFC and improve at-risk reaches. This alternative will have the quickest rate of improvement and the highest probability of effectiveness for improving riparian condition. Water quality is expected to be maintained in Fossil Creek and sediment delivered to the watershed's streams would be decreased from current conditions with improved vegetative ground cover and litter. The rate of decreased sediment loads will be faster with this alternative than any of the grazing action alternatives.

Proposed Action Alternative: Managing woody riparian utilization at 20% and adaptive management would maintain or improve riparian conditions. The rate of improvement will be dependent on time of use and precipitation. If persistent riparian damage is occurring, an adaptive management action will be implemented to fence sites to minimize impacts. Riparian function will improve over time and reaches that are currently in PFC will maintain this status and reaches that are not in PFC will move towards PFC. An exception to this may be the at-risk reach of Fossil Creek that has heavy recreation impacts that are affecting functionality of the reach. Water quality is expected to be maintained in Fossil Creek and sediment delivered to the watershed's streams would be decreased from current conditions with improved effective vegetative ground cover and litter.

Reduced Utilization and Intensity Alternative: Effects would be the same as the Proposed Action because livestock use near and in riparian areas would be managed the same. Water quality is expected to be maintained in Fossil Creek and sedimentation coming from the watershed would be decreased from current conditions with improved vegetative ground cover and litter. Recovery rate and improvements in watershed conditions will be similar to the Proposed Action Alternative, but may be slightly faster with the reduced initial utilization and intensity rates.

Wildlife and Wildlife habitat

No Action Alternative: The no graze alternative can reasonably be expected to: increase rodent and small mammal density and diversity, increase songbird and raptor diversity, increase abundance and diversity of lizards, increase abundance of garter snakes and other riparian dependent species. A standing crop of biomass and litter should increase as a result of the no action alternative. Soil compaction from livestock grazing would not continue. Current soil conditions would be maintained and would improve over time. These changes in soil and vegetative conditions will benefit wildlife. Herbaceous vegetation is a food source for many species and their prey, and herbaceous vegetation is necessary for cover for many species, and for some species herbaceous cover is used to construct and conceal nests which are critical for species recruitment. The no action alternative will also allow for optimal riparian conditions, increasing species abundance and diversity.

Proposed Action Alternative: Since a higher grazing intensity during the early part of the year could decrease the amount of seed heads, damage young plants, and leave slightly less standing crop and litter as compared to the Reduced Utilizaton and Intensity alternative, this alternative could result in less herbaceous cover for wildlife. Many species of wildlife are dependent on herbaceous vegetation for various aspects of their behavior or habitat. Depending on the species, these aspects of vegetation usage can be a food source for themselves or their prey, as cover from predators and the elements, and for constructing and concealing nests.
Proposed utilization and intensity levels will have less benefit to wildlife species that depend on herbaceous vegetation for food, cover, and nesting.

Reduced Utilization and Intensity Alternative: Fewer initial livestock numbers and a lower levels of grazing intensity and utilization will result in a slight increase ofstanding crop of biomass and litter remaining on-site, especially during the early growing season. This will move resources towards the Forest Plan standard and guideline for improving watershed condition faster than the Proposed Action alternative. Although slight, an increase in standing crop will benefit wildlife because herbaceous vegetation is a food source for many species and their prey, herbaceous vegetation is necessary for cover for many species, and for some species herbaceous cover is used to construct and conceal nests which is critical for species recruitment. In the Reduced alternative, a lighter grazing regime will not only provide more benefits for wildlife during drought years, but also during the years following drought when the range is in a recovering state. Lighter stocking compared to conservative stocking can speed recovery of vegetation from drought.

Threatened and Endangered Wildlife Species

No Action Alternative: Beneficial effects – refer to Wildlife and Wildlife Habitat section above.

Proposed Action Alternative and Reduced Utilization and Intensity Alternative: There may be adverse impacts to the Yuma Clapper rail and the Chiricahua leopard frog and their habitat. There may be minor impacts to the Mexican spotted owl, its habitat or its designated critical habitat. There may be minor impacts to the Southwestern willow flycatcher, and its habitat.

Forest Service Sensitive Wildlife Species

No Action Alternative: Beneficial effects. Refer to Wildlife and Wildlife Habitat section above.

Proposed Action Alternative and Reduced Utilization and Intensity Alternative: There may be impacts to individual species but the impacts are not likely to result in a trend toward federal listing or a loss of viability for all 26 species analyzed.

Management Indicator Species

No Action Alternative: Beneficial effects are expected but may not change the forest-wide trend for MIS species. Refer to Wildlife and Wildlife Habitat section above.

Proposed Action Alternative and Reduced Utilization and Intensity Alternative: The effects of grazing from this project would not change the habitat trend for grasslands, meadows, open pinyon-juniper, or the population trends for pronghorn on the forest. When compared to the total riparian on the forest, the alternatives will not result in a change in the forest-wide trend for Lucy's warbler or yellow-breasted chats.

Aquatic Conditions

No Action Alternative: This alternative has a much greater potential and higher probability to result in improved watershed conditions and reduce the amount of sediment entering stream channels than the grazing alternatives. Though the degree of improvement is dependent on precipitation, improvement would be faster.

Proposed Action Alternative: Livestock grazing can indirectly affect water quality when upland grazing removes biomass, reduces the protective vegetative ground cover that normally traps sediments, increases soil compaction, reduces water infiltration, increases sediment production and nonpoint source pollution into streams. Both of the action alternatives have the potential to result in improved soil conditions over the current conditions of grazing management which would reduce sedimentation and would be an improvement of aquatic habitat and fishery resources over existing conditions.

Reduced Utilization and Intensity Alternative: The lower initial utilization, intensity and stocking rates of the Reduced Utilization and Intensity alternative has the potential for faster improvement of watershed conditions than the Proposed Action Alternative, and would result in a faster benefit to aquatic biota and their habitat.

Threatened and Endangered Fish

No Action Alternative: There would no effects to Colorado pikeminnow. There is the potential for beneficial effects to the razorback suckers, loach minnow and spikedace from decreased sedimentation to streams.

Proposed Action Alternative and Reduced Utilization and Intensity Alternative: There would not be any measurable effects to the Colorado pikeminnow from sedimentation from the project. There may be adverse effects from sedimentation to the razorback sucker once it is introduced into Fossil Creek; effects to this species in the Verde River from the project area would not be detectable. There may be adverse impacts to loach minnow and spikedace from sedimentation into Fossil Creek from the project area. The effects of the

Reduced Alternative may be somewhat less but overall the effects of the two grazing alternatives are similar.

Forest Service Sensitive Fish Species

No Action Alternative: No effects.

Proposed Action Alternative and Reduced Utilization and Intensity Alternative: The two grazing alternatives may impact individuals, but is not likely to result in a trend toward federal listing or a loss of viability for headwater chub, roundtail chub, desert and Sonora sucker, and longfin dace.

Effects to Management Indicator Species, Macroinvertebrates

No Action Alternative: No effects.

Proposed Action Alternative and Reduced Utilization and Intensity Alternatives: The continued sedimentation into Fossil Creek from grazing will have minimal affects on the availability of habitats for macroinvertebrate species and it is unlikely that either the Proposed Action Alternative or the Reduced Utilization and Intensity Alternative will have any adverse affects on the macroinvertebrate composition of Fossil Creek. There would be no effect on the Forestwide trend for macroinvertebrates.

Botany and Forest Service Sensitive Plants

No Action Alternative: No effects to TES plants

Proposed Action Alternative and Reduced Utilization and Intensity Alternative: Effects to potential habitat is mitigated by surveys before constructing improvements. Effects of increased ground cover and vegetation and decreased grazing and trampling to potential TES plants from the reduced alternative are a minimal and insignificant improvement. Improved range conditions and control of livestock from both alternatives my indirectly improve TES habitat.

Noxious and Invasive Weeds

No Action Alternative: The introduction, spread of invasive species would not be attributed to grazing or livestock management actions.

Proposed Action Alternative and Reduced Utilization and Intensity Alternative: Mitigation measures would minimize the introduction or spread of invasive species, but would not stop the spread of these species.

Recreation Resources and Wilderness, Inventoried Roadless Areas

No Action Alternative: No effects to recreation sites, uses, lands and recreation special uses, recreation opportunity spectrum, visual quality objectives, wilderness or inventoried roadless areas.

Proposed Action Alternative and Reduced Utilization and Intensity Alternative: Minor impacts to dispersed camping opportunities at the three water access sites for livestock along Fossil Creek. Otherwise, there would be no effects on the other recreation values.

Wild and Scenic Rivers

No Action Alternative: No effects to the Verde Wild and Scenic River and no effects on eligibility or proposed designation and classification of Fossil Creek as a Wild and Scenic River.

Proposed Action Alternative and Reduced Utilization and Intensity Alternative: The Fossil Creek Wild and Scenic ORV of Riparian Community will be minimally affected by livestock grazing and management at the three proposed livestock water access points. The other ORVs would not be directly or indirectly affected. Otherwise there would be no effects to either the Verde or Fossil Creek Wild and Scenic Rivers.

Effects to Heritage Resources:

No Action Alternative: No effects.

Proposed Action Alternative and Reduced Utilization and Intensity Alternative: No adverse effects.

Economic Effects:

No Action Alternative: No jobs or federal payments to counties

Proposed Action Alternative and Reduced Utilization and Intensity Alternative: The proposed action provides more jobs and federal payments to counties than the reduced alternative, and has an overall larger benefit/cost ratio than the reduced alternative. The estimated gross annual revenue to the permitee is larger with the proposed action than with the reduced alternative.

Chapter 3 – Environmental Consequences

This section summarizes the physical, biological, social and economic environments of the affected project area and the potential changes to those environments due to implementation of the alternatives. It also presents the scientific and analytical basis for comparison of alternatives presented in Chapter 2.

The information pertaining to the affected environment and effects of the alternatives are summarized from other documents, including specialist reports. The planning record includes all project-specific information including specialist reports, ecosystem analyses, and other results of project-related investigations. The record also contains information resulting from public involvement efforts. The planning record is located at the Mogollon Rim Ranger District at the Blue Ridge Ranger Station in Happy Jack, Arizona and is available for review during regular business hours.

Effects of the alternatives are discussed in this section for the following resource areas:

- Range Resources, includes upland vegetation
- Soil and Water Resources, including Riparian Vegetation
- Wildlife
- Fisheries
- Botany and Sensitive Plants
- Invasive Plant Species
- Other Environmental Components
    - Recreation
    - Wilderness
    - Wild and Scenic Rivers
    - Inventoried Roadless Areas
    - Heritage Resources
    - Economics
    - Environmental Justice

Also, acres used in the effects analysis may differ from one resource to another and may not always agree down to the exact acre. This may be due to the type of database that is being queried to generate acres or rounding parameters used. The acre differences will not affect conclusions made by the resource specialist.

Past, Ongoing and Reasonably Foreseeable Future Actions

Cumulative impacts can result from individually minor, but collectively significant actions taking place over a period of time. Past, present and reasonably foreseeable

future actions within the Fossil Creek Range Allotment project area, and the Fossil Creek – Lower Verde 5th code watershed are listed in Tables 8-12 below. Further discussion is provided about various actions significant in magnitude or scope. Projects listed are on the Coconino National Forest except where otherwise noted.

This section discloses actions considered in the cumulative effects sections of each resource area evaluated in this Environmental Consequences Chapter of the EA. In most cases, past and ongoing activities are incorporated into each resource's existing conditions because they help explain the current condition of the resource. That is, past and ongoing activities are described in the context of how these actions affect present conditions. Similarly, foreseeable future actions (such as the Travel Management Rule and the Managing Motorized Travel EIS) are evaluated as to how they would increase, reduce or not change conditions for the resource.

Tables 8, 9, 10, 11 and 12 list the projects that were considered in the cumulative effects analyses by various resources, depending on the scope of their analysis. Past actions are those that have been implemented. For most resources, the time frame evaluated for effects of past actions ranged from 10 to 20 years. Ongoing actions are those that have decisions made and are ready to implement or are being implemented. Projects that are being appealed are also included. Reasonably foreseeable future actions are those projects that are in the planning stages and have developed a proposed action or alternatives, but a decision has not been made. Data sources for ongoing and future and foreseeable actions include the various forest's schedule of proposed actions databases.[4]

Past Actions

Past actions include livestock grazing for the past 100 to 125 years on a variety of allotments on the three National Forests that occur within the watershed, diversion of water from Fossil Creek, wildfires and limited pinyon-juniper clearing through the use of fire, and sediment reduction projects on tank sites in the Fossil Creek Allotment.

Livestock numbers were very high at the turn of the 20th century and have decreased to present numbers for approximately the last 20-30 years. Approximately nine large fires totaling about 2,400 acres have occurred over the past 10 years within the cumulative effects watershed area boundary. There have been multiple small fires within the watershed boundary, burning a total of about 250 acres. Almost all of the fires within the watershed have been lightning caused. Pre-treating juniper woodlands and then burning to remove juniper did occur on the Fossil Creek allotment in the early 1990's, but is outside of the timeframe for this analysis.

From 1909 to 2005, most of the base flow of Fossil Creek was diverted by the Childs-Irving Hydroelectric Project at the Fossil Springs diversion dam, approximately 14 miles

[4] Coconino: http://www.fs.fed.us/sopa/components/reports/sopa-110304-2007-04.pdf
Tonto: http://www.fs.fed.us/sopa/components/reports/sopa-110312-2007-04.pdf
Prescott: http://www.fs.fed.us/sopa/components/reports/sopa-110309-2007-04.pdf

upstream from the Fossil Creek / Verde River confluence and just below Fossil Spring. The diversion dam (a 25-foot high concrete structure) removed most of the base flow discharged from Fossil Springs, leaving only approximately 1.5 cubic feet per second (cfs) of seepage flow in the 3.8-mile stream reach between the dam and the Irving Power Plant. After passing through the Irving Power Plant, approximately 5.5 cfs of water was returned to the Fossil Creek stream channel, while an estimated 36 cfs of the spring discharge was diverted through another series of flumes and pipes to Stehr Lake, a regulating reservoir for the Childs Power Plant. From Stehr Lake, the spring water was piped down to and through the Childs Power Plant and then discharged into the Verde River. With the decommissioning of the flume and power plant in 2006, the full base flow of ~ 43 cfs has been returned to Fossil Creek.

Past actions excluding grazing (described above) are shown in Table 8 below.

Table 8. Past Actions in the Fossil Creek Range Allotment Area, and the Fossil Creek – Lower Verde 5th code Watershed (excluding grazing)

Project Name, Year	Forest	Description
Deadman Mesa Grassland Maintenance Categorical Exclusion, 2006	Tonto	Cut junipers less than 8" diameter using a hydraulic cutting device and chainsaws to maintain grassland vegetation type on 350 acres
Childs/Irving Decommissioning/Restoration Activities, 2004	Coconino	Removal of Childs/Irving Powerplant infrastructure. Completed to date and summarized in *Childs-Irving Hydroelectric Project 2005 – 2006 Decommissioning Progress Report* http://www.aps.com/images/CI/2006_Progress_Report.pdf
Native Fish Restoration in Fossil Creek, 2004	Coconino, Tonto	Constructed a fish barrier, salvaged native fishes for restocking, eradicated non-native fishes, protected habitat.
Habitat Improvement, 2006	Coconino	Sediment reduction activities at Sycamore Basin and Buckskin stock tanks. Pinyon and juniper cutting and lop and scatter on small acreages, and installation of erosion control filter sox to reduce sedimentation into stock tanks.
Dispersed Recreation	Coconino, Prescott, Tonto	Non-developed recreation activities including: hunting, fishing, camping, driving for pleasure, hiking, biking, bird-watching etc.
Road maintenance	Coconino, Prescott, Tonto	Only occurring on main roads (generally Maintenance Levels 3-5) on each forest

Table 9: List of Past Wildfires Occurring Within the Fossil Creek Range Allotment and Fossil Creek –Lower Verde 5th code Watershed, 1997-2006.

FIRE NAME	FOREST	YEAR	ACRES
SANDROCK	Coconino	1997	93
SAND	Coconino	1998	271
IRVING	Coconino	2001	15
PINE MOUNTAIN	Prescott	2001	120
FIVE MILE	Coconino	2002	379
BACKBONE	Coconino	2003	16
CEDAR BENCH	Prescott	2004	71

FIRE NAME	FOREST	YEAR	ACRES
BULL RUN	Coconino	2005	884
BLACK	Tonto	2005	293
TOWEL	Coconino	2006	278
TOTAL ACRES			***2,420***

Ongoing Actions

Present grazing management actions that are occurring within the Fossil Creek – Lower Verde 5th code watershed in addition to the Fossil Creek Range Allotment include livestock grazing within various allotments on the Coconino, Tonto and Prescott National Forests (Table 10). Approximately 7% of the watershed boundary is not grazed by livestock. Wildlife have access to graze the entire watershed area.

Table 10: List of Present Grazing Actions Occurring Within the Fossil Creek Range Allotment and Fossil Creek-Lower Verde 5th code Watershed.

ALLOTMENT_NAME	FOREST	ACRES	% of watershed
No Grazing	Coconino	11,036	6
Walker Basin	Coconino	2,700	1
Thirteen-Mile Rock	Coconino	8,477	4
Hackberry/Pivot Rock	Coconino	29,280	15
Baker Lake/Calf Pen	Coconino	10,764	6
Fossil Creek	Coconino	42,091	22
Ikes Backbone	Coconino	3,187	2
Bald Hill	Prescott	2,711	1
Brown Springs	Prescott	16,148	8
Copper Canyon	Prescott	7,993	4
Horner Mountain	Prescott	669	0
Squaw Peak	Prescott	11,216	6
Sycamore	Prescott	1,434	1
Young	Prescott	964	1
No Grazing	Prescott	384	0
Cedar Bench	Tonto	11,328	6
Deadman Mesa	Tonto	16,846	9
Hardscrabble	Tonto	1,114	1
Pine	Tonto	2,818	1
Skeleton Ridge	Tonto	8,797	5
No Grazing	Tonto	2,282	1

Additional activities that are occurring in the cumulative effects boundary area include developed and dispersed recreation, road maintenance, fire suppression, wildland fire use, permitted hunting, manual treatment of noxious weeds, roadside hazard tree removal, and special uses. Of these activities, recreation and hunting activities have the most qualitatively measurable impact. There is one developed recreation site within the area, Childs Campground, and several trails that are within or near to the allotment: Sycamore, Flume Cimarrron Springs, Mail Trail and Fossil Springs trails. Recreational activities include: hiking; viewing wildlife; hunting; dispersed car-camping; backpack camping;

orienteering; horseback riding, caving, rock climbing, photography, picnicking; taking scenic drives; bicycling; shooting; and gathering in family or social groups. Off Highway Vehicle (OHV) use has increased dramatically in the last several years as neighboring Forests implement tighter restrictions on the use of jeeps, 4x4's and "quads". Family-oriented groups tend to gather at dispersed campsites, and explore from their campsite along old roads or off through the forest, making their own trails.

Specific ongoing major actions are listed within Table 11.

Table 11: List of Ongoing Actions (excluding grazing) the Fossil Creek Range Allotment and Fossil Creek –Lower Verde 5th code Watershed.

Project Name	Forest	Description
Childs/Irving Decommissioning/Restoration Activities, 2004	Coconino	Removal and rehabilitation of Childs/Irving Powerplant infrastructure. Expected completion, June 30, 2010.
Dispersed Recreation	Coconino, Prescott, Tonto	Non-developed recreation activities including: hunting, fishing, camping, driving for pleasure, hiking, biking, bird-watching etc.
Hunting	Coconino, Prescott, Tonto	Hunting game, mainly elk, deer, turkey in Unit 6A on the Coconino, Units 21 and 22 on the Prescott and Tonto Forests
Road Maintenance	Coconino, Prescott, Tonto	Only occurring on main roads (generally Maintenance Levels 3-5) on each forest.
Wild Animal Grazing	Coconino, Prescott, and Tonto	Grazing by wild animals
Integrated Treatment of Noxious or Invasive Weeds ROD & FEIS, 2005	Coconino, Prescott	Treatment and control of noxious and invasive weeds

The local hunting seasons last from about mid-August through December and account for much of the fall use in the area. The area is part of the Arizona Game and Fish hunt "Unit 6A", and units 21 and 22 on the Prescott and Tonto National Forests, and is popular for turkey, elk and deer hunting during various seasons.

Future and Foreseeable Actions

The following future and foreseeable actions that are proposed to occur within the analysis area have been taken from the Schedule of Proposed Actions (SOPA) for the Coconino, Prescott, and Tonto National Forests.

Table 12: List of Future and Foreseeable Actions Occurring Within the Cumulative Effect Analysis Area

Project Name	Forest	Description
Coconino National Forest Travel Management Plan EIS	Coconino	Designate a system of roads, trails, and areas that will be open to public motorized use on the Coconino National Forest. Decision anticipated 2009
Pivot Rock-Hackberry Range Allotment EA	Coconino	Determine whether to continue to authorize livestock grazing, determine where livestock grazing is appropriate and to what intensity or level of grazing. Decision anticipated 2008

Project Name	Forest	Description
Issuance of New Special Use Permits for Expired Permits or New Owners 2006 CE	Coconino	Proposal to reissue permits that have expired or have new owners throughout the ranger district area.
Fire Program Management Direction EA	Tonto	Forest Plan amendment to implement the National Fire Plan with regard to fire use.
Integrated Treatment of Noxious and Invasive Weeds	Tonto	Eradication or control of noxious weed and invasive plant species forestwide using an integrated approach. Treatment methods may include cultural, physical, mechanical, biological, or chemical control measures.
Personal Use Driftwood, Dead/Down, Dead/Standing, and Dying Standing Progam CE	Tonto	Program includes the the cutting and gathering of fuelwood and/or forest products for personal use only
Personal Use Small Forest Products Program CE	Tonto	Annually occuring program for the personal cutting and/or gathering of forest products. Products include, but are not limited to: Christmas trees, mistletoe, posts, poles, manzanita, wildlings, etc.
Forest Plan Amendment - Fire Use EA	Prescott	LMP amendment for wildland fire use.
VV01 to Copper Canyon 69 kV Powerline Project	Prescott	Proposal by Arizona Public Service to construct a new 69kV power line from the Dugas Area to Camp Verde along starting near I-17 to Forest Road 68D, 738A and Trail 521. Project includes road and trail improvements and construction to access power line.

Range Resources

The following section describes the affected environment and effects of the alternatives for the range resource which includes upland vegetation diversity, upland vegetation density, and upland vegetation production. The analysis presented is summarized from the following report which is incorporated by reference: *Range Specialist's Report* by G. Hase Jr., 2007. (PR#120).

Affected Environment for Range Resources

Grazing History

Livestock grazing has occurred in the area since the late 1870's. Permitting began around 1908 with the establishment of the National Forests. No specific documentation is available regarding the type and number of livestock grazed in the early years on an individual allotment. However, the grazing history of the Fossil Creek Allotment most likely reflects the Coconino National Forest trends, starting with high numbers and generally dropping to the current levels. Actual use on the Fossil Creek Allotment over the past twelve years is shown in Figure 3. Actual use averaged 93.5% of permitted numbers from 1995 to 2001 with reductions in stocking level primarily in response to operational requirements and dry years. In response to drought conditions, actual use was reduced from 2002 to 2006 and livestock were completely removed from the allotment from June 20, 2002 to February 28, 2003 and from October 31, 2004 to October 31, 2006.

Grazing Capability

Grazing capability of a land area is dependent upon the interrelationship of the soils, topography, plants and animals. Grazing capability is expressed as one of three capability classes (Region 3 Rangeland Analysis and Management Training Guide; June, USDA – Forest Service 1997; 2.8-2.10): Full Capacity, Potential Capacity, and No Capacity.

The analysis of grazing capability on the Fossil Creek allotment indicates that the major factors in determining and classifying capability are slope and soil condition/soil stability. The following is a summary of the Grazing Capability classification for the allotment.

Table 13. Fossil Creek Allotment Grazing Capability Classification

Grazing Capability Class	Acres	Description
Full Capacity	1,525	0 to 10% slope; Satisfactory Soil Condition
Potential Capacity Condition	28,031	0 to 40% slope; Impaired/Unsatisfactory Soil Condition
No Capacity	12,577	>40% slope; Inherently Unstable Soil Condition
Unclassified	26	Stehr Lake
Allotment Total Acres	*42,159*	

Range Condition and Trend

Range Condition and Trend are assessed at permanent monitoring locations; the Parker 3-Step method is used on the Fossil Creek Allotment. Parker 3-Step clusters were read in the years 1998/1999/2001 and these same locations were read again in late 2006. The following summary reflects data collected from the 15 permanent locations in 2006 and compares it with data from the previous reading (1998/1999/2001).

Table 14. Fossil Creek Allotment Range Condition and Trend

Range Condition	# of Locations	Range Trend	# of Locations
Improved Condition	1 (7%)	Improving Trend	0 (0%)
Static Condition	5 (33%)	Static Trend	2 (13%)
Decreased Condition	9 (60%)	Downward Trend	13 (87%)

In summary, the decline in range condition and trend are attributable to a reduction in ground cover (vegetation and litter), a reduction in perennial grasses (primarily cool-season grass species), and an increase in unpalatable shrub species. In some areas, the reduction in ground cover and perennial grasses is due to encroachment of pinyon-juniper. Impacts from the 1998-2006 drought period, coupled with livestock grazing, are believed to be the significant factors in the decline in range condition and trend.

Forage Production

Forage production was stratified by Terrestrial Ecosystem (TES) Unit. Forage production within each TES unit was either measured or forage production estimates were obtained from the potential forage production predictions listed in the Terrestrial Ecosystem Survey of the Coconino National Forest, (Miller et al. 1995).

TES Units with Forage Production Data

Forage production measurements were taken at four locations in mid-October, 2006 and at the 15 Parker 3-Step clusters in November/December, 2006. Forage production averaged 524 pounds per acre; the lowest measured forage production was 14 pounds per acre and the highest measured forage production was 1,161 pounds per acre. The major components of forage production on the Fossil Creek allotment are warm season grasses and forage production varies widely on an annual basis dependant primarily on precipitation. For the 2006 growing year, precipitation amounts and the timing of the precipitation were very favorable for above average forage production. As a result, this forage production data was used to represent maximum forage production for the TES unit in which the data was collected.

TES Units without Forage Production Data

Forage production estimates were obtained from forage production potential values estimated and listed in Table 3, Interpretations for Coconino Terrestrial Ecosystem Survey of the Coconino National Forest, (Miller et al. 1995). Forage Maximum values from TES were not used because they are estimates based on the total annual yield of native forage plants after elimination of non-forage species.

Grazing Capacity

Grazing capacity is a function of grazing capability, forage production, topography, allowable use, and the level of management that may be applied. The analysis used grazing capability, forage production (measured and estimated), topography, and an appropriate allowable use to determine the estimated grazing capacity. Based on the factors used in the analysis, the estimated maximum grazing capacity for the Fossil Creek allotment is approximately 5,800 Animal Unit Months or 483 Animal Units yearlong. Based on the factors used in the analysis, the initial permitted livestock numbers will be a maximum of 3,600 AUMs (300 AUs yearlong) until soil and vegetation conditions improve.

Vegetation

The analysis area consists of five major vegetation types: ponderosa pine, pinyon-juniper woodland, pinyon-juniper grasslands, semi-desert grassland/desertscrub, and riparian. The following table summarizes the vegetation types within the analysis area.

Table 15. Fossil Creek Range Allotment Vegetation Communities

Vegetation Community Type	Acres	Percent of Analysis Area	Management Areas
Ponderosa Pine	1,109	2.6 %	1, 4, and 6
Pinyon-Juniper Woodland	34,596	82.1 %	1, 2, 7, 8, 11, 001M
Pinyon-Juniper Grasslands	5,727	13.6 %	10
Semi-Desert Grassland/Desertscrub	314	0.7 %	11
Riparian	412	1.0 %	1, 2, 7, 11, 12, 001M
TOTAL	*42,158*	*100 %*	- - -

Environmental Consequences for the Range Resource

This section describes environmental consequences to vegetation found in the uplands, woodlands and grasslands. Effects on riparian vegetation are not covered in this section but are described in the Soils and Water analyses in this chapter. Vegetation condition and trend, as measured by vegetation density and diversity, is the primary unit of measure used to compare alternatives. Plant height and canopy cover is a secondary unit of measure.

No Action Alternative

Direct and Indirect Effects

Under this alternative, livestock grazing would not occur and as a result, there would be no direct or indirect effects from cattle grazing on upland vegetation. Wildlife will continue to graze on the allotment, creating localized impacts and potentially areas of excessive utilization.

When cattle graze, herbaceous plant height and canopy cover is reduced; however this is only a temporary reduction because these plants recover with favorable climatic

conditions. Under this alternative, short term reductions in the height and canopy cover of herbaceous vegetation from livestock grazing would not occur.

Short-term changes in range condition and trend (as measured by changes in vegetation density and diversity) may be observed under this alternative. These changes would be most noticeable, and occur most rapidly, in the more mesic sites (requiring moderate moisture) within the analysis area (less than 5% of the analysis area). Within the drier sites (greater than 95% of the analysis area), these changes would likely occur much slower. However, a long-term increase in vegetation density and diversity is not expected due to livestock removal. Courtois, et al., (2004) found few differences in species composition, cover, density, and production in comparing 16 long-term livestock exclosures (65 years) with adjacent areas that had been moderately grazed. Similar results have been found locally on the Coconino National Forest at exclosures on the Pickett Lake and Anderson Springs allotments (Peaks Ranger District records; Loeser et al. 2004). Under this alternative, range condition and trend is expected to remain static or move upward, except in areas where overstory species limit improvement potential. The ability for improvement in range condition and trend will be most affected by climatic conditions.

Cool-season species will continue to receive a disproportionate share of the grazing by wildlife. If wild ungulate (such as elk) numbers across the landscape fluctuate up or down (which could be the result of weather or Arizona Game and Fish Department hunt numbers or a combination of these two main factors), this would also affect the vegetative resource on the allotment as plants are either allowed to recover from grazing effects or are continually grazed. In the latter case, the eventual result may be a loss in plant species diversity (Vavra et al. 1994; Briske, 1991; Szaro et al. 1999; Archer et al. 1991).

Forage production and forage quality are expected to have a short-term increase (1-3 years), followed by a period of stabilization and then declining (years 5+). Holechek (1981) reported that forage production and quality is maintained and enhanced by light to moderate grazing. Under this alternative, wildlife will continue to graze within the analysis area and maintain forage production and forage quality on small areas. However, with no livestock grazing, maintenance of forage production and forage quality over large areas will no longer occur.

Under this alternative, structural range improvements would not be constructed. As a result there would be no direct or indirect effects relating to that activity. An additional direct effect would be that the existing improvements would not be maintained or removed. Indirect effects would be realized through a loss of water available for wildlife as stock tanks fill with sediment and as the pipeline/drinker system degrades.

Cumulative Effects

The focus of this analysis is on upland vegetation which receives very little influence from off site activities. As a result, the geographical extent of the cumulative effects analysis is confined to the Fossil Creek allotment. The timeframe selected for this

analysis is 20 years; 10 years in the past and 10 years in the future. This timeframe was selected because ground disturbing activities that have occurred within the analysis area are expected to recover within 10 years. The past, present, and reasonably foreseeable future activities considered in the cumulative effects analysis for upland vegetation include: dispersed recreation, firewood gathering, hunting, roads, OHV use, wildlife grazing and livestock trailing.

Livestock grazing, in combination with dispersed recreation, firewood gathering, hunting, roads, OHV use, wildlife grazing, and livestock trailing, can cumulatively affect the vegetation density, vegetation diversity, plant height, and canopy cover of understory plants. Under this alternative, there would be no direct or indirect effects from cattle grazing on range condition and trend, plant height, or canopy cover. Short term changes in range condition and trend (both positive and negative) are expected with changes driven primarily by climatic conditions and overstory species competition. Similarly, forage production and quality is expected to improve over the short term, but will decrease over time unless wildlife grazing increases substantially or prescribed fire is used to maintain foraging areas. Available water for wildlife is expected to see a short term increase followed by a steady decline as water sources begin to fail and fill with sediment due to a lack of maintenance. These cumulative effects are considered to be minor beneficial short term effects. Long term effects are expected to be neutral to negative.

This alternative provides the most cumulative protection to upland vegetation by not authorizing livestock grazing. Wildlife grazing would still occur as would other uses. Changes in road management and elimination of cross country off-road travel through the Managing Motorized Travel EIS will cumulatively lessen the impact to the upland vegetation across the Fossil Creek Allotment.

Proposed Action Alternative

Direct and Indirect Effects

Under this alternative, livestock grazing would occur and as a result, there would be direct and indirect effects from cattle grazing on upland vegetation. Adaptive management and monitoring will be used to mitigate the direct and indirect effects by adjusting the timing, intensity, frequency, and duration of livestock grazing. Wildlife will continue to graze on the allotment, creating localized impacts and potentially areas of excessive utilization.

Livestock grazing effects to vegetation occur by reducing plant height and cover. These effects are primarily managed through forage utilization and grazing intensity; the actual numbers of livestock grazed is largely irrelevant. The reduction in plant height and cover, as a result of grazing, does recover with favorable climatic conditions.

Under this alternative, the following management guidelines for forage utilization and grazing intensity by livestock and wildlife would be established:

- 30 to 40 percent forage utilization.

- 40-50 percent grazing intensity during the late spring and early summer months.
- 30-40 percent grazing intensity during the remainder of the year.

Adaptive management and monitoring will provide the ability to reduce these management guidelines if needed to maintain or improve vegetation conditions. See Chapter 4 for more details on adaptive management and monitoring. In Galt, et al. (2000), a 25 percent utilization guideline is recommended for livestock, with 25 percent allocated for wildlife and natural disturbance, and the remaining 50 percent left for site protection. Under this alternative, wildlife use is included within the proposed forage utilization guideline of 30-40 percent. As a result, this alternative leaves a minimum of 60 to 70 percent of the forage production available at the end of the growing season (generally October) for site protection, which is above what Galt, et al.(2000) recommend. Using the same rationale for grazing intensity, the grazing intensity guidelines established for this alternative would result in a minimum of 50 to 70 percent of the current forage production remaining on site after livestock grazing occurs to reproduce, grow to maturity, build necessary root mass, produce seed heads, produce litter important for nutrient cycling, and propagate and move into new areas. Again, this would meet or exceed the recommendations proposed by Galt et al., (2000).

This alternative would have direct effects to understory plants by reducing plant height and canopy cover. This reduction could lead to a decrease in grass, forb and shrub plant species composition, plant canopy cover, plant abundance, plant production and ground cover. However, findings in Courtois, et al. (2004), Loeser et al. (2004), and data available from the Coconino National Forest, Peaks Ranger District, indicate that there is not an increase in grass, forb, and shrub abundance, diversity, and production when the areas are rested or excluded from cattle grazing. Under this alternative, through effective implementation of monitoring and adaptive management, upland vegetation condition and trend is expected to remain static or move upward, except in areas where overstory species limit improvement potential. The ability for improvement in range condition and trend will be most affected by climatic conditions. The overall effects of this alternative with respect to upland vegetation condition and trend are similar to the No Action Alternative.

Livestock grazing can have an effect in improving or decreasing plant species composition depending on the timing of grazing. For instance, spring and early summer grazing occurs mainly on cool season species. After the monsoon season, grazing occurs mainly on warm season species. As the weather cools in the fall, use changes back to cool season species. Under this alternative, the grazing use period within a pasture is seasonally rotated so that forage is grazed and rested at different times each year. Loeser, et al. (2004) showed evidence of increased vegetative production in response to livestock grazing. Additionally, Holechek (1981) reported that forage production and quality is maintained and enhanced by light to moderate grazing. By alternating the livestock use and rest periods on cool and warm season species, forage production, forage quality, and plant species composition will be maintained or improved. Additionally, adaptive management and monitoring will provide the necessary resource information and

management options to adjust the timing, intensity, frequency and duration of livestock grazing to ensure that vegetation condition is maintained or improved.

There will not be direct or indirect effects to upland vegetation as a result of the structural improvements proposed for construction under this alternative as these improvements are designed mainly as mitigations for wildlife and riparian habitat. There are no additional direct and indirect effects to upland vegetation that will result from the removal of existing structural improvements that have not already been discussed.

Cumulative Effects

The geographical extent, timeframe, and past, present, and reasonably foreseeable future activities are the same as described in the No Action Alternative.

Livestock grazing, in combination with dispersed recreation, firewood gathering, hunting, roads, OHV use, wildlife grazing, and livestock trailing, can cumulatively affect the vegetation density, vegetation diversity, plant height, and canopy cover of understory plants.

Under this alternative, livestock grazing would have direct effects to understory plants by reducing plant height and canopy cover. When the effects from cattle grazing are added to the effects from the other activities, the overall cumulative effect of cattle grazing on upland plant height and canopy cover is more than the No Action Alternative and slightly more than the Reduced Utilization and Grazing Intensity Alternative. Cumulatively, condition and trend for upland vegetation is expected to remain static or move upward with cattle grazing additive to other activities and natural events. This alternative does not cumulatively result in a decline of vegetation condition or trend. There would be no measurable differences in vegetation condition and trend between any of the alternatives.

Changes in road management and OHV use by eliminating cross country off-road travel and coming from the Managing Motorized Travel EIS will cumulatively lessen the impact to the upland vegetation across the Fossil Creek Allotment.

Reduced Utilization and Grazing Intensity Alternative

Direct and Indirect Effect

With the following exceptions, all direct and indirect effects from livestock grazing on upland vegetation will be the same as described in the Proposed Action Alternative.

Under this alternative, the following management guidelines for forage utilization and grazing intensity by livestock and wildlife would be established:

- 15 to 25 percent forage utilization; increased to 30 to 40 percent when vegetation and soil conditions have improved.
- 15 to 25 percent grazing intensity; increased to 40-50 percent grazing intensity during the late spring and early summer months and 30-40 percent grazing intensity during the remainder of the year when vegetation and soil conditions have improved.

Under the initial forage utilization guidelines established in this alternative, a minimum of 75 to 85 percent of the annual forage production would remain on site at the end of the growing season for site protection. In comparison to the Proposed Action Alternative, this alternative would initially result in slightly more forage production remaining on site at the end of the growing season within the last few pastures grazed before the end of the growing season. There would be no difference between this alternative and the Proposed Action alternative for pastures that were grazed from the dormant season period (winter) through the mid-growing season period (generally August) due to plant regrowth and recovery.

The initial grazing intensity guidelines established for this alternative would result in a minimum of 75 to 85 percent of the current forage production remaining on site after livestock grazing occurs to reproduce, grow to maturity, build necessary root mass, produce seed heads, produce litter important for nutrient cycling, and propagate and move into new areas. In comparison to the Proposed Action Alternative, this alternative would initially result in slightly more forage production remaining on site after a livestock grazing period. However, there would be no difference between this alternative and the Proposed Action alternative at the end of the growing season due to plant regrowth and recovery.

Since this alternative allows for increasing the forage utilization guideline and the grazing intensity guideline when vegetation and soil conditions improve, there are no long term differences between this alternative and the Proposed Action alternative.

This alternative establishes an initial stocking level of 2,400 Animal Unit Months (200 head yearlong). There are no direct or indirect effects to upland vegetation as a result of livestock numbers. As discussed in the Proposed Action Alternative, livestock grazing effects to vegetation occur through a reduction in plant height and cover. These effects are primarily managed through forage utilization and grazing intensity. Providing that forage utilization and grazing intensity are properly managed, the effects to vegetation based on the actual number of livestock grazed are largely irrelevant. Therefore, there is no difference in overall effects between this alternative and the Proposed Action Alternative with respect to a reduced livestock numbers.

Cumulative Effects

The geographical extent, timeframe, and past, present, and reasonably foreseeable future activities are the same as described in the No Action Alternative.

Livestock grazing, in combination with dispersed recreation, firewood gathering, hunting, roads, OHV use, wildlife grazing, and livestock trailing, can cumulatively affect the vegetation density, vegetation diversity, plant height, and canopy cover of understory plants.

Under this alternative, livestock grazing would have direct effects to understory plants by reducing plant height and canopy cover. When the effects from cattle grazing are added

to the effects from the other activities, the overall cumulative effect of reducing upland vegetation height and canopy cover is greater under this alternative than the No Action Alternative. Abundant research and literature exists documenting the beneficial effects of light grazing (defined as 20-30% utilization; depending on author) or conservative/moderate grazing (defined as 30-50% utilization; depending on author) compared to heavy grazing (60+% utilization) on plant height and canopy cover (generally measured by vegetative production in most studies). Additionally, research and literature exists documenting the beneficial effects to plant height and cover when comparing livestock grazing to no grazing. Very little research or literature could be found comparing the effects between light grazing and conservative/moderate grazing. Khumalo, et al. (2007) found that there were no differences in species or species categories (grasses, forb, shrubs) of autumn standing crop and basal cover between light and conservative stocked pastures (author defined light stocked pastures as less than 30% utilization and conservative stocked pastures as 31 to 40% utilization). Additionally, the authors found that climatic conditions exerted the overriding influence on vegetation standing crop and basal cover. Based on the research described above, there is expected to be no measurable difference in the cumulative effects of cattle grazing on upland vegetation height and canopy cover between this alternative and the Proposed Action alternative.

Cumulatively, condition and trend for upland vegetation is expected to remain static or move upward with cattle grazing additive to other activities and natural events. This alternative does not cumulatively result in a decline of vegetation condition or trend. There would be no measurable differences in vegetation condition and trend between any of the alternatives.

Changes in road management and OHV use by eliminating cross country off-road travel and coming from the Managing Motorized Travel EIS will cumulatively lessen the impact to the upland vegetation across the Fossil Creek Allotment.

Comparison of Alternatives and Response to the Issues

One key issue was used to analyze effects of the alternatives specific to the range resource of upland vegetation. The issue analyzed was as follows:

- Livestock grazing under the intensity and utilization rates of the proposed action would not adequately improve soil conditions in the short term (10 years or less) and would negatively affect soil productivity, vegetation conditions and aquatic conditions.

The alternatives were compared using the units of measure: vegetation diversity and density, vegetation height and canopy cover and vegetation production.

Proposed Action versus Reduced Utilization and Intensity Alternative

Measurable differences in upland vegetation diversity, upland vegetation density, and upland vegetation height and canopy cover are not expected to occur between the two action alternatives. Forage production and forage quality is expected to be maintained

and enhanced by light to moderate grazing with no measurable differences between these alternatives.

No Action – No Grazing alternative versus Action Alternatives

Measurable differences in upland vegetation diversity and density are not expected to occur between any of the alternatives. Vegetation condition and trend is expected to remain static or move upward, except in areas where overstory species limit improvement potential.

Short term reductions in the height and canopy cover of herbaceous vegetation from livestock grazing will occur under both action alternatives. These short term reductions will not occur under the No Action alternative. Long-term measurable differences between any of the alternatives are not expected.

In the absence of livestock grazing there would be short term increases in forage production and quality but this would be followed by stabilization and then a decline. Both grazing alternatives would see maintenance or enhancement of forage production and quality.

Table 16. Comparison of Alternatives for the Range Resource

Indicator	Unit of Measure	No Action	Proposed Action	Reduced Grazing Intensity and Utilization
Upland Vegetation Condition and Trend	Vegetation Diversity and Density	Vegetation Diversity and Density is expected to remain static or move upward, except in areas where overstory species limit improvement potential. The ability for improvement in vegetation diversity and density will be most affected by climatic conditions. Measurable differences in vegetation diversity and density between any of the alternatives is not expected.		
	Vegetation Height and Canopy Cover	Short term reductions in the height and canopy cover of herbaceous vegetation from livestock grazing would not occur. Long-term measurable differences between any of the alternatives are not expected.	Short term reductions in the height and canopy cover of herbaceous vegetation from livestock grazing will occur. The reduction in plant height and cover, as a result of grazing, does recover with favorable climatic conditions. Short-term measurable differences between the two action alternatives are not expected and long-term measurable differences between any of the alternatives are not expected..	
	Vegetation Production	Forage production and forage quality are expected to have a short-term increase (1-3 years), followed by a period of stabilization and then declining (years 5+).	Forage production and forage quality is expected to be maintained and enhanced by light to moderate grazing. Measurable differences between the two action alternatives are not expected.	

Soil Resource

The following section describes the affected environment and effects of the alternatives for the soil and water resource. The analysis presented is summarized from the following reports which are incorporated by reference: *Soil and Water Specialist's Report* by D. Fleishman, 2007 (PR#133) and the *Soil and Water Existing Condition Report* by D. Fleishman, 2007. (PR#47).

Affected Environment for the Soils Resource

Soil Condition

The current soil conditions for the Fossil Creek Allotment are shown in Table 17. Soil conditions were determined by field data collection in 2004 and 2005 using the soil condition protocol developed in Region 3 (FSH 2509.18-99-1). Three soil functions were evaluated: the ability of the soil to resist erosion, infiltrate water and recycle nutrients. The field soils assessment was conducted by the former Red Rock Ranger District watershed specialist, Jack Norman, and the Coconino National Forest soil and watershed program manager and Certified Professional Soil Scientist Rory Steinke (PR#11). They also used information from the Coconino National Forest Terrestrial Ecosystem Survey (TES). Copies of data sheets and a complete discussion of specific soil conditions by TES map unit can be found in the project record (PR#133). Soil loss is currently about 35% above a natural, non-disturbed condition averaging about 5.9 tons per hectare per year.

Table 17: Soil Conditions of the Fossil Creek Range Allotment

SOIL CONDITION CLASS	ACRES	RELATIVE PERCENT
Satisfactory	1,525	4%
Inherently Unstable	16,872	40%
Impaired	20,669	49%
Unsatisfactory	3,067	7%
None (Stehr Lake)	26	0%
TOTAL % (Acres):	42,139	100%

Unsatisfactory

Most of these soils are in areas accessible to livestock grazing on slopes less than 40% in steepness and are located adjacent to Fossil Creek and in areas of high recreation impact. These soils have compacted soil surfaces or current erosion rates exceeding tolerable limits and amount to about 7 percent of the allotment. Soil characteristics include platy blocky soils that limit water infiltration, poor litter production and vegetative conditions that limit nutrient cycling, and varying degrees of visible erosion.

Inherently Unstable

These soils have natural erosion rates exceeding tolerable limits and amount to about 40% percent in the allotment. Based on the Universal Soil Loss Equation (USLE) these soils are eroding faster than they are renewing themselves but are functioning properly and normally, indicating an inherently unstable soil condition (Miller et al. 1995). These soils are located primarily in pinyon-juniper – chaparral vegetation types on slopes generally greater than 40%. These soils contribute the majority of soil loss and are not extensively grazed. A field traverse through map unit 430 was made in the Bull Canyon and Sycamore Canyon in January of 2007 and evidence of erosion existed, with effective ground cover at approximately 15-20% (PR#34).

Impaired

Impaired soils have reduced ability to accept, hold, and release water. Excessive livestock grazing may compact soil and reduce infiltration capacity. Impaired soil conditions amount to about 49 % of the allotment. Where impaired soils exist, they are found on plains and hill slopes in pinyon-juniper and juniper-semi-desert grassland transitional vegetation types or adjacent to Fossil Creek. On-site soil conditions showed blocky, platy soil surfaces and a lack of litter to provide effective ground cover. Since these soils are found on both flat slopes (0-15%) and moderately steep slopes (15-40%), surface runoff varies from slow to fast and accelerated peak flows or reduced baseflows vary accordingly. It is unlikely that these soils significantly alter water quantity, and timing of flows to a great enough degree as to adversely affect riparian habitat vegetation, and fluvial geomorphology, as long as the stream banks are protected with adequate vegetation to withstand peak flows.

Satisfactory

Satisfactory soils occur where all three soil functions are properly functioning: the ability of the soil to resist erosion, infiltrate water and recycle nutrients. Satisfactory soil conditions comprise about 4% of the allotment.

Environmental Consequences

Units of Measure and Indicators of Effects

The most dynamic feature of soil condition is the vegetation type, composition and density and litter production that guides the nutrient cycling function, as well as aids in reduction of erosion. The unit of measure for evaluating effects to soil conditions is effective ground cover. The analysis will focus on change to vegetation resources (plants and litter) that provide nutrient cycling and erosion control through litter development (effective ground cover). Two other components of soil condition are used as measurements of effects: infiltration and compaction. The rate of infiltration and the degree of compaction affects the density and type of vegetation cover which in turn affects litter development and nutrient cycling. The discussion will be narrative and effects will be measured qualitatively.

No Action Alternative

Direct and Indirect Effects

There would be no direct effects from grazing livestock under the No Action Alternative as grazing would not occur. There would be no direct effects from removal of biomass; the standing crop would increase in the short term and no compaction would occur from livestock grazing. Precipitation (timing and amount) will influence the amount and extent of vegetative ground cover that occurs on the allotment. Bredy et al. (1989) noted in a 16 year study of grazed and ungrazed semi-desert grasslands that ground cover increased more on the ungrazed plot, but that ground cover increased on both grazed and ungrazed plots and suggest precipitation was the reason for the increase in ground cover on both plots. As stated in the range management section above, the effects to ground cover over the long-term may be negligible. The indirect effect of accelerated erosion and sediment delivery to connected stream courses caused from livestock grazing would be eliminated. There would not be an effect of other wild animals re-grazing on succulent re-growth after livestock have left a pasture as there would be in the Proposed Action. Grazing by wild animals would be the only agent causing direct and indirect effects to soil condition.

Cumulative Effects

The cumulative effects boundary for soil resource effects is the Fossil Creek-Lower Verde River 5th code watershed (HUC 1506020304). The allotment falls almost entirely within the Fossil Creek – Lower Verde 5th code watershed (totaling about 191,700 acres) with an insignificant acreage in the West Clear Creek 5th code watershed (HUC 1506020301) which is about 191,000 acres. About 42,091 acres of the allotment (99% of the allotment) are in the Fossil Creek-Lower Verde 5th code watershed. An analysis of the West Clear Creek 5th code watershed was not performed because of the small amount of acreage of project located in the watershed (67 out of approximately 191,000 acres—less than 1% of the watershed). The timeframe of the analysis will be 10-years because ground disturbing activities recover in this timeframe. The analysis will be narrative in form, relying on overall soil condition ratings for the Terrestrial Ecosystem Survey for map units described on the Coconino, Prescott and Tonto National Forests that occur within the cumulative effects boundary. The analysis has considered the listing of past, ongoing and future foreseeable projects in Chapter 3.

As there would be no livestock grazing, there would be no cumulative effects to add to past, ongoing and future foreseeable actions in the analysis area. This would leave about 136,500 acres of the 191,000 acre Fossil Creek –Lower Verde watershed still in livestock grazing. This would be a 22% reduction of direct grazing impacts (loss of biomass and compaction). The magnitude of this beneficial effect is however, also tied to the amount and timing of precipitation, and whether or not the area is in a drought condition.

In summary, the No Action Alternative within the Fossil Creek Range Allotment would maintain or improve current soil conditions over time with increased effective vegetative

ground cover and litter due to no livestock grazing. The amount and probability of success of improved effective ground cover will be dependent on timing and amount of precipitation, but is expected to be quicker and have a higher probability of success than either of the grazing alternatives. Improved soil condition equates to improved watershed condition, and thus this alternative will move towards the Forest Plan standard and guideline for improving watershed condition by the year 2020, although it may not be fully attained by this time if drought conditions persist.

Proposed Action Alternative

Direct Effects

Vegetation and Litter Production

The most dynamic feature of soil condition is the vegetation type, composition and density and litter production that guides the nutrient cycling function, as well as aiding in reduction of erosion. The unit of measure used focuses on change to vegetation resources (plants and litter) that provide nutrient cycling and erosion control through litter development. No quantitative measure will be used to discuss effects; rather, the effects will be discussed in narrative fashion using research as a guide for effects.

The following summary of research discusses the effects of grazing on plant production, which in turn affects the potential for the amount of biomass produced. Grazing can stimulate plant production, increase Annual Net Primary Production (ANPP) which can produce more above ground biomass that would be available for litter and thus improve soil conditions (Loeser et al. 2004; Eneboe 2002). Drought also has effects on ANPP and above ground standing crops, which again affects litter available for nutrient cycling, by reducing it (Enoboe et al. 2002; Heinshmidt et al. 1999). Light grazing (30% utilization) has been found to leave a greater amount of vegetation standing crop than moderately grazed sites and that perennial grass survival is higher in a lightly grazed scenario than a moderately grazed scenario (50% utilization) Holecheck et al. (2003).

The differences in forage production reported in studies between heavy, moderate, and light grazing intensities has been summarized by Holecheck et al. (1999). He noted that when averaging reported forage production, “heavy stocking overall resulted in a 20% decline in forage production, moderate stocking had no change, and light stocking resulted in an 8% increase. In drought years, moderately stocked pastures produced 20% more forage than those heavily stocked. Forage production was 49% higher under light than heavy grazing and 24% higher under light than moderate grazing. These studies consistently showed that the greatest benefit of light or conservative stocking in terms of forage production occurred in the dry years.” (Holecheck et al. 1999:13). He further noted that “Heavy stocking consistently caused a downward trend in ecological condition, light stocking caused an upward trend, and slight improvement occurred under moderate stocking” (Holecheck et al. 1999:13). The effects to soil resources, in particularly litter production, are the lower the utilization level, the greater the amount of standing crop available for litter for nutrient cycling.

Examining the Palmer Drought Severity Index (PDSI) as an indicator, range cluster data and soil condition assessments for the Fossil Creek Allotment area together display a strong relationship between precipitation and litter production. Namely, the greater the amount of precipitation, the more litter is produced. Bredy et al. (1989) noted in a 16 year study of grazed and ungrazed semi-desert grasslands that ground cover increased on both grazed and ungrazed plots and suggest precipitation was the reason for the increase on both plots. Consistent with this assertion, water stress is found to limit plant growth in pinyon-juniper woodlands (Gottfried and Peiper: 2000 in Milchanus, 2006:26) and in temperate grasslands, litter quality varies as a consequence of two forces: mean annual rainfall and grazing regime (Semmartin et al. 2004).

The conclusion is that soil resources will be improved under the Proposed Action Alternative's scenario of utilization and intensity over current conditions because vegetative conditions will be improved. However, on unsatisfactory soils the improvement will likely not occur in the short-term. There will also be greater improvement in soil condition during wet cycles because litter creation will increase with wetter conditions. The use of Adaptive Management principles, especially varying utilization and stocking numbers during and immediately after drought, will improve or maintain vegetative conditions that will in also in turn improve soil conditions.

Infiltration and Compaction

Related to infiltration is soil compaction. Soil compaction refers to a change in physical structure of soil and relates to available pore spaces within a soil. The more compacted or dense a soil, the less space there is available for water in the soil and vegetative growth. Increased soil compaction means a reduced water infiltation rate into the soil and increased surface water runoff or overland flow.

Infiltration and compaction can affect above ground biomass production as well. The greater the compaction, the less the infiltration and the more difficult it is for plants to grow (Belsky et al. 1999). Several studies show that the greater the intensity of the grazing, the greater the detrimental effects to soil physical properties (compaction) which lead to less infiltration (Gifford and Hawkins 1978; Warren et al. 1986; Belsky et al. 1999). One study noted that low and moderate intensity grazing had a minmal effect on infiltration and that high intensity grazing had a high, negative effect to infiltration (Warren et al. 1986).

Compaction is expected to occur where livestock congregate, primarily near water sources. This is a small percentage of the allotment. For this alternative, the ability to manipulate utilization and livestock numbers under adaptive management will be key to minimizing compaction across the allotment. Litter is expected to increase over time, which in turn will aid in reducing raindrop impact and improve soil structure over time, thereby minimizing the compaction effects of livestock. As stated above, the lower the utilization level, the more standing crop there will be available for litter incorporation into the soil.

Indirect Effects

An indirect effect considered is that of other wild animal grazing following the succulent re-growth after livestock have left a pasture on the allotment. This "re-grazing" by wildlife can have a negative effect to soil condition through a reduction in biomass. Wild ungulate grazing is both an indirect and cumulative effect considered along with livestock grazing.

Cumulative Effects

The cumulative effects boundary and time frame for soil and watershed effects is the same as described for the No Action Alternative. Cumulative effects are evaluated at the Fossil Creek-Lower Verde Watershed scale.

The acres of grazing considered in the Proposed Action Alternative added to the other grazing that is ongoing within the Fossil Creek –Lower Verde Watershed will total about 178,500 acres of grazing. Current on-going environmental analysis for the Hackberry Pivot/Rock Range Allotment (Coconino National Forest) is proposing to limit grazing in the Teepee Pasture (part of Hackberry Allotment) that is currently unsatisfactory soil condition. This will reduce grazing impacts of removing biomass and improve standing crop available for ground cover creation on approximately 500 acres. In addition, the Hackberry/Pivot Rock allotment will also be applying lower utilization standards than current and using adaptive management with a goal to improve overall soil condition and litter creation and retention. However, a major factor for improvement in ground cover over both grazed and ungrazed pastures is drought conditions.

The new Travel Management Rule will limit off-road travel for all forests within the watershed boundary, which include the Prescott, Tonto and Coconino National Forests. Banning cross-country OHV travel will reduce impacts to vegetation and improve overall soil condition. The lower utilization standards and adaptive management that are being proposed within this Proposed Action, as well as on the Hackberry Allotment are designed to improve current soil conditions. The 350 acres of pinyon-juniper treatment on the Tonto National Forest will improve or maintain soil conditions where the project is occurring, but is so small it will make little difference on a 191,000 acre Fossil Creek-Lower Verde watershed. Other projects such as implementation of the Integrated Treatment of Noxious and Invasive Weeds; Personal Use Driftwood, Dead/Down, Dead/Standing, and Dying Standing Progam CE; and the Personal Use Small Forest Products Program CE on the Tonto National Forest will likely have little effect on the entire watershed because projects within the watershed are likely to be small in acreage. The Noxious Weed EA may have the ability to treat noxious weeds on the 43,000 acre Tonto National Forest portion of the watershed that could lead to improved vegetative conditions and subsequently lead to improvements in soil condition. The Forest Plan Amendment – Fire Use EAs on the Prescott and Tonto National Forests may lead to more fires on the landscape that can have both positive and negative effects to soil and water resources depending on the location and burn intensity of the fires. Burning may reduce potential indirect effects of increasing canopy cover, but can also have negative effects if the burn intensity is moderate to high increasing erosion and sedimentation over the short

term. The VV01 to Copper Canyon 69 KV Powerline Project on the Prescott National Forest would have minimal effects as long as site-specific BMP's are implemented to reduce the effects of access roads on the powerline.

In summary, the actions within the Proposed Action Alternative will improve effective ground cover through increased retention of litter. The cumulative effects of this project would be beneficial over the long term when considered along with the project mentioned above, that are also largely beneficial or neutral to the soil resource. The project design feature of retaining at least 2/3 of effective ground cover will improve current soil conditions. The rate of improvement will be dependent on adaptive management and the timing and amount of precipitation, but vegetation and litter components would improve in the short-term while grazing unsatisfactory soils would only improve slightly in the long-term. Monitoring of grazing on unsatisfactory soils (as outlined in Chapter 2 and Chapter 4) will be used to inform adaptive management strategies for grazing on unsatisfactory soils. The probability of success will be high if effective ground cover targets are met. The Proposed Action is designed to improve conditions and to move towards Forest Plan Standards and Guidelines of satisfactory soil condition by the year 2020 but it will be slower than the No Action alternative.

Reduced Utilization and Grazing Intensity Alternative

Direct Effects

The effects of grazing on vegetation and litter are similar to the Proposed Action. There may be a slight amount of increased standing crop remaining on-site with the Reduced Utilization and Grazing Intensity Alternative if maximum livestock numbers and maximum utilization of 30 to 40% are utilized in the Proposed Action. Light grazing (30% utilization) has been found to leave a greater amount of vegetation standing crop than moderately grazed sites and that perennial grass survival is higher in a lightly grazed scenario than a moderately grazed scenario (50% utilization) (Holecheck et al. 2003). However, the amount of improvement over the Proposed Action is very difficult to quantify. The following discussion outlines that a lighter grazing level does create the conditions where more standing crop is available for litter.

The differences in forage production reported in studies between heavy, moderate, and light grazing intensities has been summarized by Holecheck et al. (1999). He noted that when averaging reported forage production, "heavy stocking overall resulted in a 20% decline in forage production, moderate stocking had no change, and light stocking resulted in an 8% increase. In drought years, moderately stocked pastures produced 20% more forage than those heavily stocked. Forage production was 49% higher under light than heavy grazing and 24% higher under light than moderate grazing. These studies consistently showed that the greatest benefit of light or conservative stocking in terms of forage production occurred in the dry years" (Holecheck et al. 1999:13). He further noted that "Heavy stocking consistently caused a downward trend in ecological condition, light stocking caused an upward trend, and slight improvement occurred under moderate stocking" (Holecheck et al. 1999:13). The effects to soil resources, in

particularly litter production, are the lower the utilization level, the greater the amount of standing crop available for litter for nutrient cycling.

The only difference between the Reduced Utilization and Grazing Intensity Alternative (Reduced Alternative) and the Proposed Action is that grazing intensity during the early part of the year in the Proposed Action can decrease seed heads and damage young plants through the higher use rate to a greater degree than what would be seen with the lower grazing intensity of 15-25%. This is referring to the grazing intensity, and not the end of growing season utilization, and therefore does not consider re-growth of vegetation after livestock have left a pasture. However, for a portion of the year (early season growing season), slightly more standing crop would be left under the Reduced Alternative than the Proposed Action. The amount of difference this makes across the allotments is not measurable.

Infiltration and compaction can affect above ground biomass production as well. The greater the compaction, the less the infiltration and the more difficult it is for plants to grow (Belsky et al. 1999). Several studies show that the greater the intensity of the grazing, the greater the detrimental effects to soil physical properties (compaction) which lead to less infiltration (Gifford and Hawkins 1978; Warren et al. 1986; Belsky et al. 1999). One study noted that low and moderate intensity grazing had a minmal effect on infiltration and that high intensity grazing had a high, negative effect to infiltration (Warren et al. 1986).

As discussed in the Proposed Action section under direct effects, drought and moisture will play a key role in plant recovery and overall production of litter. This effect is the same for the Proposed Action as it is for this Alternative. The effects of livestock to infiltration and compaction are also the same under the Reduced Alternative.

The 25% utilization level would increase litter on-site, especially during average to moderate wet cycles. The lower utilization level proposed under this alternative may be too high during prolonged drought and would be adjusted for years of multiple droughts to a lower utilization level or through removal of livestock, which would increase forage production (Holecheck et al. 1999). Under an adaptive management scenario, utilization levels of 0% up to the maximum of 15-25% can occur. The goal of maintaining at least 2/3 of maximum vegetative ground cover will improve effective ground cover and maintain long-term soil productivity and improve it during wet cycles. When utilization levels are adjusted for drought and wet cycles, then the net effect will move impaired soils to satisfactory over time similarly to the Proposed Action Alternative. The effect to unsatisfactory soils will be similar to the Proposed Action. Improved soil condition equates to improved watershed condition, and thus this alternative will move towards the Forest Plan standard and guideline for improving watershed condition by the year 2020.

Indirect Effects

The indirect effects are the same as the Proposed Action, namely wild ungulate grazing on re-growth (this may be slightly lessened because there will be less use).

Cumulative Effects

The cumulative effects boundary, and duration of the effects are the same as the Proposed Action. The lists of past, present, and future and foreseeable projects that were considered are the same as discussed in the Proposed Action Alternative section. The effects of these other project would be the same for this alternative.

The acres of grazing considered in the Reduced Utilization and Intensity Alternative added to the other grazing that is ongoing within the Fossil Creek-Lower Verde Watershed will total about 178,500 acres of grazing. This alternative will not add any additional acres of grazing treatments over the current condition. This alternative will decrease the utilization standard on the Fossil Creek allotment from the current 50% to 15-25% on approximately 42,000 acres. The Proposed Action for the Hackberry Allotment proposes to remove livestock grazing on about 500 acres and decrease utilization standards from the current level on an additional 29,300 acres, for a total reduction in grazing utilization of about 71,000 acres, or 37% of the watershed. These actions are designed to improve soil conditions and cumulatively, this action will improve soil conditions over current conditions.

In summary, the actions within the Reduced Utilization and Grazing Intensity Alternative will improve effective ground cover through increased retention of litter. The design feature of retaining at least 2/3 of effective ground cover will improve current soil conditions. The rate of improvement will be dependent on adaptive management and the timing and amount of precipitation, but vegetation and litter components would improve in the short-term while grazing unsatisfactory soils would only improve slightly in the long-term. Monitoring of grazing unsatisfactory soils (as outlined in Chapter 2 and Chapter 4) will be used to inform adaptive management strategies for grazing unsatisfactory soils. The probability of success will be high when effective ground cover targets are met. The Reduced Utilization and Grazing Intensity Alternative is designed to improve conditions and to move towards Forest Plan Standards and Guidelines of satisfactory soil condition by the year 2020.

Comparison of Alternatives and Response to the Issues

One key issue was used to analyze effects of the alternatives specific to the soils resource. The issue analyzed was as follows:

- Livestock grazing under the intensity and utilization rates of the proposed action would not adequately improve soil conditions in the short term (10 years or less) and would negatively affect soil productivity, vegetation conditions and aquatic conditions.

Soil conditions are an overall measure of soil productivity. Effective ground cover and litter was the unit of measure used to evaluate soil conditions.

Table 18. Comparison of Alternatives for the Soil Resource

Alternative	Effects Indicator: Effective Ground Cover and Litter
No Action No Grazing	Soil condition will improve over time with increased effective vegetative ground cover and litter due to no livestock grazing. The amount and probability of success of improved effective ground cover will be dependent on timing and amount of precipitation, but is expected to be quicker and have a higher probability of success than either of the grazing alternatives. Improved soil condition equates to improved watershed condition, and thus this alternative will move towards the Forest Plan standard and guideline for improving watershed condition by the year 2020 although it may not be fully attained by this time if drought conditions persists.
Proposed Action	Soil condition would improve over time with increased effective vegetative ground cover and litter. The rate and probability of improvement will depend upon precipitation amount and timing and the corresponding changes in utilization and stocking under adaptive management. With adaptive management as described in the Proposed Action, the rate and probability of improved effective ground cover and litter will be similar to the Reduced Utilization and Grazing Intensity Alternative. The rate of improvement will be slower and have a slightly lower probability of success than the No Grazing alternative because standing crop will be removed by livestock and wild ungulates. Improved soil condition equates to improved watershed condition, and thus this alternative will move towards the Forest Plan standard and guideline for improving watershed condition by the year 2020 although it may not be fully attained by this time if drought conditions persist. This improvement will be very slow on unsatisfactory soils (7% of the allotment).
Reduced Utilization and Grazing Intensity	Soil condition would improve over time with increased effective vegetative ground cover and litter. The rate of improvement will depend upon precipitation amount and timing, but may occur slightly quicker than the Proposed Action Alternative. The probability of success will be similar to the Proposed Action when adaptive management techniques are implemented, and improvements would occur slightly faster and have a higher probability of success if the Proposed Action uses maximum livestock number and utilization. The use of a lower utilization rate will improve chances of recovery after drought over the Proposed Action Alternative if the Proposed Action is at maximum utilization. Improved soil condition equates to improved watershed condition, and thus this alternative will move towards the Forest Plan standard and guideline for improving watershed condition by the year 2020, although it may not be fully attained by this time if drought conditions persist. Again, improvement will be slow on unsatisfactory soils (7% of the allotment).

Water and Riparian Resources

The following section describes the affected environment and effects of the alternatives for the water resource which includes riparian conditions, and water quality. The analysis presented is summarized from the following reports which are incorporated by reference: *Soil and Water Specialist's Report* by D. Fleishman, 2007 (PR#133) and the *Soil and Water Existing Condition Report* by D. Fleishman, 2007. (PR#47).

Affected Environment for the Water Resource

Riparian Condition

There are approximately 143 miles of stream courses within and adjacent to the Fossil Creek allotment. Of these, approximately 11 miles are riparian in nature (Table 19). Proper functioning condition assessments were completed in 1998 and 2002 using protocol set forth in the BLM's Riparian Proper Functioning Condition Assessment (Prichard et al. 1998) on a majority of the reaches. Fossil Creek is the only perennial stream and it borders the southern portion of the allotment and is mainly in proper functioning condition (one reach is Functional At-Risk with recreation, road, and grazing impacts being the stressors on the reach). The PFC assessments were completed before full flows were returned to the reach through decommissioning of the power plant at Childs/Irving. Sandrock Canyon and Tin Can Draw are intermittent in nature and are also rated at PFC.

Sally May Wash is an intermittent drainage and is rated as functional at-risk, primarily from a lack of woody vegetation that does not allow for multiple age classes of woody riparian vegetation. Boulder Canyon, Mud Tanks Draw and Sycamore Canyon are also intermittent in nature and riparian vegetation is associated with springs primarily. The entire reach lengths are not riparian in nature, only small portions of the reach. The condition of these portions is tied to spring condition, which is primarily PFC to functional, at-risk, depending on grazing pressure. Non–riparian streams cannot be analyzed under PFC due to a lack of riparian species. The non-riparian streams flow only in response to precipitation events.

Table 19: Riparian Conditions of the Fossil Creek Range Allotment

Stream Name	Stream Reach ID	PFC	Miles
Boulder Canyon	1506020392C001	UNKNOWN	0.3
Fossil Creek	1506020392A002	PFC	0.3
Fossil Creek	1506020392A001	PFC	1.3
Fossil Creek	1506020392D001	AT RISK	1.4
Fossil Creek	1506020392D004	PFC	1.0
Mud Tanks Draw	1506020392E001	UNKNOWN	2.2
Sally May Wash	1506020392B001	AT RISK	1.3
Sandrock Canyon	1506020392G001	PFC	0.2
Sycamore Canyon	1506020394D006	UNKNOWN	1.8
Tin Can Draw	1506020392F001	PFC	1.2
Grand Total			10.8

Nine springs exist within the allotment (Table 20). Sally May Springs has been historically negatively affected by grazing activities through vegetative biomass removal and trampling as noted in 1999 surveys. The three springs in Sycamore Creek (Sycamore Spring and two unnamed springs) were functional in 1999. A field visit in January of 2007 noted that Sycamore Spring has little evidence of trampling or grazing of riparian

vegetation, mainly due to the non-use on the allotment (PR#34). The rest of the springs have not been visited, but are likely affected similarly as the Sycamore Creek Springs and Sally May Springs, depending on the grazing pressure at each spring.

Table 20: Pasture Location of Springs of the Fossil Creek Range Allotment

PASTURE NAME	SPRING NAME
Chalk Springs	Burnt Springs Chalk Springs
Lower Wilderness	Eds Point Spring
Sally Mae	Cimmaron Springs Sally May Springs
Surge	Quail Springs
Sycamore Canyon	Sycamore Springs Unnamed in Sycamore Canyon Unnamed in Sycamore Canyon

Water Quality

Fossil Creek is the only perennial streams in the allotment and the Verde River is directly adjacent to the allotment and are the only streams that have water quality measurements by the Arizona Department of Environmental Quality. The most recent assessment of water quality for Fossil Creek[5] and the Verde River were completed in 2006. Water quality measures display that there are no exceedences for water quality standards in Fossil Creek, and that turbidity in the Verde River impairs this reach for Agriculture and Wildlife watering.

A Total Maximum Daily Load (TMDL) for turbidity was completed in 2002 for the Verde River. The 2006 report notes that there is a "Need to re-evaluate the turbidity TMDL developed in 2002 in terms of the new suspended sediment concentration (SSC). Only 1 of 11 SSC samples exceeded the 80 mg/L." In other words, the turbidity standard has changed and that it is very likely that the new SSC standard will display this reach as attaining the new standard. Further details on water quality data are found in the project record (PR#133).

Environmental Consequences for Water and Riparian Resources

The units of measure for the water and riparian resources are water quality, and riparian condition as evaluated by Proper Functioning and Condition assessment. The evaluation will be qualitative.

[5] No samples or data are available for Fossil Creek since full flows have resumed.

No Action Alternative

Direct, Indirect and Cumulative Effects to Water Quality and Riparian Conditions

There are no direct effects to water quality and riparian conditions from livestock grazing in this alternative because livestock grazing would not occur. There would be no effects to uplands that would indirectly impact water quality or riparian conditions because there would be no livestock grazing. Therefore, nonpoint source pollution would be reduced and water quality maintained or improved. Riparian conditions are expected to improve with the absence of livestock grazing. Streams with PFC would remain in PFC. Sally May Wash would display improved riparian condition and would move towards PFC.

The cumulative effects boundary for water quality and riparian conditions is the Fossil Creek – Lower Verde 5th code watershed. The timeframe of the analysis will be 10-years because ground disturbing activities that could affect water quality riparian conditions can recover in this timeframe. The analysis will be narrative in form and considers the past, ongoing and future foreseeable projects in Chapter 3.

The No Action Alternative does not add any negative direct cumulative effects to the watershed, riparian streams and water quality because no livestock grazing would occur. Removal of livestock would maintain stream PFC and improve the water quality of at-risk reaches because grazing stress would be limited to only that of wild ungulates. This alternative will have the quickest rate of improvement and the highest probability of effectiveness for maintaining water quality and riparian conditions. The at-risk reach of Fossil Creek would not be affected by grazing, but will probably not improve until recreation impacts are minimized. The Travel Management Plan and the Managing Motorized Travel EIS will decrease some vehicular access to Fossil Creek and would reduce some negative recreation effects over time.

Proposed Action Alternative

Water Quality

Direct Effects

Livestock can have a variety of direct effects to water quality including bacterial contamination from livestock waste, including fecal coliform, *Cryptosporidium, Giardia*, and *Salmonella* (Belsky et al. 1999). The occurrence of these pathogens increases with an increase in livestock grazing intensity (numbers of livestock and duration of grazing). Grazing ungulates can also increase the sediment load and suspended solids resulting in turbidity in streams. This is accomplished through trampling, disturbance and erosion from denuded stream banks, and reduced sediment trapping by stream bank vegetation that has been removed by grazing. These factors all come into play when grazing intensity is high, which would occur at the livestock water access areas along Fossil Creek.

Water quality in the State of Arizona is determined by the Arizona Department of Environmental Quality (ADEQ). Currently, water quality within Fossil Creek is in full compliance with ADEQ standards (ADEQ 2006). The Verde River has one constituent element that is in non-compliance for turbidity and there is no indication of bacterial waste from livestock in any of the water quality samples. Improved soil conditions would maintain soil loss at or close to natural levels, hence, water quality would remain the same or improve in Fossil Creek. Limited watering of livestock at Fossil Creek may have a site-specific, short-term impact of water quality at the watering sites, however, this will be short-term and is not expected to impair the water quality of Fossil Creek.

Indirect Effects

Upland grazing removes biomass and reduces the protective vegetative ground cover than normally traps sediments. Unsatisfactory soils are generally compacted and are caused from both livestock grazing and recreational impact and are located in heavily used areas adjacent to Fossil Creek including near watering sites and at holding pastures. Across the watershed, loss of vegetative ground cover beyond identified ground cover objectives and soil compaction caused from grazing can increase sediment production and nonpoint source pollution into Fossil Creek.

The Universal Soil Loss Equation model was used to predict soil loss across the allotment from the published Terrestrial Ecosystem Survey for the Coconino National Forest (Miller et al, 1995). The TES soil erosion modeling used a Forest-wide (landscape level) map unit average and may or may not accurately reflect allotment specific conditions but are still our best available science at the allotment level. Comparing natural soil loss (undisturbed) versus current soil loss there is approximately a 35% increase in soil loss over a natural, undisturbed soil condition across the map units that occur in the allotment (PR#176). The causes of this are not all attributed to grazing. Other factors contributing to accelerated soil loss include increased canopy covers, recreation and surface erosion from roads. Increases in canopy cover will continue to reduce understory vegetation through competition for moisture over the next 10-100 years.

Most of the sediments that are mobilized are stored either onsite or nearby and are not transported directly into stream channels but are not quantified. However, some of the sediment is transported to connected stream course contributing to increased sediment loads into Fossil Creek and other riparian areas. As noted above, not all of this sediment is attributed to grazing impacts. The proposed action is designed to improve vegetative ground cover over time, which would move soil loss from grazing impacts closer to the natural condition over time resulting in slightly reduced nonpoint source pollution and maintained or slightly improved water quality Increased canopy cover will still be a contributor to increased soil loss over natural conditions under this alternative.

Cumulative Effects

The cumulative effects boundary for water quality and riparian conditions is the Fossil Creek – Lower Verde 5th code watershed. The timeframe of the analysis will be 10-years

because ground disturbing activities that could affect water quality riparian conditions can recover in this timeframe. The analysis will be narrative in form and considers the past, ongoing and future foreseeable projects in Chapter 3.

Cumulatively, the Proposed Action would add an increment of sediment load to streams from the 42,000 acres of grazing in the allotment. The alternative would show a gradual improvement in soil condition over time with the 30-40% utilization rate, and perhaps lower under adaptive management. This is because the proposed utilization rate is lower than the current rate. Meeting at least 2/3 of the natural vegetative ground cover on this allotment is also expected to improve soil conditions. Similar improvements are expected for the Hackberry Allotment for the same reasons. This is expected to result in a reduction of soil loss in the watershed over time. This will not occur rapidly, but will be gradual and will be heavily dependent upon the timing and amount of annual precipitation. The recreation activity along Fossil Creek will continue and is expected to increase and may increase the Connected Disturbed Area along Fossil Creek. The implementation of the Travel Management Rule (TMR) and the Managing Motorized Travel EIS will eventually decrease the amount of direct sedimentation at stream crossings from roads that are scheduled to be closed or decommissioned. In addition, the management of road travel under the Managing Motorized Travel EIS will be decreased near Fossil Creek and some of the impacts from recreation may be diminished.

Riparian Condition

Direct Effects

Grazing can negatively affect stream channel morphology in a variety of ways. The removal of streamside vegetation such as *Carex spp.*, *Juncus spp.*, and *Salix spp.*, decreases the ability of the stream channel to filter sediments and maintain streambank stability (Haines 1993, Belsky et al. 1999, Rosgen 1996, Clary and Leininger 2000). In addition, shear stress can increase from trampling of banks by grazing ungulates which leads to bank destabilization (Trimble and Mendel 1995, Belsky et al. 1999). This has several negative effects to stream channel morphology. Without proper vegetation to dissipate stream energy, the stream begins to downcut (Haines 1993, Belsky et al.1999, Rosgen 1996). This creates a very efficient channel for moving water, which then cuts through stream meanders and removes all of the mechanisms for dissipating stream energy.

In the Proposed Action Alternative, a utilization standards of 20% on woody vegetation, only allowing grazing along all stream reaches when woody vegetation is dormant is a design feature that will protect riparian conditions. When attained, woody riparian vegetation would show little effect from grazing. The access sites to Fossil Creek are limited to narrow lanes that will reduce grazing impacts to the creek. Sally May wash is currently at-risk, with grazing being a major stressor. Maintaining woody utilization at a low 20% would assist with woody riparian plant regeneration. However, if improvement is not evident, the adapative management action of fencing the riparian area would remove the stressor from riparian areas. This action would be taken if necessary at Sycamore, Tin Can Draw, and Mud Tanks draw. Adaptive management is expected to

lead to improved riparian condition and would maintain or move streams toward PFC. The time of grazing will also affect riparian plants, with little effect when plants are dormant (Wyman et al, 2006). The graze period in the winter will have little effect on riparian herbacous and woody plants if grazed in the dormant season. There will likely be some grazing of riparian areas during the growing season, so there will be some detrimental effects that will be mitigated by utilization standards and stubble heights guidelines.

There will be some bank trampling along Fossil Creek at designated watering sites but it will be limited to the lane. For the reach as a whole, this will provide little negative effect to Fossil Creek. Some trampling will occur at springs also. The 1999 field visit to Sally May Springs noted heavy use at the site and sedimentation at the spring and corresponding outflow. The springs primarily have a grass component and some small amount of woody vegetation. Overall, there is a lack of monitoring data for most springs within the allotment. The recommendation to maintain a stubble height of at least 10 centimeters on riparian grasses and grass-like plants will aid in maintaining filtering from plants (Clary and Leininger, 2000). As with the woody riparian component on streams, utilization will be monitored as part of implementation monitoring. If riparian conditions are found to be adversely impacted during monitoirng, adaptive management techniques will be applied, which may include fencing or alternative water development (if feasible). Fencing for exclusion of livestock is a proven method to improve riparian conditions (Wyman et al, 2006). It is expected that riparian conditions are expected to show slight improvement over current conditions due to the implementation of the 20% utilization guideline and if they do not improve, additional fencing will exclude livestock from affected riparian areas, which would improve riparian condition.

Indirect Effects

Indirect effects to riparian areas include upland livestock grazing that can accelerate erosion and increase sedimentation to riparian areas. This process can result in aggradation of riparian areas when proper stubble heights are maintained. The effects are the same as described above in the section on water quality.

Cumulative Effects

The cumulative effects boundary for water quality and riparian conditions is the Fossil Creek – Lower Verde 5th code watershed. The timeframe of the analysis will be 10-years because ground disturbing activities that could affect water quality riparian conditions can recover in this timeframe. The analysis will be narrative in form and considers the past, ongoing and future foreseeable projects in Chapter 3.

Cumulatively, this action adds grazing along about 8 miles of streams out of the total of about 89 miles of streams, or just under 10% of the riparian reaches within the watershed. The alternative includes three water access lanes along Fossil Creek of which one is a new access site. Confining the water access by fencing to narrow lanes is an improvement over the current condtion where livestock was able to access a long section

of the creek. Total linear disturbance is estimated to about 500 linear feet or 0.6 acres in area.

Managing woody riparian utilization at 20% and applying adaptive management strategies are designed to maintain or improve riparian conditions. The rate of recovery will be dependent on time of use and precipitation. If persistent riparian damage is occurring, an adaptive management action of fencing riparian areas will be employed to minimize impacts. Riparian function will improve over time and reaches that are currently in PFC will maintain this status with this alternative. Reaches that are not in PFC will move towards PFC. An exception to this may be the at-risk reach of Fossil Creek that has heavy recreation impacts that are affecting functionality of the reach.

Reduced Utilization and Grazing Intensity Alternative

Water Quality

Direct Effects

The effects of livestock are the same as the Proposed Action. Due to the nature of livestock watering sites, use is expected to be heavy under either alternative; therefore, the direct effects are expected to be the same.

Indirect Effects

The indirect effects are similar to the Proposed Action, however, there may potentially be more biomass left on site with a lower utilization rate and the rate of improvement of the upland may be slightly quicker than the proposed action. However, the rate of upland recovery could be very similar when the utilization rate and livestock numbers are adjusted downward from the maximums under adaptive management. This may decrease sediments to riparian areas from current levels, but it would still be above natural levels.

Cumulative Effects

The cumulative effects for water quality are the same as for the Proposed Action.

Riparian Condition

Direct Effects

The direct effects of livestock grazing are the same as the Proposed Action. Due to the nature of livestock watering sites, use is expected to be heavy under either alternative; therefore, the direct effects are expected to be the same.

Indirect Effects

The indirect effects are similar to the Proposed Action, however, there may potentially be more biomass left on site with a lower utilization rate and the rate of improvement of the upland may be slightly quicker than the proposed action. Both alternatives employ

adaptive management, and because of this, there is flexibility in adjusting utilization rates and livestock numbers downward from the maximums in either alternative, depending on environmental conditions. Rates of upland recovery could be similar between the two alternatives if utilization and livestock numbers are similar. This alternative may decrease sedimentation to riparian areas from current levels, but it would still be above natural levels.

Cumulative Effects

The cumulative effects to riparian condition are the same as for the Proposed Action.

Comparison of Alternatives and Response to the Issues

One key issue was used to analyze effects of the alternatives specific to water quality and riparian conditions. The issue analyzed was as follows:

- Livestock grazing under the intensity and utilization rates of the proposed action would not adequately improve soil conditions in the short term (10 years or less) and would negatively affect soil productivity, vegetation conditions and aquatic conditions.

The alternatives were analyzed by how each would maintain or improve water quality and riparian conditions which area critical for aquatic habitat, species and watershed health. The indicator of effects used was Proper Functioning Condition of riparian stream reaches and water quality.

Table 21. Comparison of Alternatives for Water and Riparian Resources

Alternative	Effects Comparison: Indicator Riparian Proper Functioning Condition
No Action No Grazing	Removal of livestock would maintain stream PFC and improve at-risk reaches through removal of livestock grazing stressor. This alternative will have the quickest rate of improvement and the highest probability of effectiveness for improving riparian condition.
Proposed Action	Managing utilization at 20% and adaptive management are designed to maintain or improve riparian conditions. The rate of recovery will be dependent on time of use and precipitation. If persistent riparian damage is occurring, an adaptive management action will be implemented to fence sites to minimize impacts. It is felt that riparian function will improve over time and that reaches that are currently in PFC will maintain this status and reaches that are not in PFC will move towards PFC. An exception to this may be the at-risk reach of Fossil Creek that has heavy recreation impacts that are affecting functionality of the reach.
Reduced Utilization and Grazing Intensity Alternative	Same as the Proposed Action because livestock use in and near water will be the same.
Alternative	**Effects Comparison: Indicator Water Quality**
No Action No Grazing	Water quality is expected to be maintained in Fossil Creek and sediment delivered to the watershed's streams would be decreased from current conditions with improved vegetative ground cover and litter. The rate of

Alternative	Effects Comparison: Indicator Riparian Proper Functioning Condition
	decreased sediment loads will be faster with this alternative than any of the grazing action alternatives.
Proposed Action	Water quality is expected to be maintained in Fossil Creek and sediment delivered to the watershed's streams would be decreased from current conditions with improved effective vegetative ground cover and litter. The recovery rate of the watershed will be similar to the Reduced Utilization and Grazing Intensity Alternative, but may be slightly slower, but will largely depend on how adaptive management affects utilization. Similar to the rate of improvement, the probability of improved effective ground cover and litter is dependant on the adaptive management measures undertaken.
Reduced Utilization and Grazing Intensity Alternative	Water quality is expected to be maintained in Fossil Creek and sedimentation coming from the watershed would be decreased from current conditions with improved vegetative ground cover and litter. Recovery rate of the watershed will be similar to the Proposed Action Alternative, but may be slightly faster, depending on how adaptive management affects utilization. The probability of success is similar to the rate of improvement.

Wildlife

The following section describes the affected environment and effects of the alternatives for the terrestrial wildlife resource which includes special status species of: threatened and endangered species, and their critical habitats, Forest Service sensitive species, management indicator species, and migratory birds. Other non-specials status species considered in the effects analysis include general wildlife: game species, mammals, amphibians and reptiles. The analysis presented is summarized from the following reports which are incorporated by reference: *Summary of the Wildlife Specialist's Report, Fossil Creek Range Allotment,* by J. Agyagos, 2007 (PR#146) and the *Wildlife Specialist's Report, Fossil Creek Range Allotment,* by J. Agyagos and J. Oertley, 2007 (PR#139) and the *Amendment to the Fossil Creek Allotment Wildlife Specialist's Report* by J. Agyagos, 2007 (PR#179).

Affected Environment for Wildlife

The summaries of the affected environment of the species listed below (Tables 22-26) used data from a variety of sources including: field data from site visits, GIS analysis, accessing and querying websites and databases, literature searches, project- and species-specific wildlife and wildlife habitat surveys, peer communications, modeling, and professional experience. Further information and detailed descriptions of species occurrence, habitat preferences and habitat conditions, and rationale for including or excluding species from analysis are found in the reports listed above, (PR# 146,139, and 179). These reports contain tables of all listed species on the Forest and the rationale for why they were or were not analyzed for this project.

Threatened and Endangered Species

Threatened and Endangered (TE) species and/or their habitat, that may occur within or adjacent to the project area are shown in Table 22.

Table 22. Threatened and Endangered Species considered in this analysis

Species	Scientific Name	Status
Mexican spotted owl	*Strix occidentalis lucida*	Federally Threatened
Yuma clapper rail	*Rallus longirostris yumanensis*	Federally Endangered
Southwestern willow flycatcher	*Empidonax traillii extimus*	Federally Endangered
Chiricahua leopard frog	*Rana chiricahuensis*	Federally Threatened

Mexican Spotted Owl

Three levels of habitat management – protected, restricted and other forest and woodland types - are defined in the MSO Recovery Plan to achieve a diversity of habitat conditions across the landscape. No Mexican spotted owl protected activity centers (PACs) occur within the Fossil Creek allotment. One PAC is adjacent to the project area in Sandrock Canyon. MSO habitat is summarized in Table 23 below.

Table 23. Mexican Spotted Owl Habitat in the Fossil Creek Range Allotment

MSO Habitat	Acres in Project Area, % of allotment area	Description of Habitat
Protected	7 acres, 0%	Pine oak and mixed conifer
Protected	3,704 acres, 9%	Wilderness, Wild & Scenic Rivers
Restricted	336 acres, <1%	Mixed conifer and riparian
Target threshold	0 acres	Stands do not meet criteria
Sub Total	*4,047 acres*	
Designated Critical Habitat	1,867 acres , 4%	Mostly juniper woodland with a minor amount of Ponderosa pine.

All remaining acres within the Fossil Creek range allotment planning area, 38,153 acres, would be considered "other forest and woodland types", and consist primarily of Pinyon-Juniper woodlands and secondarily as transition grass with sparse Pinyon Juniper, neither of which are typically used by MSO.

The designated critical habitat occurs in the easternmost portion of the allotment. The habitat in most (68%) of the designated critical habitat is Juniper woodland, and the remainder is Ponderosa Pine.

Yuma Clapper Rail

Yuma Clapper Rails have only recently been detected in the Verde Valley. There is potential for suitable rail habitat to occur along the Verde River and Fossil Creek where large stands of cattails persist. No surveys have been conducted.

Southwestern Willow Flycatcher

Until recently, Fossil Creek did not have much potential for supporting nesting willow flycatchers. Prior to restoration, riparian habitat along Fossil Creek differed from habitats typically occupied by southwestern willow flycatcher in Arizona due to the narrow band

of riparian vegetation and the relatively open mid- and under-story vegetation layers. Since full flows were restored in 2005, travertine dams are forming resulting in sections of slower water, leading to better quality habitat that may become suitable for willow flycatchers. All surveys for southwestern willow flycatcher along Fossil Creek and the Verde River were conducted prior to 2004; all were negative.

Chiricahua Leopard Frog

The only extant population of Chiricahua leopard frogs on the Coconino National Forest occurs in the southern part of the Forest, in an area known as Buckskin Hills/Mud Tanks. Most of the leopard frog sites in the Buckskin Hills/Mud Tanks area occur on the Fossil Creek Allotment. The Fossil Creek Allotment supports two occupied sites, twelve recently occupied sites, and at least eight other sites that have suitable habitat but have been unoccupied at times surveys were conducted.

Regional Forester's Sensitive Species

A total of 26 Regional Forester's Sensitive Species are present or have potential habitat within the analysis area and have been evaluated (PR#139, 179).

Table 24. Regional Forester's R3 Sensitive Species Analyzed and Habitats in and Adjacent to the Fossil Creek Range Allotment

Common Name Scientific Name	Status	Habitat and Presence in and adjacent to the Project Area
Sensitive Mammals (9)		
Merriam's Shrew	Sen	Occupies cool grassy areas near conifer forest and can be found in similar areas as the Mexican vole. Although limited habitat occurs on the allotment, potential occurs in the northeast portion of the allotment. These insectivorous animals may occur in the burrows of other animals while hunting.
Western Red Bat	Sen	Roosts solitarily in deciduous trees along riparian corridors.
Allen's Lappet-browed Bat	Sen	Roosts underneath exfoliating bark on standing ponderosa pine snags. Some ponderosa pine forests occur on the northeast portion of the allotment and it is possible that these bats roost there.
Pale Townsend's Big-eared Bat	Sen	Roosts in caves, mines, and other man-made structures including cliff dwellings and abandoned shacks. On the Fossil allotment, possible roosting habitat occurs; in caves, in various abandoned APS flume tunnels, cliff dwellings near Fossil Springs, and abandoned buildings.
Spotted Bat & Greater Western Mastiff Bat	Sen	Roosts in cracks and crevices along high cliff ledges.
Plains Harvest Mouse	Sen	May be found in desert scrub, chaparral, and riparian habitats and are known to occur in the Verde Valley. They feed on the green parts and seeds of a variety of plants and use grasses for constructing nests above ground. They over-winter in burrows.
Wupatki Arizona Pocket Mouse	Sen	This pocket mouse may be found in desert scrub habitats and on the Fossil allotment, where creosote bush, cactus, mesquite, and scrub oak occur. They sleep and rear their young in burrows and feed extensively on seeds. They over-winter in burrows.
Mogollon Vole (formerly Navajo Mountain Mexican	WC, Sen	No documented populations or sightings of voles in the project area. Suitable habitat exists within the allotment, in

Common Name Scientific Name	Status	Habitat and Presence in and adjacent to the Project Area
Vole)		Ponderosa pine and mixed conifer forest and montane willow riparian forest. 1,117 acres of potentially suitable habitat. Use runways that access burrow entrances and feeding sites.
Sensitive Birds (7)		
Bald Eagle *Haliaeetus leucocephalus*	WC, Sen	A bald eagle nesting area occurs along the Verde River in the vicinity of the allotment. No bald eagle nest sites are known to occur in Fossil Creek, although one immature bald eagle was observed constructing a nest near the Irving power plant. Wintering bald eagles can be found foraging throughout the allotment, particularly along highways where they feed opportunistically on carrion and along riparian zones where they forage on fish and waterfowl. Potential roosting habitat occurs along Fossil Creek and at Fossil Springs. Potential roosting habitat also occurs in the pine and mixed conifer woodlands that occur in the House, Salmon Lake South, Manzanita, Natural North, and Upper Wilderness pastures.
Northern Goshawk *Accipiter gentiles*	WC, Sen, MIS	No known northern goshawk territories within the allotment. The nearest known post-fledging family area (PFA) is located 3.3 miles from the northeast boundary. Habitat occurs in ponderosa pine and mixed conifer stands above the rim and stringers below the rim, totalling 1,118 acres.
American Peregrine Falcon *Falco peregrinus anatum*	WC, Sen	No eyries are known to occur on the allotment. Suitable nesting habitat is present. Nearest known eyries are at Nash Point 1.1 miles south of the allotment boundary, and Calf Pen 2.1 miles southeast of the allotment boundary. Peregrine falcons forage all along Fossil Creek, the Verde River, at Stehr Lake, and may use the seasonal or semi-permanent wetlands or stock tanks.
Common Black Hawk *Buteogallus anthracinus*	WC, Sen, MIS	Common black-hawk has been observed in all reaches of Fossil Creek and along the Verde River. Suitable nesting habitat is present and nest sites occur along Fossil Creek and the Verde River. Potential nesting areas exist along Boulder Canyon, Sally May Wash, Hackberry Canyon, Cimarron Creek, and Dorens Defeat Canyon.
Western Yellow-billed Cuckoo *Coccyzus americanus occidentalis*	C, WC, Sen	A cuckoo was detected in the Fossil Creek riparian area from a past survey, and other suitable habitat occurs along the Verde River, Boulder Canyon, Sally May Wash, Hackberry Canyon, Cimarron Creek, Dorens Defeat Canyon, and a number of springs and seeps. Potential for them to establish occupancy in Fossil Creek now that full flows have been restored. Cuckoos forage in mesquite uplands immediately adjacent to riparian areas.
Ferruginous Hawk *Buteo regalis*	Sen	Occurs in grassland and open woodlands, particularly during the winter. They feed on mammals, mainly rabbits, hares, ground squirrels and pocket gophers.
Abert's Towhee *Pipilo aberti*	Sen	Occurs in dense brush and woodlands found along riparian areas. This ground forager feeds on insects and seeds.
Sensitive Amphibians (2)		
Lowland Leopard Frog *Rana yavapaiensis*	SC, WC, Sen	Fossil Creek supports the largest population of lowland leopard frogs on the Coconino National Forest. Lowland leopard frogs historically occurred along the Verde River, but the presence of non native aquatic organisms have led to extirpation. Suitable habitat occurs in intermittent washes where perennial pools persist i.e. Boulder Canyon, Sally May Wash, Hackberry Canyon, Cimarron Creek, Dorens Defeat Canyon, and a number of springs and seeps.
Arizona Toad	SC, Sen	Reported sightings from the Verde River just northwest of

Common Name Scientific Name	Status	Habitat and Presence in and adjacent to the Project Area
Bufo microscaphus microscaphus		Child's power plant. The presence of non native aquatic organisms decreases the suitability of the Verde River for the toads and other native amphibians. Fossil Creek offers suitable habitat. Suitable habitat also occurs in intermittent washes where perennial pools persist i.e. Boulder Canyon, Sally May Wash, Hackberry Canyon, Cimarron Creek, Dorens Defeat Canyon and a number of seeps and springs.
Sensitive Reptiles (3)		
Narrow-headed Garter Snake *Thamnophis rufipunctatus*	SC, WC, Sen	No narrow-headed garter snakes were detected from surveys of tanks in the Fossil Creek and adjacent Hackberry allotments. One sigting documented on the Verde River near the East Verde confluence. Potential habitat exists on the allotment.
Mexican Garter Snake *Thamnophis eques megalops*	SC, WC, Sen	No herpetological surveys have detected Mexican garter snakes on the allotment. Riparian areas of Fossil Creek are potential habitat. Possible habitat exists along perennial portions of Boulder Canyon, Sally May Wash, Hackberry Canyon, Cimarron Creek, Dorens Defeat Canyon, and other springs and seeps in the allotment.
Reticulated Gila Monster	Sen	Known to occur in the Verde Valley and has been sighted in the Fossil Creek area. It spends most of it's time in burrows; only a handful of weeks are spent above ground each year. Gila monsters may only feed four to five times a year on nestling mammals and birds, the eggs of lizards and birds, lizards, and even carrion.
Sensitive Invertebrates (5)		
Blue-black Silverspot Butterfly *Speyeria nokomis nokomis*	SC, Sen	No surveys conducted. Less that 1% of allotment has potential suitable habitat (soils hosting *Viola* and thistle plants) in the allotment. Population status is unknown.
Mountain Silverspot Butterfly *Speyeria nokomis nitocris*	Sen	
Spotted Skipperling *Piruna polingii*	Sen	No surveys conducted. Abundant potential habitat on the allotment (97% of the area) consisting of pinyon-juniper, ponderosa pine, and mixed conifer.
A mayfly (*Homoleptohyphes quercus*)	Sen	Occurs in the benthic portions of aquatic systems. Not much is known about the species life history. At the least, water quality and embeddedness of gravels and cobbles can affect this species.
California floater *Anodonta californiensis*	Sen	Known historically from the Verde River and its tributaries. Floaters occur in shallow, unpolluted water where, after maturation attaches to the fins of fish.

Status Codes:

C	**=**	Federally designated as Candidate for listing
WC	=	Wildlife of Special Concern in Arizona (AGFD draft 3/16/96)
Sen	=	On Regional Forester's Sensitive Species List (7/21/99; updated 9/4/2007)
MIS	=	Tonto and Coconino Management Indicator Species from the Respective Forest Plans
SC	**=**	Federal Species of Concern (former C2 species).

Management Indicator Species

Management Indicator Species (MIS) have been identified for each Management Area (MA) described in the Coconino National Forest's *Land and Resources Management Plan* (1987, as amended). Forestwide trends of all MIS have been assessed and are reported in Management Indicator Species Status Report for the Coconino National Forest, (USDA- Forest Service 2002). Habitat components for three species of

management indicators were selected which occur on the allotment. Since livestock grazing can affect low elevation riparian and grasslands, Lucy's warbler, yellow-breasted chat, and pronghorn antelope were fully analyzed. Full discussions on management areas and habitat relative to MIS, and rationale for exclusion of MIS species from full analysis may be found in (PR#139).

Table 25. Management Indicator Species Analyzed, Habitats and their Forest-wide Habitat and Population Trends

Species	Management Area	Habitat Indicator	Forest-wide Habitat Trend	Forest-wide Population Trend	Evaluation for Analysis/Affected Environment
Pronghorn antelope	MA 10: Grassland and sparse pinyon-juniper above the rim MA 11: Verde Valley	Early and late seral grasslands	Stable-to-declining	Declining	350 acres of semi-desert Grassland plus the open portions of 39,640 acres of pinyon-juniper and 1,100 acres of Ponderosa pine, which total about 4,450 acres.
Lucy's Warbler	MA12: Riparian and open water	Low elevation riparian	Inconclusive	Increasing	100 acres mixed deciduous riparian 4 acres of montane willow riparian 119 acres of cottonwood willow riparian 7 stream reaches, for a total of 223 acres.
Yellow-breasted chat	MA12: Riparian and open water	Low elevation riparian	Stable to Declining	Increasing	

Migratory Birds

Executive Order 13186 requires that an analysis be made of the effects of Forest Service actions on species of concern listed by Partners in Flight; the effects on important bird areas (IBA) identified by Partners in Flight (Latta et al. 1999); and the effects to important over-wintering areas. There are no IBAs within the project area. Six "Partners in Flight" species of concern have already been analyzed since they are either threatened or endangered species, Regional Forester's sensitive species or MIS, or they do not have habitat that is affected by grazing management. These species will not be analyzed here and include: Mexican spotted owl (mixed conifer), northern goshawk (Ponderosa pine), juniper titmouse (pinyon-juniper), western yellow-billed cuckoo, southwestern willow flycatcher, and Lucy's warbler (low elevation riparian).

The remaining migratory birds analyzed include olive-sided flycatcher, Cordilleran flycatcher, purple martin, gray flycatcher, pinyon jay, gray vireo, and black-throated gray warbler.

Table 26. Arizona Partners In Flight Designated Priority Species by Habitat in the Fossil Creek Range Allotment

Priority Species	Habitat and Presence
Olive-sided flycatcher	Forest openings and edges within mature ponderosa pine forests with snags. 8 of potential habitat on the allotment. Known to occur on the allotment.
Cordilleran flycatcher	Snags and high overstory canopy closure in ponderosa pine. Potential habitat in small patches, on steep slopes, or in pine stringers in small drainages. Known to occur on the allotment.
Purple martins	Uncommon summer resident in ponderosa pine. This species has been nearly extirpated from ponderosa pine forests due to loss of habitat. Very likely to occur on the allotment based on the presence of purple martins in similar habitats outside the project area.
Gray flycatchers	Pinyon pine and juniper, or ponderosa pine with an open overstory. Requires ground cover to support insect populations for foraging. Larger taller stands of sagebrush and greasewood are also used. Known to occur on the allotment.
Pinyon jays	Common to uncommon permanent residents in the pinyon influenced portion of the project area. Very likely to occur on the allotment based on the presence of pinyon jays in similar habitats outside the project area.
Gray vireos	Open and mature juniper woodlands where there is an understory of broadleaf shrubs. Nest low in a small tree or shrub and are known hosts to brown-headed cowbirds. Known to occur on the allotment.
Black-throated gray warblers	Open woodlands and are commonly encountered nesting in pinyon-juniper woodlands. Encountered much more frequently in tall stands with a higher density of mature pinyon pine. Known to occur on the allotment.

Environmental Consequences

General Effects of Grazing to Wildlife

Activities associated with the management of Fossil Creek Allotment include: grazing, construction and maintenance of infrastructure such as earthen water tanks, pasture and boundary fences, pipelines, troughs, cattle guards, and livestock management. These activities can directly affect wildlife species when ranch employees, vehicles, livestock, and dogs cause aural and visual disturbance to individuals that may be present in the allotment. 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 can result in the abandonment of the area, which is equivalent to loss of habitat. Individuals incapable of dispersal (nestling, terrestrial invertebrates, young) or individuals unwilling to disperse (adults with immobile young) can experience negative effects including: trampling and crushing, collection and handling; increased physiological stress; flushing of birds from incubating eggs thus increasing potential for eggs to become unviable; premature fledging of young from nests; and increased potential for predation.

Disturbance to bats may occur when noise from livestock management activities such as personnel, vehicles, and dogs are present within close enough proximity to roost

locations. Noise disturbance of high intensity 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.

There are only a handful of studies that measure the effect of grazing on lizard habitat and only one was found to have addressed livestock grazing in similar habitats and with similar species as the proposed action area. In Arizona, the abundance and diversity of open-space and wide-ranging foraging lizards was higher on lightly grazed sites (versus heavily grazed sites) in four habitat types including chaparral and desert grassland (Jones 1981). Declines in the abundance and diversity of lizards were attributed to a change in vegetative structure which was described as a reduction of low vegetation, primarily perennial grasses (Jones 1981).

Livestock grazing can indirectly affect wildlife by affecting their prey such as small mammals, lizards, and arthropods. Small mammal prey is important for many species of higher trophic levels, including raptors, carnivorous mammals, snakes, and avian predators (Hayward et al. 1997; Saab et al. 1995). When rodent prey decrease in response to reduced vegetative cover, so do the avian predators (Saab et.al 1995). Livestock grazing can directly impact rodents by trampling and collapsing burrows, compacting soils which hinders burrow construction, and by removing rodent food sources such as seed heads (Heske and Campbell, 1991; Hayward et al., 1997; Adler and Lauenroth, 2000). In one study, rodent burrow densities were higher in ungrazed plots when compared to grazed plots (Adler and Lauenroth, 2000). Numerous studies support that the abundance of rodents is higher in ungrazed and lightly grazed areas (Valone and Sauter, 2004; Jones and Longland, 1999; Bock and Bock 1984 Reynolds and Trost 1980). Indirect effects of livestock grazing on rodents can occur when grazing changes the composition of vegetative species (Heske and Campbell, 1991; Hayward et al., 1997) and structure of vegetative species (Jones and Longland 1999; Hayward et al., 1997; Adler and Lauenroth, 2000).

In addition to small mammals and lizards, arthropods are important food for various species of mammals, birds, reptiles, amphibians, and other invertebrates. Songbirds of the grasslands primarily prey on arthropods (Milchunas et al. 1998). Aboveground macroarthropods (insects and arachnids) experienced large decreases with moderate or heavy grazing, but conversely with light grazing showed slight increases (Lavigne et al. 1972 in Milchunas et al. 1998).

Birds are indirectly affected by the impacts grazing has on vegetation (Saab et al. 1995). Livestock reduce forage production which reduces litter production, increases soil compaction, and reduces infiltration (see watershed section). These changes to the soil and consequently the vegetation as a result of livestock grazing affect some breeding birds negatively (Saab et al. 1995). Birds that depend on dense herbaceous ground cover for nesting and/or foraging are most likely to be adversely affected by grazing (Saab et al.

1995). Grazing during the breeding season of ground nesting birds can reduce herbaceous vegetation necessary for concealing nests (Saab et al. 1995). A reduction in herbaceous vegetation can expose nests resulting in an increased chance for nest predation, nest parasitism, exposure to elements, and ultimately nest failure. In shrub-steppe habitats (which includes desert scrub and pinyon-juniper woodlands), Saab et al. (1995) recommends managing livestock grazing to maintain current season growth through 15 July and then retain greater than 50% of perennial bunchgrass annual growth through the next nesting season. This would likely increase successful nesting for ground nesting birds.

Riparian habitat is a dwindling resource; in the Western U.S., less than 20% of historic levels of riparian still exist (Belsky et al. 1999). Confounding the loss of riparian habitat is the number of animals dependent either entirely or partly on riparian areas. Upwards of 80% of southwestern wildlife species (Chaney et al. 1990) and approximately 60 to 70 percent of western bird species (Ohmart 1996) depend on riparian areas. Despite their importance, riparian areas have historically experienced the most degradation.

In general, livestock grazing negatively affects riparian dependent wildlife (Belsky et al. 1999). Livestock grazing in riparian areas can directly affect aquatic species such as frogs, toads, salamanders, and garter snakes by trampling. Livestock can indirectly affect riparian obligate and aquatic species by: trampling aquatic vegetation in which these species use for hiding cover, temperature regulation, and substrate (that supports birds nest and frog and toad eggs masses); and by increasing sediments in and turbidity of the water body thereby decreasing water quality for these species and their prey base. Southwestern riparian areas that were excluded from livestock grazing had 50% more small mammals when compared to plots with livestock grazing (Hayward et al. 1997). One third of riparian bird species showed significant differences in diversity between heavily and lightly grazed riparian sites (Mosconi and Hutto, 1982). Although the bark-foraging guild was unaffected, grazing affected three other guilds of riparian birds: flycatching, ground-foraging, and foliage-gleaning (Mosconi & Hutto 1982). In a study in Utah, there was a 350% increase in use and diversity of songbirds, raptors, and small mammals after eight years of no grazing in a riparian area (Duff, 1979 in Fleischner 1994). The abundance and diversity of lizards was higher on ungrazed sites in mixed riparian scrub and cottonwood-willow deciduous forests (Jones 1981, Jones 1988). Wandering garter snakes were five times more abundant in ungrazed riparian sites in New Mexico (Szaro et al. 1985).

As described in detail in the fisheries section, the primary negative impacts to aquatic systems, riparian habitat, and their associated biota from livestock grazing come as indirect effects such as: increased sedimentation into stream channels, loss of riparian vegetation, altered macroinvertebrate assemblages, lowering of groundwater tables and decreased perennial flows, increased stream temperature, larger peak flows, stock tank impacts, and changes in channel form (Belsky et al. 1999; Fleischner 1994). Indirect effects to aquatic species from sediment can occur by modifications to stream habitat. These changes include: 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 livestock grazing indirectly affect fish and macroinvertebrates, grazing subsequently affects those species that forage on fish and macroinvertebrates. Frogs and toads depend on 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 blackhawks, 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.

Nutrients in livestock waste create algal growth in ponds. The decomposition of algae causes low dissolved oxygen concentration which negatively affects aquatic organisms (Belsky et al. 1999). Ponds used by livestock had been documented to have lowered amphibian reproduction due to increased levels of phosphorus and increased turbidity (Knutson et al. 2004). Accumulating evidence suggests that nitrates and ammonium, among other chemicals, can negatively impact amphibians, and that ranids are particularly sensitive to levels of these compounds (Baker and Waights 1994; Nebeker, et al. 2000; Burgett, et al. 2007; Johansson, et al. 2001; Hatch and Blaustein 2000; Hatch and Blaustein 2003; Hecnar 1996; Rouse et al. 1999; Macias et al. 2007; and Marco et al. 1999). Livestock commonly congregate around water sources such as tanks which are also important to aquatic wildlife and are some of the last refugia available to leopard frogs since natural systems have been invaded by non-native aquatic organisms such as fish, bullfrogs, and crayfish. Because leopard frogs often represent the most sensitive aquatic organisms to water quality indices such as nitrates and ammonium, certain levels could impact the existence of frog populations in a tank or preclude the water source from providing habitat for frogs. In times of drought, tanks with residual water attract more terrestrial wildlife and livestock, increasing input of nitrates and ammonium, which is concentrated as water continues to evaporate. In order to improve the quality of water and lower nitrogen input, Knutson et al. (2004) recommend reducing livestock access to ponds.

As demonstrated by the literature review above, livestock grazing can cause: a decrease in the quality and quantity of wildlife food, cover, and shelter; reduced animal abundance; reduced abundance of prey species; and decreased nest success.

Threatened and Endangered Species and Critical Habitats

No Action Alternative (for all threatened and endangered species)

Because livestock grazing and livestock management activities will not occur, the No Action Alternative will not negatively affect listed species or their habitat. Listed species will benefit from the absence of pressure caused by direct and indirect effects from livestock grazing on species and their habitat. As summarized in the General Effects of Grazing to Wildlife section, the absence of livestock grazing can cause: a increase in the quality and quantity of wildlife food, cover, and shelter; increased animal abundance and

diversity; increased abundance and diversity of prey species; and increased reproductive success.

Proposed Action and Reduced Utilization and Intensity Alternatives

Mexican Spotted Owl

Under the Proposed Action and the Reduced Utilization and Intensity Alternative ("Reduced Alternative"), no livestock grazing or associated management activities would occur in spotted owl Protected Activity Centers (PACs). Grazing would occur in both alternatives within Mexican spotted owl (MSO) habitat types defined in the Recovery Plan (USDI 1995) including in 3,711 acres of Protected habitat, mostly in reserved lands, 336 acres of restricted habitat, and in 1,867 acres of designated critical habitat within Fossil Creek allotment.

Although there are no PACs in Fossil Creek range allotment, the proximity of at least one PAC suggests that part of the allotment could be used by MSOs for foraging. MSO prey primarily on small mammals.

The proposed improvements (fence building and removal and erosion control maintenance) in both of the grazing action alternatives would have no effect on spotted owls or their nesting habitat. Fenced areas are expected to show improvements in vegetative growth and therefore potentially improve MSO prey habitat within them.

The existence of several water sources within the designated critical habitat and other MSO habitat contribute to congregation of livestock and increase trampling and removal of vegetative forage above the utilization objective in localized areas. In the Proposed Action, more head of livestock are allowed initially as compared with the Reduced Alternative. Therefore localized trampling and vegetative removal would be slightly more than in the Proposed Action resulting in less vegetative cover and food for small mammals and potentially fewer prey available to foraging MSOs in the allotment in the short-term. In both alternatives, a rotational management system (deferred or rest-rotation grazing) is proposed, so objectives for plant growth and recovery as it relates to MSO prey would be met overall on the allotment.

Fossil Allotment is bounded by other grazing allotments including Hackberry-Pivot Rock allotments, and in fact the Fossil Allotment is used for moving livestock between Hackberry and Pivot Rock. Trailing from the additional cows from those segments of that allotment has short lived and localized trampling effects, and slightly more in the Proposed Action with more head of livestock allowed initially, as compared with the Reduced Alternative.

The amounts of remaining vegetative biomass resulting from different levels of grazing, have been shown to have varying levels of impacts on small mammal populations important to MSOs. Numerous studies support that the abundance of rodents is higher in ungrazed and lightly grazed areas (Valone and Sauter, 2004; Jones and Longland, 1999;

Bock and Bock 1984.) Ward and Block (1995) found that heavier livestock grazing can favor conditions for deer mice at the expense of voles, since deer mice are associated with areas of little herbaceous cover and extensive exposed soil. Long-tailed and Mexican voles use sites with greater herbaceous cover and less exposed ground, so would be associated with lighter or non-grazing regimes. Voles provide a greater biomass per individual as prey and per unit area. Therefore a shift from vole habitat with more vegetative cover, to deer mice habitat caused by removal of more vegetative cover could negatively affect foraging MSOs.

Effects to MSO prey habitat are considered indirect effects and these negative effects would be slightly more in the proposed action which proposes a higher utilization and intensity in late spring and early summer, and allows a higher stocking rate initially which would leave less vegetative biomass for MSO small mammal prey compared with the reduced alternative that proposes lower utilization and intensity in late spring and early summer, and allows a lower stocking rate initially which would leave more vegetative biomass for MSO small mammal prey.

Yuma Clapper Rail

No surveys have been conducted for rails, however, there is potential habitat for rails along the Verde River and Fossil Creek. Livestock grazing and livestock management activities in either grazing action alternative can directly affect rail habitat where livestock have access to Fossil Creek. Indirect effects to uplands in the watershed could affect riparian habitat for the rail. The project design feature and mitigation of 20% maximum utilization on woody riparian vegetation will reduce the amount of effects livestock have on riparian vegetation along Fossil Creek.

The Reduced Alternative calls for the same management of riparian areas as the Proposed Action with the exception of initially having a reduced number of livestock and lower intensity and utilization rates. As stated in the fisheries section, the primary negative impacts to aquatic systems and their associated biota from livestock grazing come as indirect effects such as: increased sedimentation into stream channels, loss of riparian vegetation, altered macroinvertebrate assemblages, lowering of groundwater tables and decreased perennial flows, increased stream temperature, larger peak flows, stock tank impacts, and changes in channel form (Belsky et al. 1999; Fleischner 1994). As stated in the water and riparian resource section, indirect effects to riparian condition and water quality may be slightly less with the Reduced Alternative since there may be more biomass left on site with a lower utilization rate and the rate of improvement of the upland may be slightly quicker than the proposed action. A slightly less impact to the riparian condition and water quality will have slight benefits to Yuma clapper rail habitat, to prey habitat, and to prey. Therefore, indirect effects to the rail are slightly less with the Reduced Alternative than with the Proposed Action.

Southwestern Willow Flycatcher

Due to 1) livestock access to three watering points along Fossil Creek where potential southwestern willow flycatcher habitat occurs and 2) the relationship between livestock grazing and brown-headed cowbirds which parasitize willow flycatcher nests, the proposed action and reduced alternative will have negative direct and indirect effects to the flycatcher and its habitat. Direct effects to riparian vegetation are lessened in both action alternatives since the maximum pasture grazing period is 30 days during the spring use period, and livestock use of a pasture will occur in alternate years if grazed during the critical growth period for woody riparian species. Use at the Fossil Creek water access sites will be localized to the fenced lanes for short periods of time generally during December -April. The mitigation of 20% maximum utilization on woody riparian vegetation will reduce the amount of effects livestock have on riparian vegetation.

The Reduced Alternative calls for the same management of riparian area as the proposed action with the exception of a reduced number of livestock and lower intensity and utilization rates; direct effects to riparian is the same for both alternatives. As stated in the fisheries section, the primary negative impacts to aquatic systems and their associated biota from livestock grazing come as indirect effects such as: increased sedimentation into stream channels, loss of riparian vegetation, altered macroinvertebrate assemblages, lowering of groundwater tables and decreased perennial flows, increased stream temperature, larger peak flows, stock tank impacts, and changes in channel form (Belsky et al. 1999; Fleischner 1994). As stated in the water and riparian resource section, indirect effects to riparian condition and water quality may be slightly less with the Reduced Alternative since there may be more biomass left on site with a lower utilization rate and the rate of improvement of the upland may be slightly quicker than the proposed action. A slightly less impact to the riparian condition and water quality will have slight benefits to flycatcher nesting and foraging habitat, to prey habitat, and to prey. Therefore, indirect effects to the southwestern willow flycatcher are slightly less with the Reduced Alternative than with the Proposed Action.

Chiricahua Leopard Frog

The mitigation measure of retaining water in select tanks will benefit this species. In addition, wedge fencing will be constructed to protect aquatic habitat required for egg laying, food, and shelter. Even with the fencing, livestock will still have access to portions of suitable and occupied frog sites. Grazing will be allowed around tanks and can affect the Chiricahua leopard frog by: trampling aquatic and aquatic vegetation in which these species use for hiding cover, temperature regulation, substrate to support frog and toad eggs masses, and for foraging; and increasing sediments in and turbidity of the water body thereby decreasing water quality for these species and their prey base. In addition, nutrients in livestock waste create algal growth in ponds. The decomposition of algae causes low dissolved oxygen concentration which negatively affects aquatic organisms (Belsky et al. 1999). Ponds used by livestock had been documented to have lowered amphibian reproduction due to increased levels of phosphorus and increased turbidity (Knutson et al. 2004).

Accumulating evidence suggests that nitrates and ammonium, among other chemicals, can negatively impact amphibians, and that ranids are particularly sensitive to levels of these compounds. Examples of literature on this topic include: Baker and Waights (1994), Nebeker, et al. (2000), Burgett, et al. (2007), Johansson, et al. (2001), Hatch and Blaustein (2000), Hatch and Blaustein (2003), Hecnar (1996), Rouse et al. (1999), Macias et al. (2007), and Marco et al. (1999). Livestock commonly congregate around water sources such as tanks which are also important to aquatic wildlife and are some of the last refugia available to leopard frogs since natural systems have been invaded by non-native aquatic organisms such as fish, bullfrogs, and crayfish. Because leopard frogs often represent the most sensitive aquatic organisms to water quality indices such as nitrates and ammonium, certain levels could impact the existence of frog populations in a tank or preclude the water source from providing habitat for frogs. In times of drought, tanks with residual water attract more terrestrial wildlife and livestock, increasing input of nitrates and ammonium, which is concentrated as water continues to evaporate. In order to improve the quality of water and lower nitrogen input, Knutson et al. (2004) recommend reducing livestock access to ponds.

Both grazing alternatives allow access to ponds (tanks) although in many cases, this access to occupied tanks will be partially limited by wedge fencing of the tank so that only portions, i.e. one quarter of the tank, may be accessible from one actively grazed pasture at a time. This allows for potential recovery of emergent vegetation and immediately adjacent upland vegetation which can help reduce input of animal waste and the build-up of nitrates and ammonium temporarily in those rested pastures (i.e. three quarters of the tank edge) but does not completely mitigate the potential for water contamination in the tank as a whole. Therefore water quality monitoring will be conducted periodically in tanks that are deemed otherwise suitable habitat for leopard frogs.

Livestock concentrations at tanks is traditionally higher than away from water, therefore, livestock grazing in the uplands and adjacent to tanks indirectly affects Chiricahua leopard frogs when livestock grazing reduces perennial grasses, reduces ground litter, increases compaction, decreases infiltration, which leads to increased erosion, and increased sediment transport. An increase in sediment into earthen tanks reduces the water-holding capacity of the tank, making it susceptible to drying out during drought years. Leopard frogs are highly aquatic and need year-round water and aquatic vegetation during their active period. Therefore, the Proposed Action and Reduced Alternative have negative direct and indirect effects on the Chiricahua leopard frog and its habitat.

Because the Reduced Alternative calls for lower livestock numbers initially and lower intensity and utilization rates than the proposed action, the Reduced Alternative will have a slight decrease in effects (trampling individuals and habitat, less livestock waste in tanks) due to fewer livestock accessing occupied and suitable tanks. Because the Reduced Alternative will allow for a slight increase in biomass left on site, a slightly quicker rate of improvement of the upland soil condition, and a slight improvement in

infiltration (less sediment runoff into frog tanks), this alternative will have slightly less indirect effects on the Chiricahua leopard frog than will the proposed action.

Forest Service Sensitive Species -- Environmental Consequences by Alternative and Species

No Action Alternative (for all sensitive species)

Because livestock grazing and livestock management activities will not occur under the No Action alternative, it will not impact sensitive species or their habitat. Sensitive species will benefit from the absence of direct and indirect effects from livestock grazing on species and their habitat. The absence of livestock grazing can cause: an increase in the quality and quantity of wildlife food, cover, and shelter; increased animal abundance; increased abundance of prey species; and increased nest success.

Proposed Action and Reduced Utilization and Intensity Alternatives

Merriam's Shrew

Effects to this species from livestock grazing and management activities would include trampling and removal of grass needed for cover which may make them more susceptible to predation. The effect of livestock grazing on vegetation has been documented to affect insects, upon which this shrew feed. Above ground macroarthropods (insects and arachnids) experienced large decreases with moderate or heavy grazing, but conversely with light grazing showed slight increases (Lavigne et al. 1972 in Milchunas et al. 1998). The Reduced Alternative calls for a reduced number of livestock and lower intensity and utilization rates. Light grazing (30% utilization) has been found to leave a greater amount of standing vegetative crop than moderately grazed sites and forage production was 24% higher under light than moderate grazing (Holecheck et al. 2003 and 1999). With the Reduced Alternative, there will be a slight increase in biomass left on-site; therefore, effects to the shrew's cover and their preys' (insects) food are slightly less with the Reduced Alternative than with the Proposed Action. Although shrews do not make burrows themselves, they may use other animals' burrows while hunting. Livestock grazing can directly impact small mammals by trampling and collapsing burrows and compacting soils which can hinder burrow construction (Heske and Campbell, 1991; Hayward et al., 1997). Therefore, the reduced number of livestock with the Reduced Alternative will result in decreased potential for livestock to trample burrows.

Western Red Bat

Disturbance to any bat species may occur when noise from livestock management activities such as personnel, vehicles, and dogs are present within close enough proximity to roost 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.

Livestock grazing and management activities in riparian areas are limited, but when they do coincide, they may disturb roosting red bats. Indirect effects may occur when grazing on woody vegetation affects the recruitment of large deciduous tree that are used for roosting. Direct effects to riparian vegetation are lessened in both action alternatives since the maximum pasture grazing period is 30 days during the spring use period, and livestock use of a pasture will occur in alternate years if grazed during the critical growth period for woody riparian species. Use at the Fossil Creek water access sites will be localized to the fenced lanes for short periods of time generally during December -April. The mitigation of 20% maximum utilization on woody riparian vegetation will reduce the amount of effects livestock have on riparian vegetation.

The Reduced Alternative calls for the same management of riparian area as the Proposed Action with the exception of a reduced number of livestock and lower intensity and utilization rates. As stated in the fisheries section, the primary negative impacts to aquatic systems and their associated biota from livestock grazing come as indirect effects such as: increased sedimentation into stream channels, loss of riparian vegetation, altered macroinvertebrate assemblages, lowering of groundwater tables and decreased perennial flows, increased stream temperature, larger peak flows, stock tank impacts, and changes in channel form (Belsky et al. 1999; Fleischner 1994). As stated in the water and riparian resource section, indirect effects to riparian condition and water quality may be slightly less with the Reduced Alternative since there may be more biomass left on site with a lower utilization rate and the rate of improvement of the upland may be slightly quicker than the proposed action. A slightly less impact to the riparian condition and water quality will have slight benefits to red bats roosting and foraging habitat, to prey habitat, and to prey. Therefore, indirect effects to the western red bat's habitat and prey base are slightly less with the Reduced Alternative than with the Proposed Action.

Spotted Bat & Greater Western Mastiff Bat

Both species roost in cracks and crevices along high cliff ledges that would not be accessible to livestock grazing and management activities and would not be as susceptible to noise disturbance. Mitigation measures such as retaining water in livestock tanks and supplying drinkers with wildlife escape ramps will benefit this species.

Since effects to roosting bats would not change between the two action alternatives, the difference between the alternatives would lie with the effects to their prey. Livestock grazing and the subsequent reduction in host plants adversely affect insects that insectivorous bats eat. Above ground macroarthropods (insects and arachnids) experienced large decreases with moderate or heavy grazing, but conversely with light grazing showed slight increases (Lavigne et al. 1972 in Milchunas et al. 1998). With the Reduced Alternative there will be a slight increase in biomass left on site, therefore, effects to host plants for bat prey are slightly less with the Reduced Alternative than with the Proposed Action. Therefore, the reduced alternative may have a slightly less indirect effect to these two insectivorous bats.

Allen's Lappet-browed Bat

It is not anticipated that livestock grazing will have direct effects to the lappet-browed bat. However, noise from livestock management activities (particularly people, equipment and vehicles) could disturb roosting bats. Mitigation measures such as retaining water in livestock tanks and supplying drinkers with wildlife escape ramps will benefit this species.

Since effects to roosting bats would not change between the two action alternatives, the difference between the alternatives would lie with the effects to their prey. Livestock grazing and the subsequent reduction in host plants adversely affect insects that insectivorous bats eat. Above ground macroarthropods (insects and arachnids) experienced large decreases with moderate or heavy grazing, but conversely with light grazing showed slight increases (Lavigne et al. 1972 in Milchunas et al. 1998). With the Reduced Alternative there will be a slight increase in biomass left on site, therefore, effects to host plants for bat prey are slightly less with the Reduced Alternative than with the Proposed Action. Therefore, the reduced alternative may have a slightly less indirect effect to Allen's lappet-browed bat.

Pale Townsend's Big-eared Bat

Livestock management activities in particular may disturb roosting bats when activities occur near occupied roosts. Mitigation measures such as retaining water in livestock tanks and supplying drinkers with wildlife escape ramps will benefit this species.

Since effects to roosting bats would not change between the two action alternatives, the difference between the alternatives would lie with the effects to their prey. Livestock grazing and the subsequent reduction in host plants adversely affect insects that insectivorous bats eat. Above ground macroarthropods (insects and arachnids) experienced large decreases with moderate or heavy grazing, but conversely with light grazing showed slight increases (Lavigne et al. 1972 in Milchunas et al. 1998). With the Reduced Alternative there will be a slight increase in biomass left on site, therefore, effects to host plants for bat prey are slightly less with the Reduced Alternative than with the Proposed Action. Therefore, the reduced alternative may have a slightly less indirect effect to the pale Townsend's big-eared bat.

Wupatki Arizona Pocket Mouse

Livestock grazing can directly impact rodents by trampling and collapsing burrows, compacting soils which hinders burrow construction, and by removing rodent food sources such as seed heads (Heske and Campbell, 1991; Hayward et al., 1997). Indirect effects of livestock grazing on rodents can occur when grazing changes the composition of vegetative species (Heske and Campbell, 1991; Hayward et al., 1997) and structure of vegetative species (Jones and Longland 1999; Hayward et al., 1997; Adler and Lauenroth, 2000). In one study there were significantly more pocket mice in areas with > 30% ground cover when compared to grazed areas with less than 25% ground cover (Valone and Sauter, 2004). In another study, pocket mice were more abundant in lightly

grazed areas than in heavily grazed areas (Jones and Longland, 1999). Pocket mice and harvest mice were significantly more abundant in ungrazed areas when compared to grazed areas (Bock and Bock 1984). Rodent burrow densities were higher in ungrazed plots when compared to grazed plots (Adler and Lauenroth, 2000). Livestock grazing that results in loss of cover and food for pocket mice can make them more susceptible to starvation and predation.

The Reduced Alternative calls for a reduced number of livestock and lower intensity and utilization rates. Light grazing (30% utilization) has been found to leave a greater amount of standing vegetative crop than moderately grazed sites and forage production was 24% higher under light than moderate grazing (Holecheck et al. 2003 and 1999). With the Reduced Alternative, there will be a slight increase in biomass left on-site; therefore, effects to the pocket mouse's food source are slightly less with the Reduced Alternative than with the Proposed Action. In addition, the reduced number of livestock with the Reduced Alternative will result in decreased potential for livestock to trample burrows in which this species may over-winter.

Plains Harvest Mouse and Mogollon Vole (Formerly Navajo Mountain Mexican Vole)

Although these two small mammal species differ in habitat and behavior, grazing affects them in similar ways, including directly (trampling), and their habitat and food sources (grasses, seeds or forbs). Livestock grazing can directly impact rodents by trampling and collapsing burrows, compacting soils which hinders burrow construction, and by removing rodent food sources such as seed heads (Heske and Campbell, 1991; Hayward et al., 1997). Indirect effects of livestock grazing on rodents can occur when grazing changes the composition of vegetative species (Heske and Campbell, 1991; Hayward et al., 1997) and structure of vegetative species (Jones and Longland 1999; Hayward et al., 1997; Adler and Lauenroth, 2000). Pocket mice and harvest mice were significantly more abundant in ungrazed areas when compared to grazed areas (Bock and Bock 1984). Livestock grazing that results in loss of cover and food for the plains harvest mouse can make them more susceptible to starvation and predation.

The Reduced Alternative calls for a reduced number of livestock and lower intensity and utilization rates. Light grazing (30% utilization) has been found to leave a greater amount of standing vegetative crop than moderately grazed sites and forage production was 24% higher under light than moderate grazing (Holecheck et al. 2003; Holecheck et al. 1999). With the Reduced Alternative, there will be a slight increase in biomass left on site, therefore, effects to the vole's and the harvest mouse's food source are slightly less with the Reduced Alternative than with the Proposed Action. In addition, the reduced number of livestock with the Reduced Alternative will result in decreased potential for livestock to trample burrows that these species use.

Bald Eagle

Nesting bald eagles along the Verde River and potentially along Fossil Creek may be found foraging in the uplands on the allotment. Wintering bald eagles may forage throughout the allotment and may roost in areas with ponderosa pine woodlands.

Livestock management activities can disturb foraging or roosting wintering bald eagles and nesting bald eagles that may forage in the uplands.

The Reduced Alternative calls for the same management of riparian areas as the Proposed Action with the exception of initially having a reduced number of livestock and lower intensity and utilization rates. As stated in the fisheries section, the primary negative impacts to aquatic systems and their associated biota from livestock grazing come as indirect effects such as: increased sedimentation into stream channels, loss of riparian vegetation, altered macroinvertebrate assemblages, lowering of groundwater tables and decreased perennial flows, increased stream temperature, larger peak flows, stock tank impacts, and changes in channel form (Belsky et al. 1999; Fleischner 1994). Indirect effects to aquatic species from sediment can occur by modifications to stream habitat. These changes include: 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). As stated in the water and riparian resource section, indirect effects to riparian condition and water quality may be slightly less with the Reduced Alternative since there may be more biomass left on site with a lower utilization rate and the rate of improvement of the upland may be slightly quicker than the proposed action. A slightly less impact to the riparian condition and water quality will have slight benefits to bald eagle nesting and foraging habitat, to prey habitat, and to prey. Therefore, indirect effects to bald eagle habitat and prey species are slightly less with the Reduced Alternative than with the Proposed Action.

American Peregrine Falcon

Livestock grazing can result in impacts to peregrine falcon's prey habitat which is primarily birds. These prey depend on seeds and insects as their food source. Livestock grazing can indirectly affect wildlife by affecting their prey such as arthropods. Arthropods are important food for various species of birds, including species upon which peregrine falcon prey. Above ground macroarthropods (insects and arachnids) experienced large decreases with moderate or heavy grazing, but conversely with light grazing showed slight increases (Lavigne et al. 1972 in Milchunas et al. 1998). Birds, including peregrine falcon prey species, are indirectly affected by the impacts grazing has on vegetation (Saab et. al. 1995). Livestock reduce forage production which reduces litter production, increases soil compaction, and reduces infiltration (see watershed section). These changes to the soil and consequently the vegetation as a result of livestock grazing affect some breeding birds negatively (Saab et al. 1995). Birds that depend on dense herbaceous ground cover for nesting and/or foraging are most likely to be adversely affected by grazing (Saab et al. 1995). Grazing during the breeding season of ground nesting birds can reduce herbaceous vegetation necessary for concealing nests (Saab et. al. 1995). A reduction in herbaceous vegetation can expose nests resulting in an increased chance for nest predation, nest parasitism, exposure to elements, and ultimately nest failure.

The Reduced Alternative would have similar effects to those described in the Proposed Action with the exception that the magnitude of effects on the habitat for the falcon's foraging habitat may be slightly less because of the lower number of livestock allowed

initially, and the more conservative allowable grazing utilization and intensity levels in the Reduced Alternative. The mitigation measures for retaining water in livestock tanks will benefit this species.

Northern Goshawk

Since livestock grazing can result in loss of habitat or habitat quality for northern goshawk prey (ground dwelling small mammals and birds), the Proposed Action and the Reduced Alternative may impact the northern goshawk. Small mammal prey is important for many species of higher trophic levels, including raptors, carnivorous mammals, snakes, and avian predators (Hayward et al. 1997; Saab et al. 1995). When rodent prey decrease in response to reduced vegetative cover, so do the avian predators (Saab et al. 1995). Livestock grazing can directly impact rodents by trampling and collapsing burrows, compacting soils which hinders burrow construction, and by removing rodent food sources such as seed heads (Heske and Campbell, 1991; Hayward et al., 1997; Adler and Lauenroth, 2000). In addition to mammalian prey, northern goshawks also prey on birds. Birds are indirectly affected by the impacts grazing has on vegetation (Saab et al. 1995). Livestock reduce forage production which reduces litter production, increases soil compaction, and reduces infiltration (see watershed section). These changes to the soil and consequently the vegetation as a result of livestock grazing affect some breeding birds negatively (Saab et al. 1995). Birds that depend on dense herbaceous ground cover for nesting and/or foraging are most likely to be adversely affected by grazing (Saab et al. 1995). Grazing during the breeding season of ground nesting birds can reduce herbaceous vegetation necessary for concealing nests (Saab et al. 1995). A reduction in herbaceous vegetation can expose nests resulting in an increased chance for nest predation, nest parasitism, exposure to elements, and ultimately nest failure.

Effects of the Reduced Alternative would be similar to those described for the Proposed Action, except the magnitude of the grazing effects on goshawk prey habitat would be less in the Reduced Alternative due to the reduced number of livestock proposed initially and lighter grazing utilization and grazing intensity. Livestock management activities can disturb individuals, particularly during the breeding season. Livestock grazing can affect this hawk by grazing vegetation that serves as food and cover for prey species.

Common Black Hawk

Grazing and livestock management activities have the potential to cause direct and indirect effects to common black hawks and their habitat. The black hawk nests along riparian corridors on the allotment, particularly perennial streams like Fossil Creek and the Verde River. Direct effects to riparian vegetation are lessened in both alternatives since the maximum pasture grazing period is 30 days during the spring use period, and livestock use of a pasture will occur in alternate years if grazed during the critical growth period for woody riparian species. Use at the Fossil Creek water access sites will be localized to the fenced lanes for short periods of time generally during December –April. The mitigation of 20% maximum utilization on woody riparian vegetation will reduce the amount of effects livestock have on riparian vegetation.

The Reduced Alternative calls for the same management of riparian areas as the Proposed Action with the exception of initially having fewer numbers of livestock and lower intensity and utilization levels; direct effects to the riparian habitat is the same for both alternatives. As stated in the fisheries section, the primary negative impacts to aquatic systems and their associated biota from livestock grazing come as indirect effects such as: increased sedimentation into stream channels, loss of riparian vegetation, altered macroinvertebrate assemblages, lowering of groundwater tables and decreased perennial flows, increased stream temperature, larger peak flows, stock tank impacts, and changes in channel form (Belsky et al. 1999; Fleischner 1994). Indirect effects to aquatic species from sediment can occur by modifications to stream habitat. These changes include: 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). As stated in the water and riparian resource section, indirect effects to riparian condition and water quality may be slightly less with the Reduced Alternative since there may be more biomass left on site with a lower utilization rate and the rate of improvement of the upland may be slightly quicker than the proposed action. A slightly less impact to the riparian condition and water quality will have slight benefits to black hawk nesting and foraging habitat, to prey habitat, and to prey. Therefore, indirect effects to the common black hawk are slightly less with the Reduced Alternative than with the Proposed Action.

Western Yellow-billed Cuckoo

Grazing and livestock management activities have the potential to cause direct and indirect effects to yellow-billed cuckoos and their habitat. Cuckoos nest along riparian corridors on the allotment, particularly perennial streams like Fossil Creek and the Verde River. Direct effects to riparian vegetation are lessened in both alternatives since the maximum pasture grazing period is 30 days during the spring use period, and livestock use of a pasture will occur in alternate years if grazed during the critical growth period for woody riparian species. Use at the Fossil Creek water access sites will be localized to the fenced lanes for short periods of time generally during December-April. The mitigation of 20% maximum utilization on woody riparian vegetation will reduce the amount of effects livestock have on riparian vegetation.

The Reduced Alternative calls for the same management of riparian areas as the Proposed Action with the exception of initially having fewer numbers of livestock and lower intensity and utilization levels; direct effects to the riparian habitat is the same for both alternatives. As stated in the fisheries section, the primary negative impacts to aquatic systems and their associated biota from livestock grazing come as indirect effects such as: increased sedimentation into stream channels, loss of riparian vegetation, altered macroinvertebrate assemblages, lowering of groundwater tables and decreased perennial flows, increased stream temperature, larger peak flows, stock tank impacts, and changes in channel form (Belsky et al. 1999; Fleischner 1994). As stated in the water and riparian resource section, indirect effects to riparian condition and water quality may be slightly less with the Reduced Alternative since there may be more biomass left on site with a lower utilization rate and the rate of improvement of the upland may be slightly quicker than the proposed action. A slightly less impact to the riparian condition and water

quality will have slight benefits to cuckoo nesting habitat. Therefore, effects to the cuckoo are slightly less with the Reduced Alternative than with the Proposed Action.

Cuckoos forage on insects found in mesquite stands adjacent to riparian areas. Moderate and heavy grazing has been found to result in a decrease in macroarthropods (insects and arachnids), conversely light grazing showed slight increases in macroarthropods (Lavigne et al. 1972 in Milchunas et al. 1998). With the Reduced Alternative there will be a slight increase in biomass left on site and potentially more macroarthropods. Therefore, the reduced alternative may have a slightly less indirect effect to the yellow-billed cuckoo.

Ferruginous Hawk

Avian predators (raptors) are dependent on small-mammal prey. When rodent prey decrease in response to reduced vegetative cover, so do the avian predators (Saab et.al 1995). In a review of studies measuring the relative abundance of birds in grazed habitats compared to either ungrazed or lightly grazed areas, Saab et al. (1995) summarized that the ground-nesting ferruginous hawk show a negative response to grazing where nesting cover is limited but show a positive response in areas where they prefer open grasslands for hunting.

The Reduced Alternative calls for a reduced number of livestock and lower intensity and utilization rates. Light grazing (30% utilization) has been found to leave a greater amount of standing vegetative crop than moderately grazed sites and forage production was 24% higher under light than moderate grazing (Holecheck et al. 2003 and 1999). Numerous studies support that the abundance of rodents is higher in ungrazed and lightly grazed areas (Valone and Sauter, 2004; Jones and Longland, 1999; Bock and Bock 1984. With the Reduced Alternative, there will be a slight increase in biomass left on site; therefore, effects to the food and cover for rodents are slightly less with the Reduced Alternative than with the Proposed Action. This benefit will carry over to benefit the ferruginous hawk as well.

Livestock management activities can disturb individuals, however, since these hawks are most likely only present during the winter, they will not be affected during the critical breeding season. Livestock grazing can affect this hawk by grazing vegetation that serves as food and cover for prey species.

Abert's Towhee

Livestock grazing in riparian areas has been implicated in the decline of Abert's towhees through the modification and loss of riparian habitat. Direct effects to riparian vegetation are lessened in both action alternatives since the maximum pasture grazing period is 30 days during the spring use period, and livestock use of a pasture will occur in alternate years if grazed during the critical growth period for woody riparian species. Use at the Fossil Creek water access sites will be localized to the fenced lanes for short periods of time generally during December -April. The mitigation of 20% maximum utilization on woody riparian vegetation will reduce the amount of effects livestock have on riparian vegetation.

The Reduced Alternative calls for the same management of riparian areas as the Proposed Action with the exception of initially having fewer numbers of livestock and lower intensity and utilization levels; direct effects to the riparian habitat is the same for both alternatives. As stated in the fisheries section, the primary negative impacts to aquatic systems and their associated biota from livestock grazing come as indirect effects such as: increased sedimentation into stream channels, loss of riparian vegetation, altered macroinvertebrate assemblages, lowering of groundwater tables and decreased perennial flows, increased stream temperature, larger peak flows, stock tank impacts, and changes in channel form (Belsky et al. 1999; Fleischner 1994). As stated in the water and riparian resource section, indirect effects to riparian condition and water quality may be slightly less with the Reduced Alternative since there may be more biomass left on site with a lower utilization rate and the rate of improvement of the upland may be slightly quicker than the proposed action. A slightly less impact to the riparian condition and water quality will have slight benefits to towhee nesting. Therefore, indirect effects to the towhee are slightly less with the Reduced Alternative than with the Proposed Action.

Abert's towhees forage on insects found on the floor within dense riparian scrub. Moderate and heavy grazing has been found to result in a decrease in macroarthropods (insects and arachnids), conversely light grazing showed slight increases in macroarthropods (Lavigne et al. 1972 in Milchunas et al. 1998). With the Reduced Alternative there will be a slight increase in biomass left on site and potentially more macroarthropods. Therefore, the reduced alternative may have a slightly less indirect effect to Abert's towhees.

Lowland Leopard Frog

Livestock grazing and management activities have the potential to cause direct and indirect effects to lowland leopard frogs present along Fossil Creek. There is also the potential for lowland leopard frogs to occur in potential habitat along other riparian corridors on the allotment. Direct effects to riparian vegetation are lessened in both action alternatives since the maximum pasture grazing period is 30 days during the spring use period, and livestock use of a pasture will occur in alternate years if grazed during the critical growth period for woody riparian species. Use at the Fossil Creek water access sites will be localized to the fenced lanes for short periods of time generally during December-April. The mitigation of 20% maximum utilization on woody riparian vegetation will reduce the amount of effects livestock have on riparian vegetation in both action alternatives.

Grazing in the uplands can indirectly affect frog habitat and aquatic prey. Livestock grazing can indirectly affect water quality when upland grazing removes biomass, reduces the protective vegetative ground cover that normally traps sediments, increases soil compaction, reduces water infiltration, increases sediment production and non-point source pollution into streams. The indirect effects of the Reduced Alternative are similar to the Proposed Action, however, there may potentially be more biomass left on site with a lover utilization rate and the rate of improvement of the upland may be slightly quicker than the proposed action. The indirect effect of livestock grazing on water quality may

be slightly reduced with the Reduced Alternative. A slight improvement to water quality may benefit aquatic macroinvertebrates and fish which are prey items for the lowland leopard frog. Therefore, indirect effects to the leopard frog are slightly less with the Reduced Alternative than with the Proposed Action.

Arizona Toad, Narrow-headed Garter Snake, Mexican Garter Snake

Livestock grazing and livestock management activities have the potential to cause direct and indirect effects to Arizona toad, the narrow headed garter and Mexican garter snakes, (both of which are riparian obligates), that occur along riparian corridors on the allotment. Direct effects to riparian vegetation are lessened in both action alternatives since the maximum pasture grazing period is 30 days during the spring use period, and livestock use of a pasture will occur in alternate years if grazed during the critical growth period for woody riparian species. Use at the Fossil Creek water access sites will be localized to the fenced lanes for short periods of time generally during December-April. The mitigation of 20% maximum utilization on woody riparian vegetation will reduce the amount of effects livestock have on riparian vegetation.

The Reduced Alternative calls for the same management of riparian areas as the Proposed Action with the exception of initially having fewer numbers of livestock and lower intensity and utilization levels; direct effects to the riparian habitat is the same for both alternatives. As stated in the fisheries section, the primary negative impacts to aquatic systems and their associated biota from livestock grazing come as indirect effects such as: increased sedimentation into stream channels, loss of riparian vegetation, altered macroinvertebrate assemblages, lowering of groundwater tables and decreased perennial flows, increased stream temperature, larger peak flows, and changes in channel form (Belsky et al. 1999; Fleischner 1994). Indirect effects to aquatic species from sediment can occur by modifications to stream habitat. These changes include: 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). As stated in the water and riparian resource section, indirect effects to riparian condition and water quality may be slightly less with the Reduced Alternative since there may be more biomass left on site with a lower utilization rate and the rate of improvement of the upland may be slightly quicker than the proposed action. A slightly less impact to the riparian condition and water quality will have slight benefits to frog, toad, and garter snake hiding and foraging habitat, to prey habitat, and to prey. Therefore, indirect effects to the three aquatic organisms are slightly less with the Reduced Alternative than with the Proposed Action.

Reticulated Gila Monster

Gila monsters spend most of their time in burrows. They eat small mammals, lizards and lizard eggs. Livestock grazing can trample and collapse burrows, and compact soils which hinders burrow construction. Livestock grazing can remove plant seeds on which Gila monsters' small mammal prey depend, and it can decrease arthropods on which their lizard prey depend (Heske and Campbell, 1991; Hayward et al., 1997). In Arizona, the abundance and diversity of open-space and wide-ranging foraging lizards was higher on lightly grazed sites (versus heavily grazed sites) in four habitat types including chaparral

and desert grassland (Jones 1981). Declines in the abundance and diversity of lizards were attributed to a change in vegetative structure which was described as a reduction of low vegetation, primarily perennial grasses (Jones 1981). Many species of lizards feed on insects. Aboveground macroarthropods (insects and arachnids) experienced large decreases with moderate or heavy grazing, but conversely with light grazing showed slight increases (Lavigne et al. 1972 in Milchunas et al. 1998). Therefore, grazing can affect the insects which are food for lizards, upon which Gila monsters prey.

The Reduced Alternative calls for a reduced number of livestock and lower intensity and utilization rates. Light grazing (30% utilization) has been found to leave a greater amount of standing vegetative crop than moderately grazed sites and forage production was 24% higher under light than moderate grazing (Holecheck et al. 2003 and 1999). Numerous studies support that the abundance of rodents is higher in ungrazed and lightly grazed areas (Valone and Sauter, 2004; Jones and Longland, 1999; Bock and Bock 1984). With the Reduced Alternative, there will be a slight increase in biomass left on-site; therefore, effects to the food and cover for prey are slightly less with the Reduced Alternative than with the Proposed Action. Benefits to prey species will benefit Gila monsters as well.

Mountain Silverspot Butterfly and Blue-black Silverspot Butterfly

In general, livestock grazing affects above ground macroarthropods which is a group of invertebrates in which butterflies belong. Aboveground macroarthropods experienced large decreases with moderate or heavy grazing, but conversely with light grazing showed slight increases (Lavigne et al. 1972 in Milchunas et al. 1998). Livestock grazing and livestock management activities have the potential to have direct and indirect effects to potential habitat and host plants of the two butterflies. The Reduced Alternative calls for a reduced number of livestock and lower intensity and utilization rates. Light grazing (30% utilization) has been found to leave a greater amount of standing vegetative crop than moderately grazed sites and forage production was 24% higher under light than moderate grazing (Holecheck et al. 2003 and 1999). Because the reduced alternative calls for a lower initial stocking rate and more conservative allowable grazing utilization and intensity levels than the proposed action, this alternative will have a slightly lesser effect due to: fewer livestock accessing occupied and suitable habitats and a slightly lower potential for livestock to trample or graze on host plants.

Spotted Skipperling

In general, livestock grazing affects above ground macroarthropods which is a group of invertebrates in which butterflies belong. Aboveground macroarthropods experienced large decreases with moderate or heavy grazing, but conversely with light grazing showed slight increases (Lavigne et al. 1972 in Milchunas et al. 1998). Livestock grazing and livestock management activities have the potential to have direct and indirect effects to potential habitat and host plants for the spotted skipperling. The Reduced Alternative calls for a reduced number of livestock and lower intensity and utilization rates. Light grazing (30% utilization) has been found to leave a greater amount of standing vegetative crop than moderately grazed sites and forage production was 24% higher under light than moderate grazing (Holecheck et al. 2003 and 1999). Because the reduced alternative

calls for a lower stocking rate and grazing utilization initially than the proposed action, this alternative will have a slight decrease in effects due to fewer livestock accessing occupied and suitable habitats and a slightly lower potential for livestock to trample or graze on host plants, than the proposed action.

A Mayfly

Livestock grazing in the uplands and in riparian areas can indirectly affect water quality as well as contribute to sedimentation which causes embeddedness and affects water quality. As described in the fisheries section, livestock grazing can indirectly affect water quality when upland grazing removes biomass, reduces the protective vegetative ground cover that normally traps sediments, increases soil compaction, reduces water infiltration, increases sediment production and non-point source pollution into streams. Excessive sedimentation can result in the stream substrate becoming embedded with soil. This reduces the surface area for macroinvertebrates to attach. The indirect effects of the Reduced Alternative are similar to the Proposed Action, however, there may potentially be more biomass left on site with a lover utilization rate and the rate of improvement of the upland may be slightly quicker than the proposed action. Therefore, the indirect effect of livestock grazing on water quality may be slightly reduced with the Reduced Alternative. A slight improvement to water quality may benefit aquatic macroinvertebrates including this mayfly.

California Floater

Livestock grazing activities may directly affect this species' habitat in riparian areas. Grazing in the uplands can indirectly affect aquatic habitat and aquatic prey. As described in the fisheries section, livestock grazing can indirectly affect water quality when upland grazing removes biomass, reduces the protective vegetative ground cover that normally traps sediments, increases soil compaction, reduces water infiltration, increases sediment production and non-point source pollution into streams. The indirect effects of the Reduced Alternative are similar to the Proposed Action, however, there may potentially be more biomass left on site with a lover utilization rate and the rate of improvement of the upland may be slightly quicker than the proposed action. Therefore, the indirect effect of livestock grazing on water quality may be slightly reduced with the Reduced Alternative. A slight improvement to water quality may benefit aquatic organisms including the California floater.

Management Indicator Species (MIS)

No Action Alternative (for all management indicator species)

Because livestock grazing and livestock management activities will not occur under the No Action Alternative, there would be no adverse impacts to management indicator species or their habitat. MIS will benefit from the absence of direct and indirect effects from livestock grazing on species and their habitat. However, the absence of grazing may not result in a change in the forest-wide trend for MIS species.

Proposed Action and Reduced Utilization and Intensity Alternatives

Pronghorn

Early season grazing by livestock or wildlife has the potential to reduce fawn hiding cover provided by new growth and residual growth from the prior year. Reduced hiding cover may facilitate predation of pronghorn fawns. The magnitude of effects varies by the number of animals, and timing and duration of graze during the fawning season as directed in the AOIs. Over time, livestock grazing can alter plant composition, species diversity, vegetative ground cover, plant community structure, and plant vigor over large areas. These changes are largely dependent on the grazing intensity, number of livestock grazed, season of use, climatic conditions, and amount of rest an area receives. Competition for forage between domestic livestock and antelope is usually minimal, but competition for early spring forage occurs at times (Lee et al. 1998). The mitigation measures for retaining water in livestock tanks will benefit this species.

The Reduced Alternative calls for a reduced number of livestock and lower intensity and utilization rates. Light grazing (30% utilization) has been found to leave a greater amount of standing vegetative crop than moderately grazed sites and forage production was 24% higher under light than moderate grazing (Holecheck et al. 2003 and 1999). With the Reduced Alternative, there will be a slight increase in biomass left on site, therefore, there may be slightly more forage and fawning cover for pronghorn with the Reduced Alternative.

Lucy's Warbler and Yellow-breasted Chat

Should the Lucy's warbler the yellow-breasted Chat nest within line-of-site of the proposed water access points, or within the other riparian corridors throughout the allotment, these two species may be affected directly and indirectly by livestock grazing and livestock management activities under both action alternatives. Direct effects to riparian vegetation are lessened with both action alternatives since the maximum pasture grazing period is 30 days during the spring use period, and livestock use of a pasture will occur in alternate years if grazed during the critical growth period for woody riparian species. Use at the Fossil Creek water access sites will be localized to the fenced lanes for short periods of time generally during December-April. The mitigation of 20% maximum utilization on woody riparian vegetation will reduce the amount of effects livestock have on riparian vegetation.

The Reduced Alternative calls for the same management of riparian areas as the Proposed Action with the exception of initially having fewer numbers of livestock and lower intensity and utilization levels; direct effects to the riparian habitat is the same for both alternatives. As stated in the fisheries section, the primary negative impacts to aquatic systems and their associated biota from livestock grazing come as indirect effects such as: increased sedimentation into stream channels, loss of riparian vegetation, altered macroinvertebrate assemblages, lowering of groundwater tables and decreased perennial

flows, increased stream temperature, larger peak flows, stock tank impacts, and changes in channel form (Belsky et al. 1999; Fleischner 1994). As stated in the water and riparian resource section, indirect effects to riparian condition and water quality may be slightly less with the Reduced Alternative since there may be more biomass left on site with a lower utilization rate and the rate of improvement of the upland may be slightly quicker than the proposed action. A slightly less impact to the riparian condition and water quality will have slight benefits to warbler and chat nesting and foraging habitat, to prey habitat, and to prey. Therefore, indirect effects to the warbler and chat are slightly less with the Reduced Alternative than with the Proposed Action. In addition to the aerial life forms of aquatic macroinvertebrates, these insectivorous birds forage on aboveground arthropods. Aboveground macroarthropods experienced large decreases with moderate or heavy grazing, but conversely with light grazing showed slight increases (Lavigne et al. 1972 in Milchunas et al. 1998). With the Reduced Alternative there will be a slight increase in biomass left on site and potentially more macroarthropods. In this way also, the reduced alternative may have a slightly less indirect effect to these two insectivorous birds.

Table 27. Effects to MIS Habitat Quantity by Alternatives and Summary of Habitat Effects as a% of Forest-wide Habitat Quantity and Quality.

MIS Species	Project Area Habitat	Forestwide Habitat	No Action Net Change (%)	Proposed Action Net Change (%)	Reduced Alt. Net Change (%)
Pronghorn antelope	Total of 26, 888 acres in Management Areas 10 and 11 for which pronghorn are indicators. Of 26,888 acres, only approximately 861 acres are grassland.	151,000 acres of MA10 (grasslands and sparse P/J with less than 10% canopy cover) plus 25,000 acres of MA11 Verde Valley, for a total of 176,000 acres	0%	0.48%	0.48%
Lucy's Warbler	100 acres mixed deciduous riparian 4 acres of montane willow riparian 119 acres of cottonwood willow riparian 20 stream reaches, for a total of 223 acres.	Acreage not available 129 riparian reaches forest-wide	0%	15.5%	15.5%
Yellow-breasted chat			0%	15.5%	15.5%

Migratory Birds

No Action Alternative (for all migratory birds)

Because livestock grazing and livestock management activities will not occur under the No Action Alternative, there will be no impacts to migratory birds or their habitat. Therefore there are no cumulative effects. Migratory bird species will benefit from the absence of direct and indirect effects from livestock grazing on species and their habitat.

Proposed Action and Reduced Utilization and Intensity Alternatives

Olive-sided Flycatcher

Livestock grazing in ponderosa pine will have limited affects to olive-sided flycatcher since flycatchers depend on trees, snags for nesting and roosting, and insects for foraging. Due to the sparse amount of ponderosa pine on the allotment and lack of grazing impacts to snags, there would be minor impacts to the olive-sided flycatcher as a result of the Proposed Action or the Reduced Alternative.

Cordilleran Flycatcher

Concerns about the loss of suitable habitat and habitat components ideal for Cordilleran flycatchers are primarily: (1) loss of snags and downed logs for nesting and (2) loss of closed canopy causing reduction in cool microclimate that they are most frequently associated with (Latta et al. 1999). There may be some long term cumulative impacts from overgrazing in habitat for this species, but conservative grazing levels do not result in loss of snag recruitment or large old trees. Livestock grazing at the levels proposed in either action alternative do not impact recruitment of snags and downed logs. Livestock grazing in pine habitats is considered to have no impact on habitat for Cordilleran flycatchers.

Purple Martin

Habitat loss, especially snags and large old trees, is the primary concern with purple martins. Livestock grazing is not expected to impact this species or its habitat. There may be some long term cumulative impacts from overgrazing in habitat for this species, but conservative grazing levels do not result in loss of snag recruitment or large old trees.

Gray Flycatcher

Impacts on gray flycatchers are usually related to breeding habitat loss and modification of pinyon-juniper woodlands that has occurred through chaining, clearing, and burning of large, mature woodland tracts for livestock and wildlife forage, house and road development, and firewood cutting. Grazing by wildlife and livestock reduces ground cover, inhibits regeneration of shrubs, and increases local cowbird populations (Latta et al. 1999). Livestock grazing in the project area with either grazing alternative is expected to occur at a level that maintains grass cover and the shrub component, although there would be some impact to grass and shrubs. Gray flycatchers nests may be parasitized by brown-headed cowbirds when grazing occurs in nesting habitat during the nesting season. This is offset by grazing schedules that rest or vary the timing of grazing in gray flycatcher habitat, so that not all nesting habitat has the potential for parasitism every year. In a review of studies measuring the relative abundance of birds in grazed habitats compared to either ungrazed or lightly grazed areas, Saab et al. (1995) summarized that gray flycatcher have shown no trends in population change in response to livestock grazing.

Pinyon Jay and Black-throated Gray Warbler

None of the grazing or grazing-related activities in either grazing alternative would have an impact on these species due to lack of impact to pinyon pines. Therefore there are no direct, indirect or cumulative effects to these two pinyon pine associated species.

Gray Vireo

Livestock grazing is not listed as one of the management issues in the Arizona Partners in Flight Plan (1999). Grazing could have slight impacts to gray vireo if grazing results in hedging on shrubs. However, under the grazing utilization and intensities proposed in either action alternatives, grazing on shrubs would be at a minimum.

Cumulative Effects for All Species

For the purpose of this analysis, the cumulative effects boundary is the Fossil Creek-Lower Verde River 5th code watershed. The timeframe of the analysis will be 10-years because ground disturbing activities recover in this timeframe. The timeframe selected for this analysis is 20 years; 10 years in the past and 10 years in the future. Because no activities are proposed in the no action alternative, there are no direct, indirect, or cumulative effects from this alternative.

In addition to proposed activities, there are many other activities that occur in the uplands of the Fossil Creek Allotment that contribute to cumulative effects to species and their habitats. These activities are listed in Chapter 3. These other activities include: personal use activities; livestock grazing from other allotments, operation, maintenance, and decommissioning of upland hydropower structures; maintenance of utility lines; road management (Travel Management Rule), road maintenance; watershed improvement projects, wildfire, prescribed burning, fire use, and recreation. All these activities can directly and indirectly affect wildlife species as well as cause destruction or modification to wildlife and plant habitat.

Riparian Species

There is approximately 11 miles of riparian habitat on the allotment. Fossil Creek is the only perennial stream on the allotment. While Fossil is mainly in properly functioning condition, a four mile stretch of Fossil Creek (in the Boulder and Stehr pastures) has vehicular access where high levels of recreation have denuded and compacted soils in adjacent upland terraces and down in the riparian zone. Intermittent streams on the allotment are rated from properly functioning to functional-at-risk. Sally May Wash is rated as the latter.

Grazing, as proposed under both action alternatives will have similar direct effects to riparian habitat. However, indirect effects to riparian areas can occur when grazing in the uplands reduces the standing biomass, reduces soil litter, and compacts soil. This can result in increased sedimentation into stream channels, loss of riparian vegetation, altered macroinvertebrate assemblages, lowering of groundwater tables and decreased perennial flows, increased stream temperature, larger peak flows, stock tank impacts, and changes

in channel form (Belsky et al. 1999; Fleischner 1994). Due to the concern with unsatisfactory soils in the Boulder and Stehr pastures, along with the combined impact of grazing and the heavy amount of recreation use, these two pastures will be closely monitored. In the Boulder and Stehr Lake pastures, baseline soil condition data will be collected along established transects prior to implementing the first years authorized grazing After the baseline data has been collected, soil condition will be monitored every 2 years to determine extent of soil improvement, if any. If monitoring indicates soil conditions are not improving towards satisfactory, current livestock grazing utilization and intensity will be immediately adjusted and may include pasture deferral or reduced grazing utilization and intensity.

While the decommissioning of the hydropower operations on Fossil Creek and the restoration of full flows have had an overall beneficial effect on wildlife, the subsequent increase in recreation has not. Other activities within the riparian zone, primarily recreation along four miles of Fossil Creek, may directly affect wildlife species, through aural and visual disturbance, 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. Based on common black hawk nest monitoring by USGS between the bridge and above the dam, there is one nesting black hawk nest in the high-recreation use area (1/2 of the surveyed length) compared to three nests in the remainder of the survey area. This indicates that concentrated recreation activities may limit common black hawk nesting.

These other activities, particularly the recreation occurring along four miles of Fossil Creek, can indirectly affect riparian obligate wildlife species when those activities alter or destroy riparian habitat. Trails, roads, and recreation sites within the riparian corridor fragments habitat, disrupts wildlife movement, and reduces the amount of unaltered habitat. These social roads and trails from dispersed 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 for many aquatic and riparian obligate species; when macroinvertebrate populations decline, the effects carries over to predator species as well. With implementation of the Travel Management Rule, banning cross country travel and closing roads will reduce these impacts. It is anticipated that management of recreation in Fossil Creek will improve in the near future due to the anticipated designation of Fossil Creek as Wild and Scenic and with assistance (labor and funding) from the newly assembled Fossil Creek Stakeholders group.

Other activities in the uplands can indirectly affect aquatic and riparian obligate wildlife and their habitat. While they may have short-term negative effects on wildlife and

habitat, watershed improvement projects, wildfires, prescribed burning, and wildland fire use all generally improve wildlife habitat in the long-term.

Upland Species

Activities associated with the Fossil Allotment can directly affect wildlife species when ranch employees, vehicles, livestock, and dogs cause aural and visual disturbance to individuals that may be present in the allotment. Indirect effects occur when livestock grazing affects: the structure and composition of vegetative species; prey species and their habitat; reducing standing biomass that is needed for food, cover, nest substrate, and nest concealment; exposing nests resulting in an increased chance for nest predation, nest parasitism, exposure to elements, and ultimately nest failure; trampling burrows and compacting soils which hinders burrow excavation. Literature supports that grazing affects the abundance and diversity of wildlife lizards, rodents, and rodent-eating predators such as carnivorous mammals, snakes and avian predators.

Other activities in the watershed, above and beyond those associated with the grazing operation, can also affect wildlife and their habitat. The presence of people, vehicles, and equipment in the Fossil Creek area can result in aural and visual disturbance to wildlife species, particularly during critical periods such as breeding, roosting, and feeding. The presence of people, vehicles, and equipment can also directly affect species by: collecting, handling, and trampling individuals; disturbing rocks and vegetation to which some species may be attached; crushing non-aerial life forms such as eggs and caterpillars; and collapsing burrows. 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. Implementation of the Travel Management Rule will ban cross country travel and close a percentage of roads. This will benefit wildlife and their habitat by reducing the extent of area where people and vehicles can travel.

In addition to direct disturbance to wildlife species, these other activities can indirectly affect wildlife habitat reducing the quality and quantity of vegetation which is used by wildlife for hiding cover, nesting cover, and forage. While watershed improvement projects, wildfires, prescribed burning, and wildland fire use may have short-term negative effects on wildlife and habitat, they generally improve wildlife habitat in the long-term. Trails, roads, and recreation sites fragments habitat, reduces hiding cover, disrupts wildlife movement, all of which increase the potential for predation and loss of nesting, roosting, and hiding areas. With the Travel Management Rule, banning cross country travel and reducing the number of open roads will reduce these impacts. The proposal for the Hackberry grazing allotment is designed to improve effective ground cover and soil condition through increased retention of litter. This will improve vegetation which is used as hiding cover, nesting cover, and forage for wildlife, including prey species. Fossil Allotment is bounded by other grazing allotments including Hackberry-Pivot Rock allotments, and the Fossil Allotment is used for moving livestock between Hackberry and Pivot Rock. Trailing from the additional cows from those segments of that allotment has short lived and localized trampling effects.

Comparison of Alternatives

Proposed Action versus Reduced Utilization and Intensity Alternative

Upland Species and Their Habitat

Literature specifically supports a lighter grazing level than that called for in the proposed action as a means to slightly increase standing biomass and ground litter, and a slightly faster rate of improvement in soil condition. This will in turn, improve the habitat that wildlife need for food or cover or that their prey species need for food or cover. A summary of the literature cited below, describes light grazing as ranging from 20-30%, conservative grazing as ranging from 30-40%, moderate grazing as ranging from 40-50% and heavy grazing greater than 50%. Higher perennial grass cover and yield are associated with lower utilization levels (Martin and Cable 1974). Light grazing (30% utilization) has been found to leave a greater amount of standing vegetative crop than moderately grazed sites and forage production was 24% higher under light than moderate grazing (Holecheck et al. 2003 and 1999). Basal cover of perennial grass is better maintained under light versus conservative stocking (Godfrey et al. 2007). Light grazing allows "ice cream" plant species to maximize their herbage-producing ability (Holechek et al. 2004). Grazing less and leaving more provides more residual biomass to enhance soil stability which may be a reasonable objective on poor condition ranges **(**Smith et al. 2005). Also, since grazing during the growing season is deleterious to the range and can prevent plant recovery and seed germination (Holechek et al. 2001 and Heady 1984), a lower intensity/utilization regime will have less effect on vegetation during the growing season than what is called for in the Proposed Action Alternative.

Drought years can negatively affect wildlife when vegetative conditions decline. Literature shows that light grazing is supported over conservative grazing, moderate grazing, and heavy grazing, particularly during drought years and in the years immediately following drought. Light grazing benefits the maintenance of perennial grass cover during drought and that light grazing can reduce the risk of damaging the range which can result in drastic de-stocking during drought periods and at a time when livestock prices are lower (Godfrey et al. 2007). This is further supported by Thomas et al. (2007), when the authors claim light stocking over heavy stocking can help avoid herd liquidations during short term drought. In research by Galt et al. (2000), light utilization carried nearly as many livestock as conservative utilization because light use allowed for more forage in drought years and the need for reduction of animal units was reduced. Galt et al. (2000), as well as other authors cited here, have clearly documented that light grazing compared to the level in the Proposed Action, will better allow for maintenance of perennial grass cover, higher forage production, reduced risk of damaging the range, and would minimize the need for herd reductions.

Light grazing is important not only for the years during drought, but also during the years following drought when the range is in a recovering state. Valentine's (1970) research indicates light stocking compared to conservative stocking can speed recovery of vegetation from drought. Outside of drought and recovery years, unused forage in wet years provides a reserve of forage during drought and allows for increased plant vigor and water infiltration into the soil (Galt et al. 2000). Hutchings and Stewart (1953) point

out that the extra forage left over during wet years help plants recover from drought and build feed reserves. Because actual use is consistently 10-15% higher than intended (Galt et al. 2000), the Reduced Alternative will provide a buffer needed due to under-estimations of livestock utilization. Given that there are less than optimal conditions due to drought and recovery from drought during a high percentage of the time, it is even more critical to base grazing management on drought and recovering-from-drought conditions as the norm rather than the occasional; the Reduced Alternative will allow for slightly increased biomass (compared to the Proposed Action) and this is especially important for wildlife and their prey during drought and recovery years.

In shrubsteppe habitats (which includes desertscrub and pinyon-juniper woodlands), Saab et al. (1995) recommends managing livestock grazing to maintain current season growth through 15 July and then retain greater than 50% of perennial bunchgrass annual growth through the next nesting season. This would likely increase successful nesting for ground nesting birds. Neither action alternatives meet this recommendation; however, the reduced alternative will leave slightly more annual growth than the Proposed Action and therefore is closer to meeting this recommendation.

Songbirds of the grasslands primarily prey on arthropods (Milchunas et al. 1998). Aboveground macroarthropods experienced large decreases with moderate or heavy grazing, but conversely with light grazing showed slight increases (Lavigne et al. 1972 in Milchunas et al. 1998). In addition, breeding bird species richness showed a decline proportionately from high to low across light, moderate, and heavy graze regimes (Milchunas et al. 1998).

As described in detail in the General Effects with Wildlife section, livestock grazing can: trample and collapse burrows, compact soils that can make burrowing difficult, and affect the structure and diversity of vegetative species which in turn affect the food and cover for wildlife and prey species. With the Reduced Alternative, there will be a slight increase in biomass left on-site, therefore, effects to the food and cover for wildlife and their prey species are slightly less with the Reduced Alternative than with the Proposed Action. In addition, the reduced number of livestock with the Reduced Alternative will result in decreased potential for livestock to trample burrows.

Based on the watershed analysis and the findings above, the Reduced Alternative, when compared to the Proposed Action, can reasonably be expected to slightly increase standing biomass and ground litter and result in a slightly faster rate of improvement in soil condition, all of which result in increased food and cover for wildlife, increased food and cover for prey species, increased wildlife species density, and increased wildlife species diversity. Overall, light grazing can reduce the risk of damaging the range (Godfrey et al. 2007).

Riparian Obligates and Their Habitat

The Proposed Action and the Reduced Alternative call for the same management in riparian areas; direct effects are anticipated to be the same. However, lower livestock numbers initially and a lower intensity and lower utilization, as called for under the

Reduced Alternative, will have slightly less indirect effects to riparian vegetation than the Proposed Action and this can have less indirect effects to riparian obligates. One third of riparian bird species showed significant differences in diversity between heavily and lightly grazed riparian sites (Mosconi and Hutto, 1982). As described in detail in the fisheries section, the primary negative impacts to aquatic systems, riparian habitat, and their associated biota from livestock grazing come as indirect effects such as: increased sedimentation into stream channels, loss of riparian vegetation, altered macroinvertebrate assemblages, lowering of groundwater tables and decreased perennial flows, increased stream temperature, larger peak flows, stock tank impacts, and changes in channel form (Belsky et al. 1999; Fleischner 1994). Indirect effects to aquatic species from sediment can occur by modifications to stream habitat. These changes include: 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 livestock grazing indirectly affect fish and macroinvertebrates, grazing subsequently affects those species that forage on fish and macroinvertebrates. Frogs and toads depend on 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 blackhawks, 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. In summary, the Reduced Alternative compared to the Proposed Action will slightly increase standing biomass and ground litter, and result in a slightly faster rate of improvement in soil condition. This in turn, can result in slightly less indirect effects to riparian condition consequently resulting in a slightly reduced effect to aquatic and riparian obligate species.

In addition to natural riparian areas, earthen livestock tanks are important habitats for native wildlife, especially since many natural riparian habitats have been altered or destroyed. Grazing under both action alternatives will be allowed around tanks and can affect frogs and other wildlife by: trampling aquatic vegetation which these species use for hiding cover, temperature regulation, and as substrate to support egg masses; and increasing sediments in and turbidity of the water resulting in decreased water quality for these species and their prey base. Livestock waste creates algal growth in ponds; the decomposition of which causes low dissolved oxygen concentration that negatively affects aquatic organisms (Belsky et al. 1999). In addition, ponds used by livestock had been documented to have lowered amphibian reproduction due to increased levels of phosphorus and increased turbidity (Knutson et al. 2004). Accumulating evidence suggests that nitrates and ammonium, among other chemicals, can negatively impact amphibians, and that ranids are particularly sensitive to levels of these compounds (Baker and Waights 1994; Nebeker, et al. 2000; Burgett, et al. 2007; Johansson, et al. 2001; Hatch and Blaustein 2000; Hatch and Blaustein 2003; Hecnar 1996; Rouse et al. 1999; Macias et al. 2007; and Marco et al. 1999). In times of drought, tanks with residual water attract more terrestrial wildlife and livestock, increasing input of nitrates and ammonium, which is concentrated as water continues to evaporate. Both grazing alternatives allow access to ponds (tanks) although in many cases, this access is partially limited by wedge

fencing of the tank so that only portions, i.e. one quarter of the tank, may be accessible from one actively grazed pasture at a time. This allows for potential recovery of emergent vegetation and immediately adjacent upland vegetation which can help reduce input of animal waste and the build-up of nitrates and ammonium temporarily in those rested pastures (i.e. three quarters of the tank edge) but does not completely mitigate the potential for water contamination in the tank as a whole. Under the Reduced Alternative, there will be fewer livestock and fewer livestock in ponds resulting in less effects to pond vegetation, water quality, and sedimentation into the tank; all of which would consequently have slightly less effect to aquatic organisms.

No Action - No Grazing Alternative versus the Grazing Alternatives

Upland Species and Their Habitat

Southwestern arid grasslands have been drastically modified by grazing in that plant species composition has been changed, perennial grass cover has been reduced, and in some cases, conversion of former grasslands to desert scrub (Buffington and Herbel, 1965; Chew 1982, Bredy et al. 1989 all in Bock et al. 1990). A review by Jones (2000) found 11 of 16 response variable showed detrimental effects from livestock grazing. Soil related variables were most negatively impacted, followed by vegetative cover variables and biomass and rodent diversity and richness. Effects to soil are described in detail in the soil section of this chapter but in summary include trampling, compaction, increased bulk density, erosion, infiltration, and cryptogrammic crusts (Jones 2000). All these effects affect wildlife habitat, prey habitat, and herbaceous forage for wildlife or their prey.

Livestock grazing can indirectly affect wildlife by affecting their prey. Indirect effects of livestock grazing on rodents can occur when grazing changes the composition of vegetative species (Heske and Campbell, 1991; Hayward et al., 1997) and structure of vegetative species (Jones and Longland 1999; Hayward et al., 1997; Adler and Lauenroth, 2000). Small mammal prey is important for many species of higher trophic levels, including raptors, carnivorous mammals, snakes, and avian predators (Hayward et al. 1997; Saab et al. 1995). When rodent prey decrease in response to reduced vegetative cover, so do the avian predators (Saab et al 1995). Livestock grazing can directly impact rodents by trampling and collapsing burrows, compacting soils which hinders burrow construction, and by removing rodent food sources such as seed heads (Heske and Campbell, 1991; Hayward et al., 1997; Adler and Lauenroth, 2000). In one study, rodent burrow densities were higher in ungrazed plots when compared to grazed plots (Adler and Lauenroth, 2000). Numerous studies support that the abundance of rodents is higher in ungrazed and lightly grazed areas (Valone and Sauter, 2004; Jones and Longland, 1999; Bock and Bock 1984 Reynolds & Trost 1980). In addition to rodents, lizards are prey for many carnivorous mammals, raptors and other avian predators, snakes, and other lizards. In Arizona, the abundance and diversity of lizards was higher on ungrazed sites in chaparral and desert grassland (Jones 1981, Jones 1988).

Birds are indirectly affected by the impacts grazing has on vegetation (Saab et. al. 1995). Livestock reduce forage production which reduces litter production, increases soil compaction, and reduces infiltration (see watershed section). These changes to the soil and consequently the vegetation as a result of livestock grazing affect some breeding birds negatively (Saab et. al. 1995). Birds that depend on dense herbaceous ground cover for nesting and/or foraging are most likely to be adversely affected by grazing (Saab et.al. 1995). Grazing during the breeding season of ground nesting birds can reduce herbaceous vegetation necessary for concealing nests (Saab et. al. 1995). A reduction in herbaceous vegetation can expose nests resulting in an increased chance for nest predation, nest parasitism, exposure to elements, and ultimately nest failure. In shrubsteppe habitats (which includes pinyon-juniper woodlands), Saab et al. (1995) recommends managing livestock grazing to maintain current season growth through 15 July and then retain greater than 50% of perennial bunchgrass annual growth through the next nesting season. This would likely increase successful nesting for ground nesting birds.

In summary, the No Action Alternative will allow for optimal upland vegetative and soil conditions; increased vegetative biomass that provides food and cover for wildlife and their prey ultimately resulting in increased quality and quantity of wildlife food, cover, and shelter; increased rodent and small mammal density and diversity, increased rodent species richness, increase songbird and raptor diversity, increase abundance and diversity of lizards, and increased reproductive success. Livestock grazing, as proposed under both action alternatives, will result in less than optimal vegetative conditions which ultimately lead to reduced species abundance and diversity.

Riparian Obligates and Their Habitat

Under both of the grazing action alternatives, livestock grazing is allowed in some riparian areas. Riparian habitat is a dwindling resource; in the Western U.S., less than 20% of historic levels of riparian still exist (Belsky et al. 1999). Confounding the loss of riparian habitat is the number of animals dependent either entirely or partly on riparian areas. Upwards of 80% of southwestern wildlife species (Chaney et al. 1990) and approximately 60 to 70 percent of western bird species (Ohmart 1996) depend on riparian areas. Belsky et al. (1999) concluded grazing has damaged approximately 80% of stream and riparian ecosystems in the western United States, that “riparian recovery is contingent on total rest from grazing”, and that livestock grazing negatively affects riparian dependent wildlife.

In general, livestock grazing negatively affects water quality, seasonal water quantity, hydrology and morphology of the stream channel, aquatic and adjacent vegetation, and riparian dependent wildlife (Belsky et al. 1999). As summarized in Platts (1981), “Grazing can affect the streamside environment by changing, reducing, or eliminating vegetation bordering the stream. Channel morphology can be changed by accrual of sediment, alteration of channel substrate, disruption of the relation of pools to riffles, and widening the channel. The water column can be altered by: increasing water temperature, nutrients, suspended sediment, bacterial populations, and changing the

timing and volume of streamflow. Livestock can trample streambanks, causing banks to slough off, creating false setback banks, and exposing banks to accelerated soil erosion".

Livestock grazing in riparian areas can directly affect aquatic species such as frogs, toads, salamanders, and garter snakes by trampling. Livestock can indirectly affect riparian obligate and aquatic species by: trampling aquatic vegetation in which these species use for hiding cover, temperature regulation, and substrate (that supports birds nest and frog and toad eggs masses); and by increasing sediments in and turbidity of the water body thereby decreasing water quality for these species and their prey base. The primary negative impacts to aquatic systems, riparian habitat, and their associated biota from livestock grazing come as indirect effects which, though a series of cause and effect, ultimately affect the primary food source for many aquatic and riparian obligate species. When livestock grazing indirectly affect fish and macroinvertebrates, grazing subsequently affects those species that forage on fish and macroinvertebrates. Frogs and toads depend on 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 blackhawks, 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.

Southwestern riparian areas that were excluded from livestock grazing had 50% more small mammals when compared to plots with livestock grazing (Hayward et al. 1997). Although the bark-foraging guild was unaffected, grazing affected three other guilds of riparian birds: flycatching, ground-foraging, and foliage-gleaning (Mosconi & Hutto 1982). In a study in Utah, there was a 350% increase in use and diversity of songbirds, raptors, and small mammals after eight years of no grazing in a riparian area (Duff, 1979 in Fleischner 1994). In a study in Utah, there was a 350% increase in use and diversity of songbirds, raptors, and small mammals after eight years of no grazing (Duff, 1979). The abundance and diversity of lizards was higher on ungrazed sites in mixed riparian scrub and cottonwood-willow deciduous forests (Jones 1981, Jones 1988). Wandering garter snakes were five times more abundant in ungrazed riparian sites in New Mexico (Szaro et al. 1985).

In summary, the No Action Alternative will allow for optimal riparian conditions, whereas the grazing action alternatives will result in less than optimal conditions in riparian areas that are accessible to livestock, leading to reduced species abundance and diversity.

In addition to natural riparian areas, earthen livestock tanks are important habitats for native wildlife, especially since many natural riparian habitats have been altered or destroyed. Effects of livestock use of these tanks have been previously described. Because leopard frogs often represent the most sensitive aquatic organisms to water quality indices such as nitrates and ammonium, certain levels could impact the existence of frog populations in a tank or preclude the water source from providing habitat for frogs. In times of drought, tanks with residual water attract more terrestrial wildlife and

livestock, increasing input of nitrates and ammonium, which is concentrated as water continues to evaporate. Under the No Action Alternative, since no livestock grazing or management activities associated with grazing management would occur, these effects to earthen livestock tanks would not occur or would be negligible (from wildlife use). Improvements such as earthen stock tanks that are also important to wildlife would remain and would be beneficial for as long as they are maintained or at least until they degrade to the point that they no longer hold water. Water quality in the absence of grazing is expected to be maintained or improved with no addition of waste products from livestock. The absence of livestock would also decrease the chances of the spread of diseases from one water source to another although wildlife usage presents a certain amount of risk even in the absence of livestock.

In summary, wildlife will benefit from the absence of pressure caused by direct and indirect effects from livestock grazing on species and their habitat. Based on the a literature review, the No Action/No Grazing Alternative, when compared to the Reduced Utilization and Intensity and the Proposed Action Alternatives, can reasonably be expected to: increase in the quality and quantity of wildlife food, cover, and shelter; increase rodent and small mammal density and diversity, increase rodent species richness, increase songbird and raptor diversity, increase abundance and diversity of lizards, increase abundance of garter snakes, increasing/improving habitat components; and increased reproductive success.

Fisheries

The following section describes the affected environment and effects of the alternatives for fisheries resources. The analysis presented is summarized from the following report which is incorporated by reference: *Fisheries Specialist Report, Fossil Allotment,* by D. Renner, 2007 (PR#147).

Affected Environment

The analysis area of effects for the Fossil Creek Allotment includes portions of the Fossil Creek and Verde River watersheds. About two thirds of the Fossil Creek Allotment is within the Fossil Creek watershed, comprising close to 28,000 acres.

Fossil Creek

Grazing has occurred in these pastures for the last 100-125 years and most of the impacts that would degrade riparian and aquatic habitat have likely already occurred. Degraded soil conditions have increased levels of erosion in the allotment approximately 35% over natural background levels based on soil TES unit USLE modeling (Table 28), (PR#133, 176). Most of the detached soil from upland watershed areas is deposited outside of stream courses (WEPP model documentation and Elliot 2002) but an appreciable portion is believed to be delivered into connecting stream courses.

Table 28. Sediment Model Results for the Fossil Creek Allotment, Natural (Baseline) and Current Conditions

Modeled Component	Soil Loss (tons/year)	
Soil Condition by TES Map Unit	Natural	Current
	75,568	101,971
	Natural	Current
Road Crossings	0 (assumes no roads)	23

The TES soil erosion modeling used a Forest-wide (landscape level) map unit average and may or may not accurately reflect allotment specific conditions but are still our best available science at the allotment level. Soil condition assessments were refined for the project. Every map unit was visited and refined but not every polygon. Field visits indicated map unit 430 was mapped to include considerable portions of 25-40 % slopes which probably would have better fit into map unit 463 which would fall into impaired, rather than inherently unstable soil condition. Additionally, natural background levels only occur under ideal conditions and do not equate to reference, but are used here for comparative purposes.

Roads are also important sources of sediment. Road-related erosion estimates made using the Watershed Erosion Prediction Project Model for Roads (WEPP-Roads) is estimated at a maximum of 23 tons of additional sediment delivered into stream drainages annually, within the Fossil Creek Allotment (PR#170). The combined effects of watershed soil erosion and road-related erosion have contributed to increase the amount of sediment entering Fossil Creek drainages. Based on USLE and WEPP outputs summarized in Table 28, the amount of road-related sediment loss is small by comparison to watershed surface erosion rates.

The effects of sedimentation were apparent during various field visits to Fossil Creek in 2007 (PR# 34, 115, 167, 169). Sedimentation into stream systems is one of the most deleterious effects to aquatic biota and their habitat (Anderson 1996).

Prior to 2005, 96% of the streamflow was diverted from Fossil Creek for power generation; currently 100% of the flows have been returned to the channel. It is likely that the spring fed nature of Fossil Creek along with increased flows, boosts its resiliency to the negative effects of increased sedimentation. In comparison to West Clear Creek, the next major watershed to the north, Fossil Creek has much greater flow. Fossil Creek watershed is less than half the size (~90,000 acres) than the West Clear Creek watershed (~190,000 acres) and it has a median flow of 43 cubic feet per second (cfs) at the springs. Flow increases with groundwater additions down the drainage. While West Clear Creek has a median flow of only 18 cfs near its confluence with the Verde River (USGS stream gage 09505800). The high discharge that Fossil Creek in comparison to watershed size likely enables the creek to transport higher sediment loads and could make the creek potentially more tolerant to watershed disturbances that increase erosion. However, even with the increased sediment transport capabilities of the stream, a 35% increase in

sediment delivery to streams is likely detrimental to aquatic habitat, but without data from pre-disturbance it impossible to provide a definitive determination.

The existing native fish community in Fossil Creek consists of recently reintroduced federally threatened spikedace (*Meda fulgida*), loach minnow (*Tiaroga cobitis*), and gila topminnow (*Poeciliopsis occidentalis occidentalis*). Additionally, headwater chub (*Gila nigra*), roundtail chub (*Gila robusta*), speckled dace (*Rhinichthys osculus*), longfin dace (*Agosia chrysogaster*), Sonora sucker (*Catostomus insignis*), and desert sucker (*Catostomus clarki*) currently occupy Fossil Creek. Prior to the fisheries restoration project, that constructed a barrier and removed nonnative species from Fossil Creek, a native assemblage existed only in the upper 0.3 miles of stream above the Childs-Irving diversion dam. The dam serves to separate the populations of headwater and roundtail chub. A fish barrier was constructed in 2004 to prevent the upstream incursion of nonnative species from the Verde River following the extirpation of these nonnative species from Fossil Creek. The barrier is located approximately 4.5 miles upstream from Verde River confluence. It is expected that below the barrier the community of nonnative species is still comprised primarily of smallmouth bass (*Micropterus dolomieu*), green sunfish (*Lepomis cyanellus*), flathead catfish (*Pylodictis olivaris*), and yellow bullhead (*Ameiurus natalis*).

Plans for Fossil Creek include the repatriation of several native federally listed fish species. The species that are likely to be (re)introduced include razorback suckers (*Xyrauchen texanus*), woundfin (*Plagopterus argentissimus*), flannelmouth suckers (*Catostomus latipinnis*), , desert pupfish (*Cyprinodon macularius*), and Colorado pikeminnow (*Ptychocheilus lucius*) according to Fossil Creek Native Fish Working Group meeting notes April 4, 2007.

Verde River

The Fossil Creek Allotment, (including Fossil Creek) drains to the Verde River. The Verde River watershed upstream and including the project area is approximately 3,200,000 acres in size. The project area makes up about 1.3% of the watershed. The remaining 98.7% of the watershed is influenced by grazing, agriculture, recreation, or urbanization.

The fish community of the Verde River is dominated by non-natives, which include channel (*Ictalurus punctatus*) and flathead catfish, largemouth (*Micropterus salmoides*) and smallmouth bass, bluegill (*Lepomis macrochirus*), green sunfish, yellow bullhead, common carp (*Cyprinus carpio*), and red shiners (*Cyprinella lutrensis*). The fish assemblage also includes a few native species as well. The native species list includes roundtail chub, Sonora and desert suckers, Colorado pikeminnow (*Ptychocheilus lucius*), and razorback suckers (*Xyrauchen texanus*). Arizona Game and Fish Department has stocked hundreds of pikeminnows and razorbacks near the Childs Power Plant over the last several years. In spite of these stockings, these two species comprise only a very small percentage of the overall collection made during monitoring surveys (Robinson 2007).

Threatened, Endangered and Forest Service Sensitive Fish Species

The Threatened, Endangered, Sensitive Species (TES) List for the Coconino National Forest and other state databases were reviewed, and a list of TES fish species was created for this project based on known occurrence or, in the absence of survey data, the presence of suitable habitat. Further information and detailed descriptions of species occurrence, habitats, habitat condition and rationale for including or excluding species from analysis are found in report listed above, (PR#147)

Rare wildlife species that are known to occur, or have existing or potential habitat within the project area include five federally listed or candidate species and four other species on the Southwestern Region, Regional Foresters' sensitive species list (PR#154) updated as of October 1, 2007 (Table 29). Spikedace and loach minnow are not presently in any of the waters affected by this allotment but there are plans for them to be reintroduced into Fossil Creek in the near future (USDA, 2004).

Table 29. Threatened, Endangered, or Sensitive Fishes and /or their Habitat Expected to Occur in the Fossil Creek and Middle Verde River Watersheds.

Species	Status[1]	Occurrence[2]
Colorado pikeminnow *Ptychocheilus lucius*	Endangered, WC	O Experimental, nonessential
razorback sucker *Xyrauchen texanus*	Endangered, WC	O Critical habitat, **Δ**
loach minnow *Rhinichthys {=Tiaroga} cobitis*	Threatened, WC	H* ,**Δ**
Spikedace *Meda fulgida*	Threatened, WC	H*, **Δ**
headwater chub *Gila nigra*	Candidate, WC, FS-S	O
roundtail chub *Gila robusta*	WC, FS-S	O
longfin dace *Agosia chrysogaster*	FS-S	O, **Δ**
desert sucker *Catostomus clarki*	FS-S	O
Sonora sucker *Catostomus insignis*)	FS-S	O

[1]**Status:**
- **WC**=Wildlife of Special Concern in Arizona (1996 Arizona Game & Fish Department classification pending revision to Article 4 of the State Regulations)
- **FS-S**=Forest Service Sensitive Species (USFS, Southwestern Region, Regional Forester's List – 21 July 1999, and updated October 2007)

[2]**Occurrence:**
- **O**=Species known to occur in the project area, or in the general vicinity of the area.
- **H**=Species not known to occur in the project area, but whose suitable or potential habitat does.
- *****=Species have historically been known to occur in project area, no recent confirmation of presence.
- **∞=**Species does not occur in project area, not known to historically occupy Verde Watershed
- **Δ**= species likely to be stocked into Fossil Creek

Management Indicator Species

Macroinvertebrates

As a group, aquatic macroinvertebrates (macroinvertebrates) are identified in the Coconino National Forest Land and Resource Management Plan (as amended) as a management indicator for high and low elevation late-seral riparian areas. The Coconino National Forest has collected macroinvertebrate data from several sources in the past, including USFS collections. However, the Arizona Department of Environmental Quality (ADEQ) has the only consistently collected macroinvertebrate dataset from the same locations over a time scale that allows for trend analysis. The ADEQ data and findings were used to assess current conditions. ADEQ prepares a biennial Arizona Water Quality Assessment (Arizona Department of Environmental Quality (ADEQ 2006) which includes such elements as water quality condition, water pollutants, and designated uses. As part of a biocriteria evaluation, ADEQ uses a macroinvertebrate-based bioassessment to evaluate the health of aquatic communities. These bioassessments are generally used as supporting evidence of impairment or good water quality. Full descriptions of macroinvertebrate monitoring and bioassessment methods and findings are found in PR#147.

As of December 2006 macroinvertebrate sampling on streams either on or close to the Coconino National Forest by ADEQ spans an 11-year time from 1992 to 2003. This analysis examined 10 streams, 5 coldwater (above 5,000 ft), and five warm water (below 5,000 ft). Fossil Creek is not included in any of the sites sampled. The nearest sampling site to the project area is on the Verde River above the confluence with West Clear Creek. Across the Forest, four of the warm water sites had an upward trend and one had a downward trend in the Index of Biological Integrity (IBI) based solely on a simple linear regression line analysis. However, since the equation explained less than 70% of the variation in data for these sites, the confidence in these trends is low. For the coldwater sites, three had downward trends with high confidence and two sites had upward trends with low confidence. Warm water sample sites have had high amounts of variation over the sample period. This variation could have a variety of causes, from changing environmental factors such as, flooding and drought cycles, microhabitat variation between collections (Heino et al. 2004), and contributing upland condition and the associated runoff effects to water quality. The IBI for warm water sites generally

have maintained attaining levels for water quality with one site where the most recent rating was inconclusive. In contrast to the warm water sites, the cold-water sites have less unaccounted for variability and have generally seen a downward trend in IBI. Only the sites with upward trends have variability that results in low confidence. The Forest-wide IBI trend for cold-water sites is upward with seven sites having upward trends and only four sites with downward trends.

Environmental Consequences

The following discussions include both general and specific direct and indirect effects of livestock grazing on aquatic habitat, biota and TES species. These general effects are common to alternatives; however, the degree of impacts varies by alternative and will be described in detail for each alternative. General effects and their importance are described in narrative form below. Site-specific consideration of each effect will be described for each alternative. Cumulative effects will be described in detail only once since these past, ongoing and future foreseeable activities will apply to all alternatives.

Determinations of effects to threatened and endangered and candidate species were made following the Region 3 Forest Service Southwest Region's "Framework for streamlining informal consultation for livestock grazing activities", (USDA-Forest Service, 2005b).

The following measures were used in the evaluation of effects of the alternatives:

- Effects on riparian vegetation – direct and indirect effects
- Alterations to channel morphology – direct and indirect effects
- Changes in sedimentation and erosion – indirect effect
- Alterations to the groundwater table – indirect effect
- Changes to hydrograph – indirect effect
- Changes to stream temperatures – indirect effect
- Changes to macroinvertebrate assemblage – indirect effect
- Spread of nonnative species – indirect effect

General Effects of Grazing to Aquatic Habitat and Biota

Direct and indirect effects of grazing on aquatic habitat and biota are summarized here from the *Fisheries Specialist Report*, by D. Renner, 2007 (PR#147).

Direct effects from grazing on aquatic habitat and biota are generally localized and can usually be mitigated or prevented. Mitigations that prevent livestock access to the streams and riparian vegetation or grazing strategies that exclude grazing during critical growth periods for riparian vegetation have been shown to lessen the effects of grazing on stream systems (Sovell et al. 2000). Aquatic habitat is altered by the direct removal of riparian vegetation from livestock grazing and altered channel morphology from bank shearing by trampling hooves. While these effects are often localized, they do contribute to more deleterious indirect effects.

Livestock tend to avoid hot, dry environments and congregate in wet areas for water and forage, which is more succulent and abundant than in uplands. They are also attracted to shade and lower temperatures near streams (Belsky et al. 1999). With the disproportionate use of riparian habitat comes the over utilization of riparian species by livestock for forage. Riparian vegetation is altered by livestock in several ways: 1) compaction of soil, which increases runoff and decreases water availability to plants; 2) herbage removal, which allows soil temperatures to rise, thereby increasing evaporation; 3) physical damage to vegetation by rubbing, trampling, and browsing; and 4) altering the growth form of plants by removing terminal buds and stimulating lateral branching (Fleischner 1994). One of the most deleterious direct effects to fish is the removal of vegetative cover and the trampling of overhanging banks (Fleischner 1994). Vegetative cover and overhanging banks provide critical habitat to fish; they provide shade, refuge habitat for young fish and important resting habitats (Keim et al. 2002; Spangler and Scarnecchia 2001; Wilzbach 1985).

Most effects to aquatic habitat and biota are the result of upland terrestrial changes that result in changes to sediment and water transport in the watershed. The primary negative impacts to aquatic systems and their associated biota from livestock grazing come as indirect effects. These indirect effects include increased sedimentation into stream channels, loss of riparian vegetation, altered macroinvertebrate assemblages, lowering of groundwater tables and decreased perennial flows, increased stream temperature, larger peak flows, stock tank impacts, and changes in channel form (Belsky et al. 1999; Fleischner 1994).

Sedimentation and erosion are natural processes and ecosystems have evolved to handle the natural background levels. When land management activities alter the natural levels of sedimentation and erosion in the watershed, deleterious effects to the habitat and biota can occur. Grazing of upland vegetation contributes to the deterioration of soil stability and porosity and increases compaction and erosion. Reductions in surface vegetative cover and riparian vegetation can result in more surface runoff, more soil erosion, and larger floods (Fleischner 1994). These factors lead to increased sedimentation into streams and changes in the hydrograph, which is the timing and volume of flow in a watershed. Changes to soil and vegetation such as loss of soil and vegetation cover, decreased water infiltration into soil caused by compaction can change the rise and fall of creek flows in storm events. The rise and fall of peak flows in streams can become much quicker resulting in a greater peak that is referred to as “flashiness.” These higher peak and base flows that come in response to storm events can also cause bank erosion, which alters channel morphology.

Sediment adversely impacts stream fishes directly through: changing fish behavior, altering fish physiology, impairing growth, shifting blood chemistry, inducing gill trauma, reducing disease resistance, increasing egg mortality, and direct mortality of juveniles and adults if strong enough (Anderson 1996; Argent and Flebbe 1999; Bisson and Bilby 1982). Other indirect effects on stream fishes from sediment can occur by modifications to stream habitat. These changes include: altered channel morphology, loss of spawning habitat, loss of rearing habitat, changes in the food supply

(macroinvertebrate assemblage), and decreased over wintering habitat (Lisle 1989; Miller and Benda 2000; Wood and Armitage 1997).

Stock tanks have been developed on public lands throughout the Southwest for livestock and wildlife use. They benefit aquatic systems by limiting and trapping sediment that otherwise would continue down ephemeral channels into perennial streams. They also capture surface water and precipitation that has the potential to increase the flashiness of a stream during a storm event and allow it percolate into the soil providing some recharge of the subsurface aquifer and potentially adding to stream base flows. Conversely, they also capture critical surface flow during drier climatic periods that would otherwise make it to streams and store it for livestock use and evaporation, resulting in a loss of water to streams. Stock tanks are detrimental to aquatic systems when the sediment berms fail creating sediment pulses into aquatic systems. An additional negative impact of stock tanks to aquatic systems is the spread of nonnative organisms including crayfish, nonnative fish, and bullfrogs. These nonnative species can negatively affect native herptefauna that may occur nearby and the nonnative species can be transported downslope to perennial aquatic systems during high flow events where they can have dramatic negative effects to the native ecosystem.

Direct and Indirect Effects to Streams

Fossil Creek

No Action Alternative

Under the No Action alternative, grazing would not be authorized. Watershed conditions would improve over time with continued rest of the associated pastures and with enough time major improvements in watershed condition could be seen (Belsky et al. 1999). With the absence of livestock on the allotment and in the Fossil Creek watershed soil and riparian conditions would continue to improve as climatic conditions allow. As upland conditions improve, there would be associated beneficial effects to stream habitat. Studies have shown that 2-15 years of total livestock exclusion maybe required to initiate watershed and riparian recovery (Belsky et al. 1999, Magilligan and McDowell 1997). Therefore, it may take extended periods of rest to rehabilitate the watershed from past grazing activities. Resting the watershed from grazing would reduce accelerated erosion occurring in impaired and unsatisfactory soils, reduce the sediment produced by the watershed through improved watershed soil conditions, and indirectly improve stream conditions in Fossil Creek. Overall, this alternative would have direct and indirect beneficial effects to Fossil Creek.

Proposed Action Alternative

The Proposed Action states that livestock use of woody riparian vegetation will not exceed 20% and that unless exclosures are built livestock grazing in these areas will be allowed only every other year during the critical growth period for riparian vegetation. The construction of three water access lanes on Fossil Creek will limit the riparian damage that would occur from grazing to specific areas. However, due to the confined

areas where livestock would have access to the stream, these areas would receive proportionately greater use resulting in localized damage to stream banks and riparian vegetation. If utilization exceeds 20% in riparian areas, livestock will be removed or riparian areas fenced to mitigate degradation. Except for the areas where livestock will access the stream directly, the direct effects of grazing on Fossil Creek would be minimal, and the majority of overhanging vegetation and stream banks would be protected. Therefore, direct impacts of the Proposed Action on riparian areas would be minimal with implementation of design features and mitigation measures.

The Proposed Action for grazing management is a reduction in utilization and intensity from past management and may slow current rates of watershed degradation. Under this alternative the following indirect effects would continue: sedimentation, altered hydrograph, and channel morphology changes. Under the Proposed Action Alternative, these effects would decrease over time by implementation of the project design features, mitigation measures and monitoring for soils, watershed, and fisheries resources and timely implementation of adaptive management responses to changes in conditions. At a minimum continued degradation of most of the watershed would be retarded and with a favorable climate, the watershed would see gradual improvement. The only exceptions to this would be the Stehr and Boulder pastures where continued grazing of the unsatisfactory soils would cause accelerated erosion and sediment delivery to Fossil Creek. This accelerated erosion, due to a continued loss in soil productivity would continue until the ground cover objective of 2/3 natural is reached. Monitoring of unsatisfactory soils in the Boulder and Stehr Lake pastures would occur as part of the alternative. If monitoring indicates soil conditions are not improving towards satisfactory, the current livestock grazing utilization and intensity will be immediately adjusted and may include pasture deferral or reduced grazing utilization and intensity.

Reduced Utilization and Grazing Intensity Alternative

This alternative is the same as the proposed action regarding the use of riparian areas, livestock use of woody riparian vegetation will not exceed 20%, and that unless exclosures are built, livestock grazing in these areas will be allowed only every other year during the critical growth period for riparian vegetation. The three livestock water access lanes are also included in this alternative. Because the alternative includes the same design features, mitigations, monitoring and adaptive management, the direct effects would be the same as the Proposed Action Alternative.

The Reduced Utilization and Grazing Intensity Alternative (Reduced Alternative) is similar to the Proposed Action in most ways except it calls for lower initial utilization and intensity rates and specifies 2400 AUMs initially. Lower initial utilization and intensity would allow for a faster improvement of watershed conditions than the Proposed Action Alternative. Under this alternative, the following indirect effects would continue but to a lesser degree than the Proposed Action Alternative: sedimentation, altered hydrograph, and channel morphology changes. However, with the reduced numbers of livestock, lower utilization, and lower intensity rates, it is likely that these effects would be minimized initially under this alternative. The only exceptions to this would be the Stehr and Boulder pastures where continued grazing of the unsatisfactory

soils would cause accelerated erosion and sediment delivery to Fossil Creek. This accelerated erosion, due to a continued loss in soil productivity would continue until the ground cover objective of 2/3 natural is reached. As with the Proposed Action Alternative monitoring of unsatisfactory soils in the Boulder and Stehr Lake pastures would occur and adaptive management adjustments would be made if soil conditions are found not to be improving towards satisfactory.

Verde River

No Action Alternative

Under the No Action alternative, grazing would not be authorized. There would still be no livestock access to the Verde River. With the absence of livestock on the allotment, upland soil and vegetation, conditions would continue to improve as climatic conditions allow. However due to the small percentage of the Verde River watershed affected by the Fossil Allotment the beneficial effects of the No Action Alternative would not be measurable. Therefore, this alternative would have no effects to the Verde River.

Proposed Action Alternative

Livestock do not have access to the Verde River; therefore, there will be no direct effects to the Verde River. Considering that the allotment consists of just over 1% of the Verde River watershed, it is unlikely that the Proposed Action Alternative will have any measurable impacts to the Verde River. This alternative will likely result in indirect effects similar to those to Fossil Creek, however, the scale of these effects is not measurable, regardless of the levels of utilization, intensity, and stocking rates. Therefore, this alternative would have no effect to the Verde River.

Reduced Utilization and Intensity Alternative

The effects are the same as for the Proposed Action Alternative.

Threatened, Endangered, and Candidate Species – Environmental Effects by Alternative and Species

Colorado Pikeminnow

No Action Alternative

Under the No Action Alternative because there would be no grazing or livestock management activities there is the potential for beneficial effects from resting , allowing upland conditions and the allotment as a whole to improve. However, these effects will not be measurable to the Verde River.

Proposed Action and Reduced Utilization and Intensity Alternatives

Colorado pikeminnow are present in the Verde River downstream of the project area but do not occur in Fossil Creek, therefore the Proposed Action Alternative and the Reduced Alternatives will have no direct effects to this species. Potential indirect effects to this species would be continued sedimentation into Fossil Creek and the Verde River from the project area. However, it is unlikely that any sediment production from the project area into the Verde River would be measurable in comparison to current background levels of sediment in the system.

Because continued sedimentation from grazing would not be measurable into the Verde River, the effects of the Proposed Action and the Reduced Utilization and Intensity Alternatives on Colorado Pikeminnow would be negligible.

Razorback Sucker

No Action Alternative

Razorback suckers will be repatriated to Fossil Creek in the next few years and allowing upland conditions to improve will decrease the amount of sediment that is currently being supplied into watershed drainages. Additionally, the unlikely threat of razorback suckers being inadvertently trampled by livestock at one of the three livestock stream access lanes will be negated by this alternative.

The Verde River is critical habitat for razorback suckers. However, it is unlikely that there will be measurable effects to the Verde River from this alternative. There is the potential for beneficial affects; however, due to the small proportion of the Verde Watershed (~1%) that the allotment comprises any effects will not be measurable.

Because sedimentation to streams would be decreased and direct impacts of livestock on fish would be eliminated, the No Action Alternative will have beneficial effects on razorback suckers. Though there is a potential for beneficial effects to critical habitat for the razorback sucker in the Verde River, because the effect is so small it would not be measurable.

Proposed Action and Reduced Utilization and Intensity Alternatives

While the razorback sucker does not currently occupy portions of Fossil Creek their reintroduction into the stream is imminent. Razorback suckers do occupy the Verde River. The potential exists for limited direct effects to occur to the species. These effects include potential trampling of fish and destruction of rearing habitat by livestock at the three proposed access points along Fossil Creek. However, these effects would be minor and are unlikely to occur**.** The Proposed Action has the potential to gradually improve watershed conditions and reduce the amount of sediment currently entering the system. However, until conditions improve sediment may cover and suffocate razorback sucker eggs deposited on stream substrates, in the unlikely event that razorbacks successfully spawn in Fossil Creek. The indirect effects of the Reduced Alternative are similar to the

Proposed Action, although they would likely occur at lower initial rates and potentially to a lesser degree than from the Proposed Action.

There will be no direct effects to razorback sucker critical habitat present in the Verde because livestock do not have access to the Verde River. There is the potential of indirect effects occurring to critical habitat from continued erosion occurring from the project area; however, increases in sediment to the Verde River from either action alternative would be undetectable in comparison to current background levels of sediment in the Verde River.

Loach Minnow and Spikedace

No Action Alternative

The No Action Alternative will result in beneficial effects to both species. Allowing the watershed continued rest from livestock grazing will improve watershed conditions and decrease the current sedimentation due to past watershed management. The No Action Alternative would also eliminate the unlikely threat of direct trampling of species or their spawning habitat. Because sedimentation to streams would be decreased and the potential for direct impacts of livestock on fish would be eliminated, the No Action Alternative will have beneficial effects.

Proposed Action and Reduced Utilization and Intensity Alternatives

The direct affects of this alternative include livestock disturbance of spawning locations including alteration of habitat and disturbance to eggs in the substrate at the three watering locations to be established for livestock under this alternative. Both alternatives have the potential to gradually improve watershed conditions and reduce the amount of sediment currently entering the system. However, there is also the potential for indirect effects of the Proposed Action to result in continued upland erosion resulting in sedimentation to Fossil Creek. Sediment has been shown to limit or affect loach minnow and spikedace habitat by altering macroinvertebrate assemblages and loach minnow abundances have been shown to decrease where sediment fills interstitial spaces in the substrate.

Both loach minnow and spikedace are historic to the Verde River and its tributaries; and until recently were thought to have been extirpated the watershed. However, spikedace and loach minnow have recently been repatriated to Fossil Creek. Sedimentation that affects these species eggs to adhere to gravel and sand substrates could negatively affect the species reproductive success. Both Action Alternatives may result in continued sedimentation into Fossil Creek that could potentially embed the substrates and reduce reproductive success of these species. The Proposed Action will reduce utilization and intensity of grazing from current levels, which may improve watershed conditions over time and sediment resulting from impaired and unsatisfactory soils, would decrease. However, the rate of improvement will likely be slow unless local weather shifts toward a wetter cycle.

While the effects of the Reduced Utilization and Intensity Alternative may occur to a lesser degree initially than the Proposed Action Alternative, the overall effects are the same as the Proposed Action Alternative.

Forest Service Sensitive Species

Headwater Chub

No Action Alternative

Headwater Chubs are present in the upper reaches of Fossil Creek upstream of the diversion dam. The absence of grazing and livestock management activities from the No Action Alternative may have minor beneficial effects for this species, through slight reductions in sedimentation in the upper reaches of Fossil Creek and from the improved upland watershed condition that will result from no grazing. Therefore, this alternative will have no impacts to headwater chubs.

Proposed Action and Reduced Utilization and Intensity Alternative

Headwater chubs have persisted in Fossil Creek with historic higher use grazing systems. As their name implies they are generally found in the headwater reaches and in Fossil Creek are abundant upstream of the diversion dam of the now decommissioned Irving Power Plant. While grazing will continue to occur in the contributing watershed, livestock will not have access to areas of Fossil Creek where headwater chub occur. Therefore, there will be no direct effects to this species from either the Proposed Action or the Reduced Utilization and Intensity Alternative. Continued livestock grazing in the watershed under both alternatives may result in the continuation of current watershed conditions initially, and likely result in improved conditions over the long-term. Both action alternatives have the potential to gradually improve watershed conditions and reduce the amount of sediment currently entering the system. The Reduced Utilization and Intensity Alternative have similar effects to the Proposed Action except that the lower initial utilization and intensity may serve to improve conditions faster. Currently degraded upland watershed conditions will continue to contribute to sedimentation that may alter channel form and fill pools, negatively affecting headwater chubs. However, the spring fed nature of Fossil Creek where headwater chubs occur that keeps flow levels high, enabling sediment transport above what is being provided by the watershed reduces the negative affects of sediment in the headwater reaches of Fossil Creek. Additionally, the travertine formations in the reaches where headwater chubs are present provide continued development of important pool habitat. Under both action alternatives watershed conditions would gradually improve, decreasing sedimentation, although it is unknown if the improvement will result in measurable decreases in sediment entering the streams.

Roundtail Chub

No Action Alternative

The absence of grazing and livestock management in the Fossil Creek Allotment will have no direct effects to roundtail chubs, and will lead to improved watershed condition and may have beneficial indirect effects to the habitat of this species.

Proposed Action and Reduced Utilization and Intensity Alternative

Roundtail chubs were one of the native fish that had been able to persist in Fossil Creek and the Verde River under past management actions and the presence of nonnative predators. The Lower Colorado River populations (Arizona and New Mexico) were petitioned for listing under the Endangered Species Act as a distinct vertebrate population segment but a 2006 finding found that it was not warranted. However, populations of roundtail chub in Arizona and New Mexico are still vulnerable. With the restoration of streamflow to Fossil Creek in 2005, habitat conditions have improved and habitat has increased in for this species throughout the stream. Roundtail chub are abundant where habitat is available. Both action alternatives have the potential to gradually improve watershed conditions and reduce the amount of sediment currently entering the system. However, there is also the potential for indirect effects of either Action Alternative to result in continued upland erosion resulting in sedimentation to Fossil Creek. This may result in the loss of some pool habitat in the lower reaches where pools are not maintained or enlarged by travertine formations. Continued affects of watershed derived sediment may cover eggs deposited on the substrate and aquatic vegetation, which could reduce reproductive success in the lower reaches of the stream. In the Verde River, potential sediment production from the allotment from either alternative will not be measurable in comparison to current background levels and will have no effects to roundtail chub in the Verde River.

Desert Sucker and Sonora Sucker

No Action Alternative

The absence of grazing and livestock management in the Fossil Creek Allotment will have beneficial watershed effects and will likely improve habitat conditions for suckers. The No Action Alternative would eliminate direct effects and have beneficial watershed effects resulting in no impacts to desert suckers or Sonora suckers.

Proposed Action and Reduced Utilization and Intensity Alternative

Both desert and Sonora suckers are found throughout Fossil Creek and in the Verde River although the Sonora sucker's range in Fossil Creek is restricted to areas downstream of the Irving power plant diversion barrier. Desert suckers are tolerant of a wide range of temperatures and environmental conditions. Both action alternatives have the potential to gradually improve watershed conditions and reduce the amount of sediment currently entering the system. However, there is also the potential for indirect effects of the Proposed Action to result in continued upland erosion resulting in sedimentation to Fossil Creek**.** While both species build nests for eggs in gravel and could be susceptible to increased sedimentation that would negatively affect eggs, the short duration in which

eggs are in the gravel prior to hatching limits the negative effects of sediment. Therefore, effects of either alternative on Sonora and desert suckers in Fossil Creek would be minimal. Eggs and nests also could be trampled on at the livestock water access lanes in Fossil Creek proposed under either alternative, although those occurrences would be rare and unlikely to occur. The removal of predatory nonnative species in Fossil Creek has reduced a primary stressor that has led to the species decline throughout the Verde and Gila Rivers (Rinne and Miller 2006) and sucker populations are expected to persist and increase in Fossil Creek even if there is continued sediment loading from the allotment area. In the Verde River, current background levels of sediment likely negate any measurable increases from the Fossil Allotment, as the allotment comprises about 1% of the total watershed area for the Verde River. In addition, the effects of land use activities upstream of the project dominate instream conditions making the relative contribution of sediment from the allotment negligible.

Longfin Dace

No Action Alternative

The absence of grazing and livestock management in the Fossil Creek Allotment will have beneficial watershed effects and will likely improve habitat conditions for longfin dace in Fossil Creed and the Verde River where they are assumed present. The No Action Alternative would eliminate direct effects and have beneficial watershed effects resulting in no impacts to longfin dace.

Proposed Action and Reduced Utilization and Intensity Alternative

Longfin dace are currently present in Fossil Creek and are assumed still present in the Verde River. Both action alternatives have the potential to gradually improve watershed conditions and reduce the amount of sediment currently entering the system. However, there is also the potential for indirect effects of the Proposed Action to result in continued and potentially increased upland erosion resulting in sedimentation to Fossil Creek. Though the two alternatives are similar in effects, the likely lower initial utilization levels of the Reduced Utilization and Intensity Alternative may allow for improved watershed conditions prior to full stocking rates. However, the primary threat to this species is from introduced nonnative fishes. Since Fossil Creek is one of the only purely native assemblages of native fishes in the Southwest, it is likely that they will persist and the effects of increased sedimentation to this species will be negligible. The species spawns by created shallow nests in sand sediments and the eggs usually hatch within four days. Because of the short time period, the eggs in the substrate would have to have an unusually large pulse of sediment to affect the eggs. It is unlikely that such a pulse would be the direct or indirect result of either Action Alternative.

Management Indicator Species -- Macroinvertebrates

No Action Alternative

If the no action alternative were selected, no livestock grazing or improvements would be implemented so there would be no direct, indirect or cumulative effects associated with the project.

Proposed Action and Reduced Utilization and Intensity Alternative

There are six monitoring sites for warm water macroinvertebrate assessments and Fossil Creek is not among them. Therefore, both alternatives will have no effect on the forest wide trend determinations for macroinvertebrates. Fossil Creek has been shown to have a highly diverse composition of macroinvertebrates due to the wide variety of habitats including the springs and the travertine formations (Marks et al. 2005). The continued sedimentation into Fossil Creek from grazing will have minimal affects on the availability of habitats for macroinvertebrate species and it is unlikely that either the Proposed Action Alternative or the Reduced Utilization and Intensity Alternative will have any adverse affects on the macroinvertebrate composition of Fossil Creek.

Cumulative Effects Analysis for the Fisheries Resource

The cumulative effects boundary for aquatic habitat and biota effects is the Fossil Creek-Lower Verde River 5th code watershed (HUC 1506020304). The allotment falls almost entirely within the Fossil Creek –Lower Verde watershed (totaling about 191,000 acres) with an insignificant acreage in the West Clear Creek 5th code watershed (HUC 1506020301) which is about 191,000 acres. About 42,091 acres of the allotment are in the Fossil Creek-Lower Verde 5th code watershed. The small amount of acres within the West Clear Creek 5th code watershed (67 acres) does not justify including the West Clear Creek watershed in this analysis.

Ongoing activities that may have cumulative effects to Fossil Creek include high recreation use, road maintenance, user created roads, and the decommissioning of the Irving power plant and associated flume. The effects of these ongoing activities are likely to increase sediment production into Fossil Creek. Recreation use affects riparian vegetation by creating areas of bare soil that without a protective layer of vegetation can easily erode into the watershed. Recreation also increases the likelihood of toxic materials entering the stream (i.e. abandoned cars, batteries, human waste) that can have negative impacts on water quality. Road maintenance can be an acute source of sediment into aquatic systems (Ziemer et al. 1991). User-created routes that do not have BMPs in place for water diversion are additional sources of sediment to streams.

The Verde River watershed upstream of the project area is approximately 4,645 square miles in size, the primary cumulative impact to the Verde River is increased groundwater

pumping (Barnett and Hawkins 2002). Other ongoing activities affecting the Verde River include, urbanization and development, range management, vegetation management, fire and fuels management, transportation and recreation, and water management structures (Barnett and Hawkins 2002).

The major past actions considered in this analysis include livestock grazing for the past 100-125 years within the two watersheds, vegetation management and prescribed burning, sediment reduction projects at various tank sites within the Fossil Creek Allotment and wildfire. Other past, ongoing and future foreseeable actions considered in this analysis are detailed at the beginning of Chapter 3.

No Action Alternative

Under the No Action there would be no cumulative effects, because with the absence of livestock grazing there would be direct or indirect effects to aquatic habitat and fisheries, such as sedimentation.

Proposed Action and Reduced Utilization and Intensity Alternatives

Past and current soil conditions, road footprints and use, recreation, and vegetation treatments all contribute cumulatively to affect the aquatic biota and habitat due to increased stream sedimentation. The erosion modeling done for the allotment area estimated that currently, soil loss is approximately 35% above natural conditions (about 25,000 tons/year). If only a quarter of this ends up in streams it would be about 30 times the amount estimated to be contributed by the road network of 23 tons.

The majority of delivered sediment appears to be contributed by watershed conditions. Watershed condition is closely linked to management of the associated rangelands. The increase in soil loss described above, accounts for the fact that the majority of soil loss is from inherently unstable soils. If inherently unstable soils are removed from the analysis, then the increase in soil loss is closer to 50% over natural background soil loss rates (PR#176). Implementation of the Travel Management Rule and the Managing Motorized Travel EIS would reduce the road-related sediment contribution to about 16 tons about a 1.5% decrease in total delivered sediment to stream channels. This decrease would result from road closure and decommissioning.

As discussed above, the greatest effect to aquatic biota is increased sedimentation, of all the cumulative effects critical to the aquatic biota and habitat, grazing and management of the allotment appears to be the most important factor in sediment production rates. Both of the action alternatives have the potential to result in improved soil conditions; the only difference is that the Reduced Utilization and Intensity Alternative could have a slightly quicker rate of improvement of watershed conditions. However, under the adaptive management strategy there is potential for the Proposed Action to start with a lower initial stocking rate than the Reduced Utilization and Intensity Alternative. Any reduction of sediment entering the watershed drainages would be an improvement of aquatic habitat and fishery resources over existing conditions.

Comparison of Alternatives and Response to the Issues

One key issue was used to analyze effects of the alternatives specific to the fisheries resource. The issue analyzed was as follows:

- Livestock grazing under the intensity and utilization rates of the proposed action would not adequately improve soil conditions in the short term (10 years or less) and would negatively affect soil productivity, vegetation conditions and aquatic conditions.

The indicators used to evaluate how the alternatives would improve aquatic conditions were watershed conditions and water quality.

No Action-No Grazing Alternative Versus the Grazing Alternatives

The No Action alternative has the greatest potential to result in improved watershed conditions and reduce the amount of sediment entering stream channels than the grazing alternatives. The amount of improvement is dependent on precipitation but the No Action would have a faster rate and higher probability of improvement than either of the grazing alternatives. Watershed improvement under both grazing action alternatives is dependent on precipitation and on timely management responses to changes in precipitation. For this reason, conditions may remain static under the No Action during drought periods, while conditions may degrade during droughts under either action alternative.

Proposed Action Versus Reduced Utilization and Intensity Alternative

The lower initial utilization, intensity, and stocking rates of the Reduced Utilization and Intensity alternative allows the potential for a faster improvement of watershed conditions that the Proposed Action alternative. Livestock grazing can indirectly affect water quality when upland grazing removes biomass, reduces the protective vegetative ground cover that normally traps sediments, increases soil compaction, reduces water infiltration, increases sediment production and nonpoint source pollution into streams. The indirect effects of the Reduced Alternative are similar to the Proposed Action, however, there may potentially be more biomass left on site with a lower utilization rate and the rate of improvement of the upland may be slightly quicker than the proposed action. Therefore, the indirect effect of livestock grazing on water quality may be slightly reduced with the Reduced Alternative. The potential for faster improvement of watershed conditions under the Reduced Utilization and Intensity Alternative would result in a faster benefit to aquatic biota and their habitat. This said, there is the potential under adaptive management for the initial rates of the Proposed Action to be lower than the Reduced Utilization and Intensity Alternative, still the watershed is likely to see faster improvement under the Reduced Utilization and Intensity Alternative, resulting in less sediment entering streams.

Botany and Sensitive Plants

The following section describes the affected environment and effects of the alternatives for botany and sensitive plants. The analysis presented is summarized from the following reports which are incorporated by reference: *Botany Specialist's Report*, (2007), (PR#83), the *Biological Assessment and Evaluation of Region 3 Sensitive Plants*, (PR#178) and the *Addendum to Sensitive Species List* (2007), (PR#180) by D. Crisp.

Affected Environment

Past surveys were reviewed and there were no documented occurrences of threatened, endangered or Forest Service Sensitive (TES) plant species in the allotment. Plant surveys were not conducted on the allotment due to time and budgetary constraints. Potential habitat for various plant species was determined based on soil types from the Terrestrial Ecosystem Survey database or plant associations. The lists of plants species considered in this analysis, their habitats and rationale for inclusion or exclusion from detailed analysis are provided in the three reports listed above (PR#83, 178 and 180). Table 30 below lists the eight Region 3 Sensitive plants having potential habitat in the project area.

Table 30. Region 3 Sensitive Plant Species Analyzed and Potential Habitats in and Adajcent to the Fossil Creek Allotment

Common Name Scientific Name	Habitat and Presence in and adjacent to the Project Area
Tonto Basin Agave *Agave delamateri*	Potential habitat, no documented occurrences or documented surveys within the allotment.
Heathleaf Wild Buckwheat *Eriogonum ericifolium* var. *ericifolium*	Potential habitat, no documented occurrences or documented surveys within the allotment. Potential soil types for this species occur over limited areas in the Childs Holding, Surge and Heifer pastures.
Ripley Wild Buckwheat *Eriogonum ripleyi*	Potential habitat, no documented occurrences or documented surveys within the allotment. Potential soil types for this species occur over limited areas in the Childs Holding, Surge and Heifer pastures.
Hualapai Milkwort *Polygala rusbyi*	Potential habitat, no documented occurrences or documented surveys within the allotment.
Verde Valley Sage *Salvia dorrii mearnsii*	Potential habitat, no documented occurrences or documented surveys within the allotment. Potential soil types for this species occur over limited areas in the Childs Holding, Surge and Heifer pastures.
Cliff Fleabane *Erigeron saxatilis*	Potential habitat, no documented occurrences or documented surveys within the allotment. Canyon slopes may provide potential habitat.
Eastwood Alum Root *Heuchera eastwoodiae*	Potential habitat, no documented occurrences or documented surveys within the allotment. The habitat is moist slopes in ponderosa pine forests and canyons where it typically grows on slopes or cliffs. Canyon may provide potential habitat.
Flagstaff Beardtongue *Penstemon nudiflorus*	Potential habitat, no documented occurrences or documented surveys within the allotment. Potential habitat includes dry pine forests, pine/oak, pine/oak/ juniper and pinyon juniper forests. Numerous locations of this species have been recorded on the Mogollon Ranger District in areas such as the Upper Beaver Creek Fuels Reduction Project.

Environmental Consequences

The unit of measure for Region 3 Sensitive plant species is to **maintain or enhance** potential habitat within the allotment area. Manual direction (FSM 2670.5(19)) emphasizes that management actions would avoid or minimize impacts to sensitive species. Mitigating measures have been incorporated into project design and implementation as necessary to minimize impacts to Region 3 Sensitive plants.

No Action Alternative

There will be no direct actions to Region 3 Sensitive plants from the No Action Alternative because none of the management actions outlined in the Proposed Action will occur. There will be no livestock grazing and no construction or modification of structural improvements in the allotment. Maintenance of existing structural improvements would require separate NEPA analysis. With the no action alternative indirect and cumulative effects to Region 3 Sensitive plants would not occur because there would be no livestock grazing in potential habitats of Region 3 Sensitive plants in the allotment. Absent livestock grazing, effects would include slight reductions in factors such as compaction of soils that may be occurring in the area, but these beneficial effects would be so small as to be insignificant.

Proposed Action and Reduced Utilization and Grazing Intensity Alternatives

Direct and indirect Effects

These two alternatives are addressed together in one discussion. Measures used to address the direct and indirect effects are generally qualitative. Therefore, the effects or either of these alternatives would be similar.

Currently there are no documented effects to Region 3 Sensitive plants in the allotment. Examples of possible direct effects would be grazing on individual plants (livestock eating plants), trampling, or grazing within sensitive habitats. Other direct effects to Region 3 Sensitive plants within the allotment include possible impacts to potential habitat (or to individuals that may have been previously undetected) during the construction of structural improvements. However, these effects would be mitigated by surveying the areas before construction and through implementing best management practices to reduce the introduction or spread of noxious or invasive weeds to potential habitat. The management actions outlined in the proposed action will indirectly benefit Region 3 Sensitive plants by reducing impacts to potential habitat that may be currently occurring. For example, objectives common to the proposed action and the reduced utilization and grazing intensity alternative include improvement of range conditions and improved control of livestock. Improved range conditions and improved control of livestock will indirectly benefit Region 3 Sensitive plants by reducing the possible effects of grazing to potential habitat**.**

When comparing these two alternatives, the Reduced Utilization and Grazing Intensity alternative could possibly lead to a larger immediate increase in ground cover and

vegetation on the allotment. However, the overall effect of this to the Region 3 Sensitive plants discussed in this document would probably be minimal and insignificant. Heath-leaf wild buckwheat, Ripley's wild buckwheat, Hualapai milkwort and Verde Valley sage typically grow in harsh environments where minimal ground cover is naturally present. There could be a minimal effect from lower levels of grazing for Flagstaff beardtongue from the reduced utilization and grazing alternative as compared to the proposed action by reducing the likelihood of trampling and grazing on the plants.

There are no known occurrences of Tonto Basin agave in the allotment so there would be no direct or indirect effects to the species. There would be no direct or indirect effects to cliff fleabane or Eastwood alum root through management actions that are included in the Proposed Action. These plants generally occur in steep, cliffy areas such as occur in the Fossil Creek Wilderness that would not be affected by any of the management actions.

An indirect effect to the potential habitat for Region 3 Sensitive plants common to both the proposed action and the reduced utilization and grazing alternative would be the introduction of noxious or invasive weeds during construction of structural improvements. Best management practices to reduce the potential for introduction and spread of noxious and invasive weeds are incorporated in to the project as design features described in Chapter 2 of the EA. These will mitigate this effect.

Cumulative Effects

The allotment boundary was chosen to analyze cumulative effects. The effects of past and present management actions on the potential habitats for Region 3 Sensitive plants in the allotment are largely unknown. Future actions such as implementation of cross-country travel restrictions under the guidance of the Travel Management Plan and actions to control noxious or invasive weeds will indirectly benefit the potential habitats of Region 3 Sensitive plants in the allotment by reducing impacts from vehicle travel and reducing the risks from noxious or invasive weed invasions. With the implementation of the project design features and mitigation measures for soil and watershed resources and noxious and invasive weeds as described in Chapter 2 of the EA, the effects of the two grazing alternatives would have a minimal cumulative impact when considered along with ongoing and future recreational and OHV impacts.

Noxious and Invasive Weeds

The following section describes the affected environment and effects of the alternatives for noxious and invasive weeds. The analysis presented is summarized from the following report which is incorporated by reference: *Invasive Plants Species Specialist Report* , by C. Boyd, (2007), (PR#122).

Affected Environment

A complete survey of the allotment and surrounding area has not been completed. There have been surveys in various parts of the allotment and adjacent area and these data are

used for this analysis. Based on these sources, there are 13 known weed species of concern that exist on the Fossil Creek Allotment. While the majority of the plants occur primarily along Highway 260 and the Childs-Irving project site (including the flume and access road), there are plants scattered throughout the allotment in varying levels of infestation. The invasive plant species of concern identified on the allotment are listed in Table 31 below. They are listed in the order as ranked in the Final Environmental Impact Statement for the *Final Environmental Impact statement for Integrated Treatment of Noxious or Invasive Weeds, Coconino, Kaibab and Prescott National Forests* (USDA-Forest Service, 2005a). Details of the ranking system are provided in the *Invasive Plants Species Specialist Report*, by C. Boyd, (2007), (PR#122).

Table 31. Weed Species of Concern in the Fossil Creek Allotment and Vicinity

Species Rank	Species common name	Objective	Occurrence
2	Yellow starthistle	Eradicate	Along road near the Childs Power Plant; Hwy 260
3	Malta starthistle	Eradicate	Stehr Lake and near other watering areas
4	Camelthorn	Contain/Control	East of the allotment. Not currently on the allotment but does pose a threat.
5	Diffuse knapweed	Contain/Control	Widespread
11	Scotch thistle	Eradicate or control	Hwy 260
13	Tamarisk	Contain/Control	FR 502; Hwy 260
16	Giant Reed	Contain/Control	Irving Power Plant
18	Dalmation toadflax	Contain/Control	Widespread
19	Tree of Heaven	Contain/Control	Childs Power Plant
20	Bull thistle	Contain/Control	Irving Power Plant
22	Cheatgrass	Contain/Control	Irving Power Plant
23	Wild Oats	Contain/Control	Widespread between Childs and Irving Powerplants
24	Common teasel	Eradicate	Hwy 260

Environmental Consequences

The discussion of effects of the alternatives will be qualitative as there is not a complete survey of the project area.

No Action Alternative

Direct and Indirect Effects

The effects considered include spread of existing populations and establishment of new populations of invasive species. Removing livestock grazing from the allotment would eliminate the direct effects of introduction or spread of invasive species from the livestock and the equipment used in the management of the allotment. There would be no spread of existing populations or establishment of new populations from livestock grazing operations. There would also be no indirect effects from livestock grazing and associated operations under this alternative as there would be no operations on the allotment. Overall, this alternative would have a slight minor benefit over the grazing alternatives.

Cumulative Effects

The cumulative effects analysis includes the allotment area and areas adjacent to it such as Highway 260. The time frame for analysis of cumulative effects is within the last 10 years and within the next 10 years. The two major ongoing activities considered in the cumulative effects analysis include recreation and the decommissioning of Irving and Childs hydroelectric power plants. Recreational activities in the project area occur primarily along Fossil Creek. These activities affect invasive species through vehicles, horses, and people spreading seeds and plant parts from existing populations. They can also introduce new populations (either species that currently occur or new species). The power plant decommissioning project has substantial mitigation measures built in to prevent the further spread of invasive species. Additionally, known populations in the project area (consisting of the two power plant sites and associated facilities) will be treated for control or eradication as part of that project (Arizona Public Service, 2003).

The overall cumulative effect of the No Action Alternative would be a small decrease in the potential for introduction and spread of weeds. While there would be no direct or indirect effects from livestock grazing operations on the allotment, and only minor positive benefits under this alternative with the absence of livestock grazing, invasive species would continue to occur and spread in the project area. Existing populations would continue to spread from annual seed production. These populations would be controlled through treatment as funding is available.

Proposed Action and Reduced Utilization Alternative

The effects of the two grazing alternatives are the same.

Direct and Indirect Effects

Implementation of the project design features and mitigation measures for noxious and invasive weeds as listed in Chapter 2 will minimize the spread of these species from livestock operations. They will not, however, eliminate the effect. Livestock and equipment associated with the management of the allotment will move seeds and plant parts from existing plants to new areas as well as bring new seeds and plant parts into the allotment. The spread of invasive species is expected to be slightly faster with the two grazing alternatives than if there were no livestock on the allotment in the No Action Alternative because there is another source of spread with the proposed action. New populations of species may also be established by bringing in seeds and plant parts from outside of the allotment.

Livestock and equipment will cause some ground disturbance in areas where invasive species occur which will allow the existing plants to spread as an indirect effect. The indirect effects of the two alternatives are that invasive species will spread at a slightly faster rate than with the No Action Alternative.

Cumulative Effects

The cumulative effects of the two action alternatives would consist of their direct and indirect effects added on to the effects caused by other projects and activities in the area.

The projects, activities and time frames considered in the cumulative effects analysis are the same as for the No Action Alternative. There would be continued spread of existing weed populations by grazing activities, but that would be modified by limited treatments and implementation of mitigation measures. New populations discovered would be treated as they are found to eradicate or control them. Recreational activities would continue to spread seed and create new seed beds. New populations would be treated as they are found. The decommissioning of Childs and Irving power plants and their associated facilities would cause ground disturbance that could promote invasive species, but it would be mitigated by Best Management Practices and treatments to eradicate or control new or existing populations of weeds. Overall, when the effects are considered together, the cumulative effects are that there would be a faster spread of invasive species than if there were no livestock grazing on the allotment. The magnitude of this effect is small, and would not be a significant impact because Best Management Practices and monitoring would be implemented as part of grazing management, and existing and discovered weed populations would be controlled and treated as needed.

Other Environmental Components

Recreation

The following section describes the affected environment and effects of the alternatives for the recreation resources which includes the following categories: recreation sites and uses; creation and lands special uses; the recreational opportunity spectrum; and visual quality objectives. The analysis presented is summarized from the following report which is incorporated by reference: *Recreation Specialist's Report* by J. Gonzales, (2007), (PR#136).

Affected Environment

Recreation Sites/Uses

Developed sites in or adjacent to the Fossil Creek Allotment include the Childs Campground which has a vault toilet, parking, picnic tables, and 12 single-unit campsites. Trails within or adjacent to the allotment include: Sycamore, Flume, Cimarron Springs and the Mail Trail.

Dispersed recreation is characterized by the common themes of summer activities, winter activities, consumptive use of forest resources, and educational/personal development type activities. The area provides a moderate degree of solitude and many opportunities for picnicking and camping at user-created sites throughout the area. None of the sites have developments other than those put there by visitors, and occupancy takes place largely on weekends during the summer and fall. There are many dispersed camping sites along Fossil Creek and the area receives heavy use.

An estimated 70% of the visits to the area occur during the summer season (Memorial Day to Labor Day). It is estimated that a full 90% of the users are Arizona residents, with many users returning to their favorite sites or settings on an annual basis. Recreational

activities include: hiking; viewing wildlife; hunting; dispersed car-camping; backpack camping; orienteering; horseback riding, caving, rock climbing, photography, picnicking; taking scenic drives; bicycling; shooting; and gathering in family or social groups. Off Highway Vehicle (OHV) use has increased dramatically in the last several years as neighboring Forests implement tighter restrictions on the use of jeeps, 4x4's and "quads". Family-oriented groups tend to gather at dispersed campsites, and explore from their campsite along old roads or off through the woods, making their own trails.

The local hunting seasons last from about mid-August through December and account for much of the fall use in the area. The area is part of the Arizona Game and Fish hunt "Unit 6A", and is popular for turkey, elk and deer hunting during various seasons. Gathering forest resources often combines subsistence needs with the pursuit of recreational experiences. Consumptive uses in or adjacent to the allotment includes: firewood cutting; post and pole cutting; collecting boughs and cones; collecting and transplanting wildlings; hunting; gathering antlers; collecting food and medicinal resources such as berries, nuts, mushrooms, and bracken fern; and collecting biological specimens for research.

Lands and Recreation Special Uses

Recreational guides and outfitted service providers are authorized under *temporary special use permits*, on an annual basis, and currently include guided hunting, and ATV services in portions of the analysis area. In addition, a Western Power Administration 345 KW powerline cuts through a portion of the Fossil Creek Allotment.

Recreation Opportunity Spectrum

The Forest Plan lists the Recreation Opportunity Spectrum (ROS) classes as Roaded Natural (RN) and Semi-Primitive Motorized (SPM) throughout the project area. Roaded Natural represents a moderate level of development and moderate to high social interaction within a modified physical setting that is not dominated by evidence of humans. Semi-Primitive Motorized represents an area with the lowest level of development, highest opportunity for solitude, and the greatest opportunity to escape from the sights and sounds of humans.

Visual Quality Objectives

Visual Quality Objective (VQO) designations in the analysis area include Retention and Partial Retention along Hwy 260, and its viewsheds. A Partial Retention VQO requires that management activities remain visually subordinate to the characteristic landscape. A Retention VOQ provides for management activities which are not visually evident. A designation of Modification covers some of the remainder of the project area. A Modification VQO specifies that management activities may visually dominate the original characteristic landscape. However, SPM (ROS) areas are required to have at least a Partial Retention VQO, therefore the northern and southwest portions of the planning area is in fact Partial Retention.

Environmental Consequences

Effects of the alternatives to recreation sites and uses and recreational special uses are assessed qualitatively. The measurement of effect for ROS and VQO is whether the alternative would change the classification or designation. The analysis area includes the allotment and where the allotment can be viewed along roads.

No Action Alternative

Use of developed sites is expected to remain at current low use levels._Trail use is expected to remain at the low use level. Conflicts between motorized and non-motorized uses are expected to continue or accelerate. Dispersed recreational activities will continue as before, the increased pressure and degradation of riparian areas near popular dispersed camp sites may make them less desirable over time as use continues to increase. Conflicts between recreationists will continue, as off road vehicle use and extended occupancy of popular sites increases. Because no livestock grazing would occur under the No Action Alternative there is not expected to be any direct or indirect effects on developed sites, trails, and dispersed recreation within the allotment. Likewise, there is not expected to be any direct or indirect effects on land and recreation special uses within the analysis area. ROS and VQO will remain within Land Management Plan guidelines under the No Action Alternative as there would not be any livestock grazing activities taking place. There would be no direct or indirect effects, or changes to the ROS or VQO designations in the analysis area. Since there are no direct or indirect effects from implementation of the No Action Alternative, there will not be any cumulative effects attributed to this alternative on the recreation sites and uses, lands and special uses, and the ROS and VQOs of the allotment analysis area.

Proposed Action and Reduced Utilization and Intensity Alternative

Effects are the same for the two action alternatives for the recreation resource.

Direct and Indirect Effects

Recreation Sites/Uses

Facilities at the developed site currently are protected by an old fence which has not been successful at keeping livestock out of the developed site at Childs boat launch and campground. This fence will be reconstructed by the District in the near future, which would protect the facilities from adverse effects from grazing management activities. Maintenance of the new fence will ensure that the site is protected in the future. Trail use is expected to remain at the low to moderate use level. Conflicts between motorized and non-motorized uses along trails are expected to continue or accelerate. Dispersed activities will continue as before however, the increased pressure and degradation of riparian areas near popular dispersed camp sites may make them less desirable over time as use continues to increase. Conflicts between recreationists will continue, as off road vehicle use and extended occupancy of popular sites increases. Activities associated with this alternative, such as livestock management and construction of range improvements, occurring over time and space, will mostly go unnoticed by the recreating public, except

at the three livestock water access areas along Fossil Creek, which are near dispersed camping areas. This is because there are segments of Fossil Creek available for dispersed recreation other than the proposed livestock water access points. The public using Fossil Creek for dispersed recreation tends to be from the local community, comfortable with the presence of cattle, and thus whose dispersed recreation opportunities are not affected (Personal communication with William Stafford, February 2008, PR#195).

The Proposed Action and Reduced Utilization and Grazing Intensity Alternatives will not have any direct or indirect effects on developed sites, and trails. Dispersed recreation would be impacted in a minor, negative way because of the range improvements (fences) and livestock presence at the three Fossil Creek livestock water access sites. This is because the fences and livestock presence at the three livestock water access sites would occur in the winter and early spring (generally December – April) when dispersed camping use of the areas is lower.

Land and Recreation Special Uses

The Proposed Action and Reduced Utilization and Grazing Intensity Alternatives will not have any impacts on existing land and recreation special uses in the analysis area, as long as there is coordination between District Range staff and Lands and Special Uses staff when any improvement and maintenance projects are planned and implemented.

Recreation Opportunity Spectrum and Visual Quality Objectives

There are no anticipated direct or indirect effects of the Proposed Action and Reduced Utilization and Grazing Intensity Alternatives to ROS or VQOs. The existing ROS or VQO class designations will not be changed from grazing management or any of the proposed improvements.

Cumulative Effects

There will be no cumulative effects on the recreation sites and uses, recreation and lands special uses, ROS, and VQOs in the analysis area, since there are no direct or indirect effects resulting from the activities of these alternatives. There will be a small cumulative impact to dispersed recreation near the three proposed livestock water access points along Fossil Creek, but it will be of short duration during the winter, during the low visitor use time of year. The public and local community that use the area for dispersed recreation activities appears to be comfortable or accommodate with the presence of cattle and there have not been any negative comments from the recreating public relating to the presence of livestock. In terms of areas affected by grazing along Fossil Creek, of the total 10.5 mile length of Fossil Creek adjacent to the Allotment, 0.6 miles will be affected by livestock use in the Proposed Action and the Reduced Utilization and Intensity Alternatives. This compares to 1.2 miles of Fossil Creek that are affected under current grazing management. (PR#192, 193, 194).

Wilderness

The following section describes the affected environment and effects of the alternatives for the wilderness. The analysis presented is summarized from the following report

which is incorporated by reference: *Recreation Specialist's Report* by J. Gonzales, (2007), (PR#136).

Affected Environment

The Fossil Springs Wilderness and the Mazatzal Wilderness are located at least partially within the allotment.

Environmental Consequences for All Alternatives

Effects to wilderness values are assessed qualitatively. A second measure of effect is whether there would be any changes to wilderness area designations. The No Action Alternative is not expected to have any direct, indirect or cumulative effects on wilderness values, as there would be no livestock grazing. As there are no new improvements proposed in either wilderness, and grazing would continue largely similar to how is has in the past, the Proposed Action and Reduced Utilization and Grazing Intensity Alternatives will not have any direct or indirect or cumulative effects on Wilderness values.

Wild and Scenic Rivers

The following section describes the affected environment and effects of the alternatives for the wild and scenic rivers. The analysis presented is summarized from the following report which is incorporated by reference: *Evaluation of Effect of the Proposed Fossil Creek Allotment Alternatives on Verde Wild and Scenic River (WSR) and Proposed Fossil Creek WSR Eligibility and Classification*, by J. Gonzales, 2007, (PR#137) and the *Recreation Specialist's Report* by J. Gonzales, (2007), (PR#136)

Affected Environment

The Verde Wild and Scenic River forms the western end of the Fossil Creek Allotment. The Verde River is presently not impacted by livestock grazing as a result of pasture fences and terrain upslope of the river. The pasture and holding area fences are however, within the ¼ mile Wild and Scenic river corridor. This was evaluated during the designation process of the Verde as a Wild and Scenic River. This allotment has been fenced from the Verde River.

The entire length of Fossil Creek is eligible for inclusion in the National System. Eligibility is an inventory as to whether a river is free-flowing and possesses at least one outstandingly remarkable value.

Fossil Creek was initially evaluated in 1993 as part of a study of potential additions to the National System on the six national forests in the State of Arizona. An approximate 13-mile segment, from below the Arizona Public Service (APS) dam and flume to the river's confluence with the Verde Wild and Scenic River, was found eligible as documented in the *Resource Information Report, Potential Wild, Scenic and Recreation River Designation* (USDA-Forest Service 1993).

Although significantly altered by water diversion for the Childs-Irving hydropower project, the study concluded the eligible segment was free-flowing (waterway unmodified below the dam) and with adequate flows to support the outstandingly remarkable values (ORVs).

The ORVs associated with the river below the dam include:

- Geology -- travertine deposits
- Fish -- potential habitat for native fish communities and recovery of threatened and endangered species
- Wildlife -- habitat for nesting for black hawks and river otters
- History -- the historic Childs-Irving hydropower facilities (National Register and National Mechanical Engineering Landmark)
- Cultural (pre-history) -- southern Sinagua sites
- Riparian community -- abundance and diversity

With the decommissioning of the hydropower project, and partial removal of the dam, unrestricted flows have been returned to the creek. The upper portion of Fossil Creek, from its source to the dam and including the springs, is also eligible.

The Senate Bill 86, **The Fossil Creek Wild and Scenic River Act of 2007** was introduced on January 4, 2007 to designate Fossil Creek, a tributary to the Verde River in the State of Arizona, as a component of the National Wild and Scenic Rivers System. The bill is in the Senate Committee on Energy and Natural Resources as of January 2008.

Environmental Consequences

Effects to Wild and Scenic Rivers and their ORVs are assessed both qualitatively and quantitatively. Another measure of effect is whether the alternatives would change the eligibility, designation or classification.

No Action Alternative

The No Action Alternative is not expected to have any direct, indirect or cumulative effects on eligibility or proposed designation and classification of Fossil Creek as a Wild and Scenic river , including its free flows or its ORV's, as there would be no livestock grazing. Similarly, the No Action Alternative is not expected to have any direct, indirect or cumulative effects to the eligibility or classification of the Verde River WSR designation, its free flows or its ORV's. Under the No Action alternative, Verde River WSR will continue to be managed according to agency policy in FSH 1909.12, Chap.8.12 and the Verde Wild and Scenic River Comprehensive River Management Plan (USDA – Forest Service 2004).

Proposed Action and Reduced Utilization and Grazing Intensity Alternatives

Direct and Indirect Effects

The effects are the same for both alternatives. The Proposed Action and Reduced Utilization and Grazing Intensity Alternatives are not expected to have any direct, indirect or cumulative effects to the eligibility or classification of the Verde River WSR designation, its free flows or its ORV's. Similar to the current situation, the Verde River would not be impacted by either of these livestock grazing alternatives because pasture fences and terrain restrict livestock access. Under these Alternatives, Verde River WSR will continue to be managed according to agency policy in FSH 1909.12, Chap. 8.12 and the Verde Wild and Scenic River Comprehensive River Management Plan (USDA – Forest Service 2004).

Under the two grazing alternatives, the Fossil Creek Wild and Scenic ORV of Riparian Community will be minimally affected by livestock grazing and management at the three proposed livestock water access points in Boulder and Stehr Pastures. The livestock water access sites are needed because of the draining of Stehr Lake and dismantling of the flume associated with the decommissioning of the Childs and Irving power plants.

In recent history (over about the last 15-20 years) cattle have only had access to about 1.2 miles of Fossil Creek (11% of 10.5 miles). Access has been about 0.7 miles in Stehr Lake Pasture, 0.5 miles in Upper Wilderness pasture, and no access in Boulder Pasture. The remainder of area of the allotment along Fossil Creek has been inaccessible to livestock due to topography and fencing (PR#192). The total area proposed for fencing as water access lanes for livestock is estimated at 0.6 acres (PR#193). The net result of improvements and restricting livestock access to Fossil Creek under the Proposed and Reduced Alternative is 3.64 acres as compared to 7.27 acres under current management (PR#194). These watering locations will restrict livestock access to smaller areas along Fossil Creek than has occurred in the past

The *Soil and Water Specialist's Report* (PR#133) documented that there would be little effect on woody riparian vegetation, because the 20% utilization standard would be met and grazing would occur during the season when the riparian woody vegetation is dormant. The *Fisheries Specialist's Report* (PR#147) found that though the three livestock water access points will receive proportionally greater use, the direct effects of grazing on Fossil Creek will be minimal, and the majority of overhanging vegetation and stream banks would be protected. The three fenced livestock water access sites would encompass an area of about 0.6 acres as compared to a total stream length of Fossil Creek of 17.2 miles (PR# 171) of which 10.5 miles is within and adjacent to the allotment. Monitoring as detailed for range, watershed, fisheries and wild and scenic rivers in Chapter 2 would be implemented at these sites. The other ORVs would not be directly or indirectly affected. The recreation classification of the upper segment of Fossil Creek and the wild classification of the lower segment of Fossil Creek will not be affected under either of the alternatives because no activities are proposed within the eligible

corridor that would affect the waterway, shoreline development, or access. Under these alternatives, Fossil Creek will remain eligible for designation under the Wild and Scenic Rivers Act.

Cumulative Effects

The cumulative effects analysis for the Wild & Scenic River Resource in the Fossil Creek Allotment includes an evaluation of the effects of grazing on riparian values in addition to the effects of dispersed recreation use on Fossil Creek. The area analyzed includes the Fossil Creek corridor within a ¼ mile or less from the stream channel. A report prepared for this analysis, *Recreation and Road Impacts Adjacent to Fossil Creek*, by D. Fleishman, December 5, 2007 (PR#171) included an estimate of disturbed acreage attributed to dispersed recreation use. This estimate utilized field data gathered in 2001 and 2002. At that time, there were a total of 121 dispersed recreation sites along Fossil Creek, totaling 2.01 acres. Within the Fossil Creek Allotment boundary, there were a total of 45 dispersed recreation sites along Fossil Creek, totaling approximately 1.7 acres of disturbed ground. The Lower Wilderness Pasture had 3 sites for .01 acres, the Upper Wilderness Pasture had 2 sites for .02 acres, the Boulder Pasture had 5 sites for .13 acres, and the Stehr Pasture had 35 sites for 1.53 acres.

Another report written by the former Landscape Architect for the Red Rock District, (Roughan 2003) assessed recreation impacts on the Fossil Creek area, assuming no development would occur to address impacts from camping and day use activities. This report is the best estimate we have to gauge what the impacts would be from additional unmanaged recreational use that has occurred along Fossil Creek since the dispersed recreation sites were mapped using GPS in 2001-2002. It is recognized that the use has increased significantly since that time period, with the report stating that "…increased population and demand for water-based recreation, contact levels and crowding are expected to increase." The report also states that lacking established vehicle and camp areas in the Middle Fossil Creek area would result in a "…degraded appearance from trash, compacted soils, damaged vegetation and a proliferation of roads."

The Travel Management Rule and proposed Managing Motorized Travel project would close many user created roads that now allow direct access to Fossil Creek. This is expected to reduce the impacts of dispersed recreation on the identified ORVs associated with Fossil Creek.

The effects of grazing on Fossil Creek's riparian woody vegetation (ORV – Riparian Community) in the three proposed livestock watering access points has been addressed previously and was assessed as being of "...little effect on riparian woody vegetation" and that the "…majority of overhanging vegetation and stream banks would be protected." An estimate of disturbed acreage associated with the three livestock water access points is approximately 0.6 acres. The one water access point in the Boulder pasture would total approximately 0.25 acre, and the two water access points in the Stehr pasture would total approximately 0.35 acres. An estimate of total acreage that would be impacted by grazing along Fossil Creek within the allotment (assuming a 50 foot buffer along the

creek) is 3.64 acres. This is about 6% of the total buffer area (50 feet) along the entire length of Fossil Creek within the allotment. This represents a reduction of about 50% of currently accessible area (under current management) within the buffer zone along Fossil Creek which is totals about 7.27 acres (PR#193, 194). Based on these data and professional judgment, the effect of livestock grazing on Fossil Creek's riparian woody vegetation in the three proposed livestock watering access points would be so minimal as to not contribute to the cumulative effects of the already existing dispersed recreation impacts.

Inventoried Roadless Areas

The following section describes the affected environment and effects of the alternatives for the Inventoried Roadless Areas (IRAs). The analysis presented is summarized from the following report which is incorporated by reference: *Recreation Specialist's Report* by J. Gonzales, (2007), (PR#136).

Affected Environment

There are three Inventoried Roadless Areas (IRAs) in or adjacent to the allotment include: Hackberry Mountain, Boulder Canyon and Cimarron Hills. There are currently several existing range improvements within the IRAs that overlay the Fossil Creek Allotment.

Environmental Consequences

Effects to IRAs are assessed qualitatively. Another measure of effect is whether the alternatives would change the eligibility, designation or classification.

The No Action Alternative is not expected to have any direct, indirect or cumulative effects on IRAs and their designation, as there would be no livestock grazing. There are several new range structural improvements proposed in the IRAs with the Proposed Action and Reduced Utilization and Grazing Intensity Alternatives. These improvements within the IRAs include livestock exclosure fences at springs and seeps as needed in Chalk Springs, Sally Mae and Sycamore Canyon Pastures. No new roads would be constructed to implement these improvements. Since no new roads would be constructed, the Proposed Action Alternative and Reduced Utilization and Grazing Intensity Alternative will not have any direct, indirect, or cumulative effects on the IRAs and their eligibility, designation or classification.

Heritage Resources

The following section describes the affected environment and effects of the alternatives for Heritage Resources. The analysis presented is summarized from the following report which is incorporated by reference the *Heritage Specialist's Report*, by T. Bone, (2007), (PR#186.)

Affected Environment

A limited number of archeological surveys for other projects have been conducted throughout the years within the Fossil Creek Allotment. As a result, slightly less than 5 percent (2,030 acres) of the allotment area has been intensively surveyed. Two hundred and eleven archeological sites have been located and recorded within the allotment. This indicates that there are hundreds, if not thousands, of unrecorded sites within the allotment area. Of the 211 previously recorded sites, one is listed on the National Register of Historic Places (Site AR-03-04-01-12, which is a contributing element of the Childs-Irving Hydroelectric System). 31 sites were previously determined eligible for but are not listed on the National Register of Historic Places and 9 have been determined ineligible. All other sites are currently unevaluated but shall be treated as if eligible for the National Register of Historic Places and will be protected until testing or additional information is available that would allow formal determinations of eligibility to be made.

Archeological survey coverage and site types and densities for the Fossil Creek Allotment are consistent with those of the surrounding areas. Known heritage properties include a wide variety of site types, ranging from simple artifact scatters to large pueblos and from historic homestead sites to bridges and generating facilities. Archeological site distribution within the Fossil Creek Allotment may be interpreted as a system of settlements designed to take advantage of various resources such as soil, water, and wild vegetation. Site density ranges from moderate to very high, and sites tend to cluster around springs, along seasonal wetlands, in canyons, and in the pinyon-juniper vegetation zone.

Although the Yavapai-Apache recognize Fossil Creek Canyon as an important traditional cultural place, its eligibility for the National Register has not yet been formally determined. There are no known specific plant gathering areas or traditional sacred sites within the Fossil Creek Allotment. The tribes expressed no concerns regarding grazing and associated improvements within this allotment.

Environmental Consequences

Impacts to heritage resources, especially archeological sites, can be defined generally as anything that results in the removal of, displacement of, or damage to artifacts, features, and/or stratigraphic deposits of cultural material. In the case of heritage resources considered eligible inclusion in the National Register of Historic Places, this can also include alterations of a property's setting or context. In the case of traditional cultural properties and sacred places, additional considerations may include alterations in the presence or availability of particular plant species.

Heritage resources, depending on their nature and composition, are subject to several different types of impacts from activities associated with grazing. Direct impacts from grazing are generally considered to be those resulting from concentrated livestock trampling or the construction of range improvements. Indirect impacts can include

erosion and changes in vegetative composition and density that alter the setting and geographic context of sites. Given the nonrenewable nature of heritage resources, particularly prehistoric and historic archeological sites, any portion of them that has been damaged or removed diminishes their cultural and scientific value permanently.

Livestock grazing has occurred in the Southwest since European contact and has been a permitted activity on the Coconino National Forest since its inception in 1908. Grazing of what would become the Fossil Creek Allotment was heavy and unregulated from the 1870s to the early 1920s. In addition, wild ungulates have ranged free, potentially in substantial numbers, throughout time. This resulted in a reduction of vegetative cover, which may have affected heritage resources through soil loss, erosion, and trampling. Since site condition assessments for heritage resources are not available for any time prior to the introduction of European livestock species to the Southwest, some level of effect is assumed to have contributed to the current condition of all sites on the Fossil Creek Allotment.

Previous effects to cultural resources caused by historic livestock and wild ungulate grazing are considered status quo, or the existing condition. However, since the establishment of allotments and implementation of grazing management, the condition of known heritage resources inventoried are considered stable and, in many cases, are believed to have improved in condition as vegetative cover returned. Based on a history of observation and consultation with the State Historic Preservation Officer (SHPO), managed grazing is not considered in and of itself to constitute an effect on heritage resources when the grazing strategy is designed to match herd size with capacity and distribute livestock as evenly as possible across the allotment in order to avoid localized concentrations of animals and the resultant impacts to soils and vegetation associated with intense trampling. Changes in grazing strategy are likewise not considered to have an effect provided that whatever new strategy is implemented does not alter these conditions. Since livestock grazing managed under these assumptions would not create any additional effects to heritage resources, a decision to reauthorize grazing does not necessarily imply any cumulative effects.

Mitigation of impacts to heritage resources for all alternatives is best accomplished by avoidance of these properties by the placement and construction of all range improvements. It can also be achieved by minimizing opportunities for the localized concentration of animals, improving distribution across the allotment and across each pasture, and by reducing the intensity of grazing for the allotment as a whole. Other, more specific mitigation requirements may be identified as each of these improvements is developed and a heritage inventory is made of their areas of potential effect.

Prehistoric rock shelters are particularly vulnerable to concentrated use impacts because accessible shelters have the potential to be used by livestock to escape inclement weather or the sun. As a result, rock shelters can become an area where trampling occurs and dung deposits build. Because fragile, perishable archeological resources occur within these shelters, these sites need to be monitored not only for human use, but also for impacts from livestock. If such impacts occur, these shelters would be isolated from

grazing. There is one such shelter known to exist in the Fossil Creek Allotment. This shelter will be monitored for impacts and mitigations developed to isolate the shelter if adverse effects are observed.

Direct, Indirect, and Cumulative Effects of All Alternatives

Because there will be no grazing and improvements would not be implemented, there will no direct, indirect or cumulative effects of the No Action Alternative.

All of the grazing alternatives, including the proposed action, would keep livestock numbers at or below their currently permitted level. These stocking levels would not constitute an effect on heritage resources within the Fossil Creek Allotment. There is no difference in effect between the Proposed Action Alternative and the Reduced Utilization and Intensity Alternatives because the improvements proposed for both alternatives are the same.

The action alternatives include several improvements (new fencing, erosion control measures, and fence removal) to mitigate for possible impacts to soils and wildlife resources that will be implemented within two years. All of these projects have been surveyed for cultural resources, and no sites were found. If any new sites are discovered during construction activities, they are to be reported to the District or Forest Archeologist and ground-disturbing work halted. By avoiding archeological sites during construction and in areas of concentrated use, there will be no effects to cultural resources.

Consultation with the Arizona State Historic Preservation Office (SHPO) for this project's effects to heritage resources and compliance with Section 106 of the National Historic Preservation Act will be completed prior to making a final decision regarding the Fossil Creek Allotment. Consultation with 13 tribes is also currently underway. Because permitted livestock numbers and the grazing management system for all the alternatives is equal to or less than the current permitted level and mitigation measures to protect heritage resources under the Proposed Action and the Reduced Grazing Utilization and Intensity Alternatives will be implemented, there will be no direct adverse impacts to heritage resources. Likewise, there will be no indirect adverse or cumulative effects from the alternatives to heritage resources.

Economics

The following economic analysis of the alternatives is summarized from the following report which is incorporated by reference: Economic Analysis, by G. Hase Jr, (2007), (PR#151).

Economy of the Affected Environment

Although the contributions of livestock grazing to local economies and county governments is small in comparison to other businesses and funding sources, this section will discuss the effects based on National Forest fees, jobs, and other revenues.

Livestock grazing contributes to the livelihood of the Fossil Creek Allotment permittee as well as to the economy of local communities and counties. The Fossil Creek allotment is located in Yavapai and Coconino Counties and is currently permitted for 477 head of livestock and 6 horses, with a yearlong use period. The presence of livestock grazing does not limit hunting or recreational activities on lands contained within the allotment. The nearest communities to the allotment are located in the Verde Valley and include Camp Verde, Cottonwood, and Sedona. The Verde Valley economy is large and fairly diverse with livestock grazing associated revenues making up a very small portion of the economy. Although livestock grazing revenues represent only a small percentage of the funds Yavapai and Coconino Counties receive from National Forest fees, they are an important contributor. Additionally, individual allotments provide incremental contributions to local economies; a change to one allotment may result in no impacts to the local economy, but changes in several allotments would most likely result in a cumulative impact to the area economy.

The economy of Yavapai and Coconino Counties gain revenue from several sources: county sales taxes, state-shared sales taxes, highway user revenues (gasoline taxes), property taxes and National Forest fees. The greatest revenues come from the county and state-shared sales taxes. National Forest fees, which include payments from timber harvesting, mining, recreational uses, and livestock grazing, are an important part of county revenues, but provide only a fraction of available funds. Yavapai County also receives National Forest fees from uses on the Tonto, Prescott and Kaibab National Forests; Coconino County also receives National Forest fees from uses on the Kaibab and Apache-Sitgreaves National Forests. National Forest fees are used primarily for highway maintenance and public schools in Yavapai and Coconino Counties. The Fossil Creek permittee directly contributes revenues to Yavapai County through property taxes.

Environmental Consequences of All Alternatives

Estimates of direct and indirect jobs and payments to Yavapai and Coconino Counties from Federal receipts provide a relative comparison of economic effects that could occur due to changes in livestock grazing. Table 32 estimates the effects expected on these indicators in Yavapai and Coconino Counties from implementing the Proposed Action, the No Action, and the Reduced Utilization and Grazing Intensity Alternative on the Fossil Creek Allotment.

For this analysis, the initial maximum stocking level of 300 head was used for the Proposed Action Alternative and the initial maximum stocking level of 200 head was used for the Reduced Utilization and Grazing Intensity Alternative. As soil and vegetation conditions improve, authorized livestock numbers will likely increase and the differences between the Proposed Action and the Reduced Utilization and Grazing Intensity Alternative will become smaller. However, the economic consequences would be the same if stocking was the same for both alternatives. Note that for the Proposed Action, 300 head was analyzed is a maximum stocking level.

Table 32. Economic effects for Yavapai and Coconino Counties

Economic Effects	Proposed Action	No Action	Reduced Utilization and Grazing Intensity Alternative
Direct and Indirect Jobs*	3.4	0	2.3
Federal Payments to Counties**	$1,215	0	$810

*Approximately 1.14 jobs per 100 livestock

**The amount shown under current management is based on 25 percent of the Fossil Creek allotment grazing fees paid to Yavapai and Coconino Counties at the 2007 grazing fee rate of $1.35 per head month. Not shown in this amount are the taxes that counties collect on range structural improvements. These taxes are based on a percentage of the assessed values of those improvements and the materials purchased for the construction of these improvments.

Quantifiable factors such as economic costs and outputs, along with projected animal months (AM) or animal unit months (AUM) have been used to help describe the economic effects of grazing on the Fossil Creek Allotment. The Quicksilver economic analysis program was used to calculate these factors. For this analysis, the initial maximum stocking level of 300 head was used for the Proposed Action Alternative and the initial maximum stocking level of 200 head was used for the Reduced Utilization and Grazing Intensity Alternative. Although projections from the Quicksilver model are precise numbers, these results are best used as indicator of change and a relative indicator of economic values, rather than a precise measurement. Additionally, identifying some of these effects is difficult, if not impossible, as economic effects tend to deal with personal issues.

The investment analysis anticipates the rate of return for the projected expenditures by the permittee and Forest Service on the Fossil Creek Allotment for a 10 year term. Measures used to conduct an investment analysis include: present value of benefits, present value of costs, present net value and the benefit/cost ratio. Table 33 displays the results of this investment analysis for the Proposed Action, the No Action, and the Reduced Utilization and Grazing Intensity Alternative for the Fossil Creek Allotment. These values have been rounded to the nearest dollar.

Table 33. Investment analysis for the Fossil Creek Range Allotment

Investment Analysis	Proposed Action	No Action	Reduced Utilization and Grazing Intensity Alternative
Forest Service			
Present Value of Benefits[6]	$44,279	0	$29,519
Present Value of Costs[7]	($109,466)	($3,000)	($109,466)

[6] *Present value of benefits* represents the income generated from grazing on the Fossil Creek Allotment by the permittee, along with the present value of the grazing fees collected by the Forest Service.

Investment Analysis	Proposed Action	No Action	Reduced Utilization and Grazing Intensity Alternative
Present Net Value[8]	($65,187)	($3,000)	($79,946)
Benefit/Cost Ratio[9]	0.40	0	0.27
Permittee – Fossil Creek			
Present Value of Benefits	$271,578	0	$181,052
Present Value of Costs	($121,444)	0	($106,684)
Present Net Value	$150,134	0	$74,367
Benefit/Cost Ratio	2.24	0	1.70
Permittee – Ikes Backbone[10]			
Present Value of Benefits	0	0	0
Present Value of Costs	0	($6,000)	0
Present Net Value	0	($6,000)	0
Benefit/Cost Ratio	0	0	0
All Partners			
Present Value of Benefits	$315,857	0	$210,571
Present Value of Costs	($230,910)	($9,000)	($216,150)
Present Net Value	$84,947	($9,000)	($5,579)
Benefit/Cost Ratio	1.37	0	0.97

Note: Dollar figures in ( ) indicate a negative amount, or loss of money

Effects to the Fossil Creek Permittee

Gross revenue estimates are created by estimating the amount of calves produced each year for each alternative. For this analysis, the initial maximum stocking level of 300 head was used for the Proposed Action Alternative and the initial maximum stocking level of 200 head was used for the Reduced Utilization and Grazing Intensity Alternative. The Estimated Gross Revenue does not include projections for the permittee's actual costs, the ability to cover costs, or any supplemental income that may be available. Table 34 represents a comparison of the Proposed Action, the No Action, and the Reduced Utilization and Grazing Intensity Alternative for Estimated Gross Annual Revenue. The following factors were used in the calculations for Table34: 15 percent of the permitted livestock are non-productive animals (young replacement animals and bulls); 80 percent calf crop; average sale weight of 500 pounds per calf; average sale price of $1.25 per pound (2006)[11]. These factors will vary annually but serve as a point of comparison.

[7] *Present value of costs* represents the cost of range improvement maintenance, range improvement construction, and range inspections (permittee), along with the costs of range inspections, permit administration, monitoring and materials for new range improvements (Forest Service).

[8] *Present net value* represents present value of benefits minus present value of costs.

[9] *Benefit/cost ratio* represents the present value of benefits divided by the present value of costs.

[10] *Ikes Backbone Permittee* is displayed because if the No Action Alternative is selected the costs of contructing and maintaining the new allotment boundary fence at Stehr Lake will be the responsibility of the Ikes Backbone permittee.

[11] The numbers do not add up to 100 because they are referring to different factors used to calculate the estimate. Example for the PA (300 head): the 15% applies to the 300 head; 45 head (15%) are non-

Table 34. Estimated Gross Annual Revenue

Value	Proposed Action	No Action	Reduced Utilization and Grazing Intensity Alternative
Estimated Gross Annual Revenue	$127,500	0	$85,000

If the allotment was not grazed, the permit for grazing livestock on this allotment would be cancelled. The permittee would lose future potential revenue derived from the sale of livestock that would have been produced on the Fossil Creek Allotment.

Initially, the Proposed Action provides the greater gross annual revenue to the Fossil Creek permittee. However, as soil and vegetation conditions improve, authorized livestock numbers will likely increase and the differences in estimated gross annual revenue between the Proposed Action and the Reduced Utilization and Grazing Intensity Alternative will become smaller. Again, if conditions warrant stocking at 200 head under the Proposed Action, (following adaptive management), then the revenues would be the same for both alternatives.

No complete projections were made for the permittee's actual costs, the ability to cover costs, or any supplemental income that may be available.

Effects to Local and Federal Economy

The No Action alternative will result in the loss of fees to the U.S. Treasury and annual Federal payments to Yavapai and Coconino Counties for livestock grazing on the Fossil Creek Allotment. This loss, by itself, is not substantial; however, the counties would also lose revenues from taxes on structural improvements and the state would lose tax revenues based on the permittee's use of Federal lands. Under this alternative, all jobs directly associated with livestock grazing on the Fossil Creek Allotment would be eliminated. Some of the jobs indirectly associated with livestock grazing on the Fossil Creek Allotment may also be eliminated; however, most indirect jobs will likely be maintained because the need for ranching supplies and services will continue to be filled by other area ranches and individuals/businesses from the surrounding communities. Since livestock grazing does not limit recreational uses, it is not anticipated that the local economies will be enhanced due to increased recreational use once livestock are removed.

The Proposed Action, and to a lesser degree the Reduced Utilization and Grazing Intensity Alternative, will help maintain current jobs within the surrounding communities and revenues to Yavapai County, Coconino County, the State of Arizona and the Federal

reproductive animals, which leave 255 head as reproductive animals (cows). The 80% calf crop applies to only the reproductive portion of the total herd; 255 head. X 80% = 204 calves.

Government. As changes to the authorized livestock numbers on the Fossil Creek Allotment occur through the implementation of adaptive management, contributions to state, county and local economies from fees, taxes and jobs associated with livestock grazing on this allotment would change accordingly.

Environmental Justice

Environmental Justice (EJ) is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation and enforcement of environmental laws, regulations and policies. Executive Order No. 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" (February 11, 1994) requires agencies to address environmental justice concerns within the context of existing laws, including NEPA. One goal of environmental justice is not to shift risks among populations, but to identify potential disproportionately high and adverse effects and to identify alternatives that may mitigate these impacts.

Information summarized here is from the *Environmental Justice Report* prepared by P. Haessig, 2007 (PR#187). The majority of the Fossil Creek Allotment is contained within Yavapai County. Information and statistics used to evaluate minority and low income populations is summarized from U.S. Census data (U.S. Census Bureau 2007) and community profiles for Camp Verde, Lake Montezuma/Rimrock and McGuireville (Arizona Department of Commerce, 2007a; 2007b).

Yavapai County has a population estimate in 2006 of about 213,285 persons, and reports a median household income of $37,309 which is within 10% of the Arizona state median level for 2004 estimated at $43,696. Unemployment rates for local communities are 5.0% for Camp Verde and 3.8% for Montezuma Well/Rimrock and McGuireville (2006 data). These communities have a large retiree population. Ethnic minority populations in the county are dominated by persons of Hispanic or Latino origin estimated at 11.6% which is much lower than the state average of 28%. Relative percents of other ethnic groups are also lower than the statewide averages. Major employment in the Camp Verde area is provided by construction, ranching, light-industry, trade and service, a casino, government and schools, and tourism.

After considering the environmental, economic, and social impacts of this project, it has been determined that none of the alternatives considered in this analysis would have a disproportionate impact on any minority or low income population in the immediate area, within surrounding counties, or in the central and northern Arizona region. Either not authorizing or authorizing livestock grazing would not prevent access to the Fossil Creek Allotment, nor would it prevent minority or low income individuals from recreating within the allotment, collecting firewood or other special forest products within the area. The No Action, No Grazing Alternative would negatively affect the permittee and other providers of goods and services used for the ranching business. However, this would only affect a few individuals and would not likely disproportionately affect the greater population within the county or the local community.

Chapter 4 – Monitoring and Adaptive Management

Range Monitoring and Adaptive Management

This chapter describes adaptive management and monitoring component of range management. Project design features for the range resource and other resource monitoring is described in Chapter 2. Both of the grazing alternatives, the Proposed Action Alternative and the Reduced Utilization and Grazing Intensity Alternative will implement adaptive management. Adaptive management provides a menu of management options that may be needed to adjust management decisions and actions to meet desired conditions as determined through monitoring (Figure 5). A critical component of adaptive management is monitoring.

Under both of the grazing action alternatives, two types of monitoring will be used for upland vegetation: ***implementation monitoring and effectiveness monitoring.*** Under the No Action Alternative, monitoring of upland vegetation would not continue. Both qualitative and quantitative monitoring methods will be used in accordance with the Interagency Technical References, Region 3 Rangeland Analysis and Management Training Guide, (USDA – Forest Service 1997) and the Region 3 Allotment Analysis Handbook. Monitoring frequency varies by each activity and will be accomplished collaboratively by Forest Service personnel, permittee, and cooperating agencies.

Implementation Monitoring

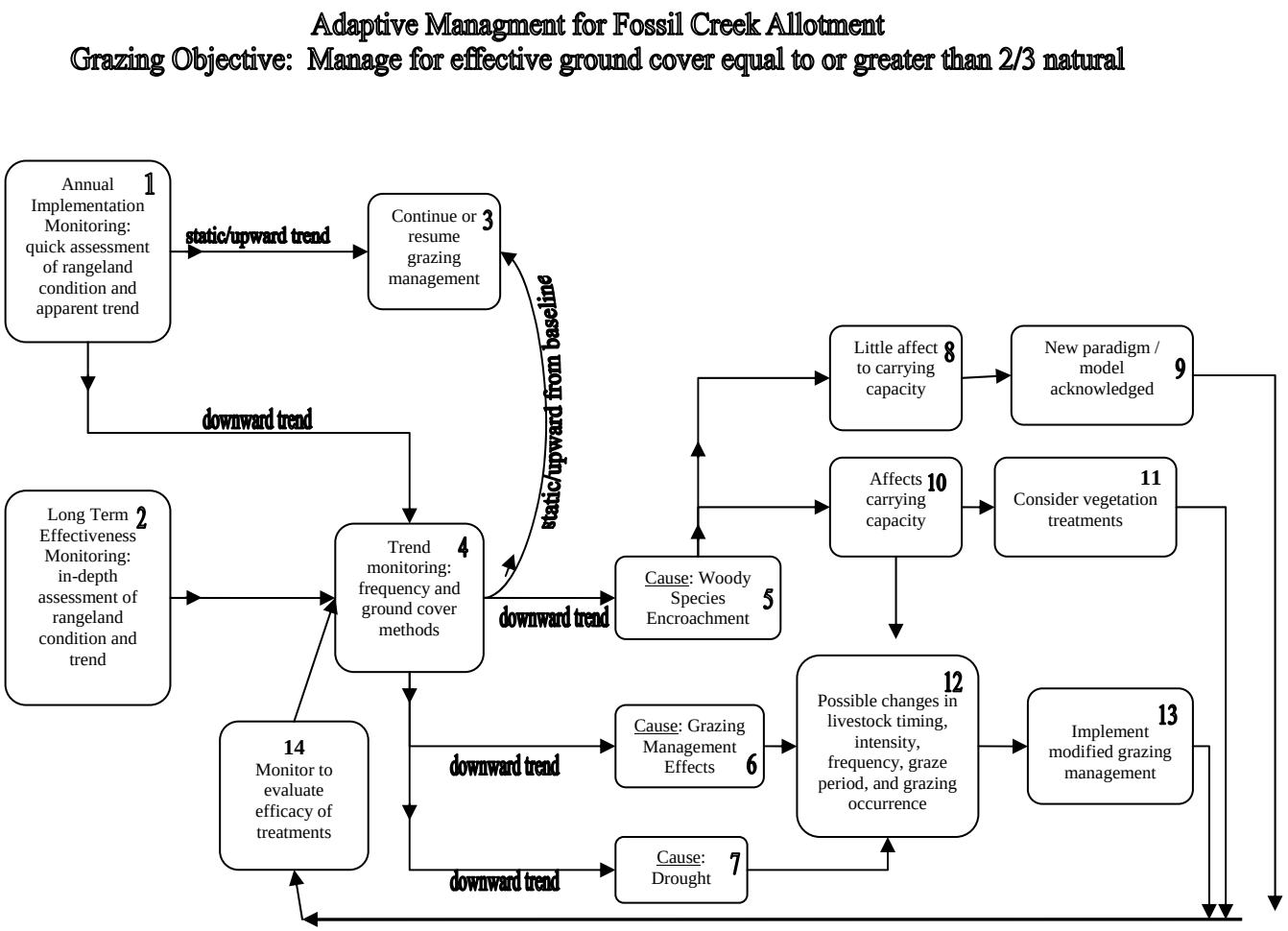
Implementation monitoring will be conducted on an annual basis and will include: permit compliance, livestock actual use data, grazing intensity, utilization, assessments of forage production and ground cover, precipitation, and allotment inspections.

Permit Compliance: Throughout each grazing season, Forest Service personnel will monitor activities on the allotment to ensure compliance with Permit terms and conditions, the Allotment Management Plan (AMP), and the Annual Operating Instructions (AOI).

Livestock Actual Use: Permittee will keep accurate records regarding actual livestock numbers and pasture use dates on the form supplied as part of the AOI. This form will be submitted to the Forest Service at the end of the grazing season.

Grazing Intensity: Grazing intensity monitoring will occur within each of the main grazing pastures during, or immediately after, the period when livestock are grazing the pasture. Each pasture would be visited two times every year. Grazing intensity is

Figure 5. Monitoring and Adaptive Management Flow Chart



as the amount of herbage removed through grazing or trampling during the grazing period. Grazing intensity will be used by the Forest Service and the permittee to control actual pasture moves. Livestock may need to be moved out of a pasture sooner if the grazing intensity guideline is reached before the planned move date. Likewise, livestock may stay longer in a pasture if grazing intensity is below the established guideline when the planned move date arrives.

Grazing intensity measurements will be taken in key areas which reflect grazing effects within an entire pasture. A minimum of one key area will be established within each main grazing pasture, at existing long-term monitoring sites if possible, to represent the overall grazing intensity within the pasture.

Utilization: Utilization monitoring will occur at the end of the growing season within each of the main grazing pastures. Utilization is defined as the proportion or degree of current year's forage production that is consumed or destroyed by animals (including insects). It is a comparison of the amount of herbage left compared with the amount of herbage produced during the year. Utilization is measured at the end of the growing season when the total annual production can be accounted for and the effects of grazing in the whole management unit can be assessed.

Utilization measurements will be taken in key areas which reflect grazing effects within an entire pasture. A minimum of one key area would be established within each main grazing pasture, at existing long-term monitoring sites if possible, to represent overall pasture utilization. Utilization guidelines are not intended as inflexible limits. Utilization measurements can indicate the need for management changes prior to this need being identified through long term monitoring. Utilization data would not be used alone, but would be used along with climate and condition/trend data, to determine stocking levels and pasture rotations for future years.

If monitoring shows that the utilization guideline was exceeded in a pasture, the grazing schedule and/or livestock numbers would be adjusted for the following year. If utilization is exceeded after these adjustments are made, then changes would be made to the grazing management system.

Forage Production and Ground Cover: Forage production assessments will be made to determine stocking levels for the grazing season and will also be used during the grazing season to determine if adjustments in the stocking level would be made. Qualitative assessments of ground cover will also be made and used as an indicator of apparent condition and trend; observed changes may indicate the need to conduct effectiveness monitoring (condition and trend) prior to the scheduled interval.

Precipitation: Precipitation is currently recorded at 4 sites that approximate the precipitation for the allotment. Two additional precipitation gauges may be placed on the allotment for more localized information.

Allotment Inspection: A written summary will be completed each year by Forest Service personnel to document the overall history of that year's grazing. This document will include a monitoring summary, livestock actual use, weather history, and a discussion of the year's accomplishments and problems. Information from this report will be used in preparing the following year's grazing plan.

Effectiveness Monitoring

Effectiveness monitoring will be used to evaluate the success of management in achieving the desired objectives. Effectiveness monitoring will occur within key areas on permanent transects at an interval of 10 years or less. Effectiveness monitoring may also be conducted if data and observations from implementation monitoring (annual monitoring) indicate a need. Effectiveness monitoring will include forage production and vegetation condition and trend.

Forage Production: Forage production surveys will be conducted using the best available methods at that time. Forage production data will be used as a tool to manage this allotment, but will not be the sole measurement to establish carrying capacity. The most recent forage production survey was completed in 2006. The next survey is scheduled to occur after 2015.

Range Condition and Trend: Eighteen Parker Three-Step clusters were established throughout this allotment in 1961; fifteen of these permenant transects still exist. These transects are one of the best historic records of range condition and trend. The photo points and vegetative ground cover data show how the site has changed over time. Canopy cover and frequency plots were placed adjacent to the existing Parker Three-Step transects in 2007 to add to this historic data.

Ocular plant canopy cover 0.10-acre plots will be used to compare existing conditions with potential and desired vegetative community conditions. Over time, these plots will document canopy cover changes.

Frequency and ground cover data will be collected using the widely accepted plant frequency method as described in Rule (1997). These plots will monitor trends in plant species abundance, plant species distribution and ground cover. This will provide information on plant composition and additional information on regeneration.

Initially, two to three years of baseline data will be collected from the canopy cover and frequency plots. After the baseline data has been collected, these transects will be read at least every 10 years by Forest Service personnel.

In the case that changing circumstances require physical improvements or management actions not disclosed or analyzed herein, further interdisciplinary review would occur. The review would consider the changed circumstances and site-specific environmental effects of the improvements in the context of the overall project. Based on the results of the interdisciplinary review, the District Ranger would determine whether correction,

supplementation or revision of the EA is necessary in accordance with Forest Service Handbook direction at FSH 1909.15(18) and FSH 2209.13(96.1).

Soil and Riparian Condition: The intergovernmental agreement between the Forest Service and State of Arizona that controls water quality and the Clean Water Act requires implementation and effectiveness monitoring. The objectives of monitoring are to: (1) collect data sufficient to evaluate effects of management activities on soil and water resources; and (2) support changes in management activities to protect soil and water quality. Monitoring will help determine how successfully managers are implementing guidance practices and how effectively those practices are protecting soil and water quality. The current and proposed livestock grazing system incorporates best management practices (BMPs) specific to grazing practices and constitutes compliance with Arizona State and Federal Water Quality Standards. Arizona Department of Water Quality (ADEQ) will continue to monitor water quality in the area.

Watershed condition can be assessed using information from the monitoring schemes described above. Monitoring of plant abundance, ground cover, species diversity, and estimates of overall soil condition (using the methods described throughout this monitoring section) will indicate whether or not management practices are effectively meeting management goals. Trends toward improvements in species abundance and diversity as well as ground cover would indicate that management practices are effectively improving soil condition and, by inference, maintaining or improving downstream water quality and complying with water quality standards. Conversely, decreases in plant abundance and species diversity may indicate that management practices are not effective and need to be changed. Environmental factors, especially precipitation, will be considered when evaluating monitoring results.

As stated in Chapter 2, Monitoring, Soil, Watershed and Fisheries Resources, soil condition assessments will be conducted at least once every 10 years. Riparian areas will be assessed for Proper Functioning and Condition at least once every ten years. Initially, two to three years of baseline soil condition data will be collected on unsatisfactory soils in the Boulder and Stehr Lake pastures. After the baseline data has been collected, these transects will be read at least once every 10 years by Forest Service personnel to assess the effects of grazing on unsatisfactory soils.

Chapter 5 – Consultation and Coordination

The Forest Service consulted the following individuals, Federal, State, and local agencies, tribes and non-Forest Service persons during the development of this environmental assessment:

Interdisciplinary Team Members

Heather Provencio – Red Rock Ranger District, District Ranger
Carol Holland – Mogollon Rim Ranger District, Planning Staff Officer, IDT Leader
Gary Hase Jr. – Peaks and Mormon Lake Ranger Districts, Rangeland Management Specialist
Polly Haessig – Mogollon Rim Ranger District, NEPA Specialist/Writer Editor
Jerry Gonzales – Mogollon Rim Ranger District, Recreation Staff Officer
William Stafford – Red Rock Ranger District, Recreation Staff Officer
Jill Oertley – Mogollon Rim Ranger District, District Wildlife Biologist
Janie Agyagos – Red Rock Ranger District, District Wildlife Biologist
Travis Bone – Red Rock Ranger District, District Archeologist
Dirk Renner – Coconino National Forest, Forest Fisheries Biologist
Dick Fleishman – Mogollon Rim/Peaks/Mormon Lake Ranger Districts, Soil & Water Specialist
Debbie Crisp – Coconino National Forest, Botanist
Carol Boyd – Coconino National Forest, Forest Stewardship Staff Officer, Noxious and Invasive Weeds
Carl Beyerhelm – Mogollon Rim Ranger District, GIS/Data Base Specialist
Melinda Roth – Mogollon Rim Ranger District, District Ranger
Sandra Nagiller – Coconino National Forest, NEPA Coordinator
Rodger Zanotto, Facilitator

Federal, State, and Local Officials and Agencies

U.S. Fish and Wildlife Service, – Brenda Smith
U.S. Fish and Wildlife Service – Shaula Hedwall
Ed Armenta, Tonto National Forest, Payson Ranger District, District Ranger
Dee Hines, Prescott National Forest, Verde Ranger District, District Ranger
Colleen Madrid, Tonto National Forest, Cave Creek Ranger District, District Ranger
Arizona Game and Fish Department – Rick Miller
Arizona Game and Fish Department – Susan MacVean
Yavapai County Board of Supervisors

Permittees

Herbert Ward – Permittee, Ward Ranch
Vida Ward – Permittee, Ward Ranch
Walt Richburg – Ward Ranch
Justin MacDonald – Fossil Creek and 13 Mile Rock Allotments, Ranch Foreman

Tribes

Yavapai-Apache Nation, Fort McDowell Yavapai Nation, Hopi Tribe, Hualapai Tribe, Havasupai Tribe, Navajo Nation, Pueblo of Zuni, San Carlos Apache Tribe, San Juan Southern Paiute Tribe, Tonto Apache Tribe, Yavapai-Apache Nation, Yavapai-Prescott Tribe, and White Mountain Apache Tribe

Responded During Initial Public Scoping

Chip Davis, District 3 Supervisor, Yavapai County Board of Supervisors
Thomas D. Lustig, and Joseph M. Feller, National Wildlife Federation
Diana Marsh, Arizona Department of Environmental Quality
Richard Miller, Arizona Game and Fish Department
Warren S. Smith II, Houston Creek Ranch, Ikes Backbone Allotment
Phil Smithers, Arizona Public Service
Steven L. Spangle, U.S. Fish and Wildlife Service
Herbert Ward, Ward Ranch, Rimrock, Arizona

Glossary and Acronyms

A

ADEQ: Arizona Department of Environmental Quality

Adaptive Management: Adaptive management is a formal, systematic, and rigorous approach to learning from the outcomes of management actions, accommodating change and improving management. It involves synthesizing existing knowledge, exploring alternative actions and making explicit forecasts about their outcomes. Management actions and monitoring programs are carefully designed to generate reliable feedback and clarify the reasons underlying outcomes. Actions and objectives are then adjusted based on this feedback and improved understanding. The alternatives are designed to provide sufficient flexibility to adapt management to changing circumstances. If monitoring indicates that desired conditions are not being achieved, management will be modified in cooperation with the permittee. Changes may include administrative decisions such as the specific number of livestock authorized annually; specific dates of grazing, class of animal or modifications in pasture rotations, but such change will not exceed the limits for timing, intensity, duration and frequency defined for the alternatives.

Allotment Management Plan (AMP): A document that specifies the actions to be taken on individual allotments to manage and protect the rangeland resources and reach the stated set of objectives. A long-term operating plan which is the implementing document for the decision made through the National Environmental Policy Act process and promotes progress toward desired future conditions.

Annual Operating Instructions (AOI): A set of instructions cooperatively developed by the Forest Service and range permittee on an annual basis that explains the specific pastures to be used and adjustments to the allotment management plan for the current year.

Animal Unit (AU): Considered to be one mature cow (approximately 1,000 pounds), either dry of or with a calf up to six months of age, or their equivalent, based on a standardized amount of forage consumed.

Animal Unit Month (AUM): The amount of dry forage required by an animal unit for one month, based on a forage allowance of 26 pounds of dry matter per day. Not synonymous with head month.

Apparent Condition and Trend: An interpretation of condition and trend based on observation and professional judgment at a single point in time. It includes, but is not limited to, consideration of such factors as plant species composition, plant species density, plant vigor, abundance of seedlings and young plants, accumulation or lack of plant residues on the soil surface, and soil surface characteristics (i.e. crusting, gravel pavement, pedestalled plants, and sheet or rill erosion).

B

Best Management Practices (BMPs): A combination of practices that are the most effective and practical means of achieving resource protection objectives (primarily water quality protection) during resource management activities.

Browse: (1) The part of shrubs, half shrubs, woody vines, and trees available for animal consumption; or (2) to search for or consume browse.

Browse Plant or Browse Species: a shrub, half shrub, woody vine, or tree capable of producing shoot, twig, and leaf growth suitable for animal consumption.

C

Carrying Capacity: The average number of livestock and/or wildlife which may be sustained on a management unit compatible with management objectives for the unit. In addition to site characteristics, it is a function of management goals and management intensity. Capacity classifications are described as follows:

Full Capacity - Lands which can be used by grazing animals under proper management without long term damage to the soil resource or plant communities. The land is stable and vegetative ground cover is maintaining site productivity and producing a minimum of 100 pounds of forage per acre on slopes less than 40%.

Potential Capacity - Areas that could be used by grazing animals under proper management but where soil stability is impaired, or range improvements are not adequate under existing conditions to obtain necessary grazing animal distribution. Grazing capacity may be assigned to these areas, but conservative allowable use assignments must be made.

No Capacity - Areas that cannot be used by grazing animals without long-term damage to the soil resource or plant community, or are barren or unproductive naturally. In addition, it includes areas that produce less than 100 pounds per acre of forage and/or are on slopes greater than 40 percent. Grazing capacity is not assigned to sites with a “no capacity” classification.

Condition: As evaluated and ranked by the Forest Service, is a subjective expression of the status or health of the vegetation and soil relative to their combined potential to produce a sound and stable biotic community. Soundness and stability are evaluated relative to a standard that encompasses the composition, density, and vigor of the vegetation and the physical characteristics of the soil.

Corral: A range improvement that generally is made of logs, boards or pipe, and is used to hold, load, or unload livestock.

Critical Habitat: That portion of a wild animal's habitat that is critical for the continued survival of the species ("Critical" is a formal designation under the Endangered Species Act).

Cumulative Effects: The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions (40 CFR § 1508.7).

D

Decision Notice: A decision document prepared for an environmental assessment that explains the rationale for the decision.

Deferment: The delay of grazing to achieve a specific management objective. A strategy aimed at providing time for plant reproduction, establishment of new plants, restoration of plant vigor, a return to environmental conditions appropriate for grazing, or the accumulation of forage for later use.

Deferred Rotation Management: A grazing management system that provides for a systematic rotation of the deferment among pastures.

Deferred, Rest-Rotation Management: A grazing management system which incorporates both deferment and rest in a systematic rotation among pastures.

Developed Recreation: Recreation areas that require facilities that result in concentrated use of an area. Examples are campgrounds and ski areas. Facilities might include roads, parking lots, picnic tables, toilets, water systems, ski lifts, and buildings.

Direct Effects: The effects caused by the action and occur at the same time and place (40 CFR§ 1508.8).

Dispersed Recreation: Recreation use that occurs outside of developed sites and requires few, if any, improvements other than roads and trails. Representative activities are hiking, backpacking, driving for pleasure, viewing scenery, snowmobiling, cross-country skiing, hunting, off-road vehicle use, and berry picking.

E

Ecological Units: Map units designed to identify land and water areas at different levels of resolution based on similar capabilities and potentials for response to management and natural disturbance. These capabilities and potentials derive from multiple elements: climate, geomorphology, geology, soils and potential natural vegetation. Ecological units should, by design, be rather stable. They may, however, be refined or updated as better information becomes available.

Effects: The results expected to be achieved from implementation of actions relative to physical, biological, and social (cultural and economic) factors resulting from the achievement of outputs. Examples of effects are tons of sediment, pounds of forage, person-years or employment, and income. There are direct effects, indirect effects, and cumulative effects.

Emergent Vegetation: Plants rooted underwater that grow above the surface of the water.

Environmental Assessment (EA): A "concise public document [that] briefly provides sufficient evidence and analysis for determining whether to prepare an EIS or a finding of no significant impact…and shall include brief discussions of the need for the proposal…alternatives…the environmental impacts of the proposed action and alternatives…[and] a listing of agencies and persons consulted." (40 CFR 1508.9).

F

Finding of No Significant Impact (FONSI): A document briefly presenting the reasons why an action will not have a significant effect on the human environment and for which an environmental impact statement will not be prepared (40 CFR 1508.13).

Forage: All non woody plants (grass, grass-like plants, and forbs) and portions of woody plants (browse) available to domestic livestock and wildlife for food. Only a portion of a plant is available for forage if the plant is to remain healthy.

Forage Production: The weight of forage that is produced within a designated period of time or a given area. Production may be expressed as green, air dry, or oven dry weight. The term may also be modified as to time of production such as annual, current year, or seasonal forage production.

G

Game Species: Any species of wildlife or fish for which seasons and bag limits have been prescribed and which are normally harvested by hunters, trappers, and fishermen under State or Federal laws, codes, and regulations.

Grasslands: Lands where the vegetation is dominated by grasses, grass-like plants, and/or forbs. Non-forest land is classified as grassland when herbaceous vegetation provides at least 80 percent of the canopy cover excluding trees.

Grazing Intensity: This is defined as the amount of herbage removed through grazing or trampling during the grazing period.

Grazing Intensity Level: Descriptors for grazing intensity levels as determined at the end of the grazing period (FSH, R3-2209.13-2007-1).

Light to non-use 0-30 percent

Conservative	31-40 percent
Moderate	41-50 percent
Heavy	51-60 percent
Severe	61+ percent

Grazing Period: The percentage of forage produced in the current season, to the date of the measurement, that has been consumed or trampled by animals. It is a comparison of the amount of herbage left compared with the amount of herbage that has been produced to the date of the measurement. Grazing intensity is measured at the end of a grazing period. Grazing intensity differs from utilization because it does not account for subsequent growth of either the ungrazed or grazed plants. May also be referred to as "seasonal utilization" or "relative utilization".

H

Head Month (HM): One month's use and occupancy of range by one weaned or adult animal cow, bull, steer, heifer, horse, burro, mule or five sheep or goats.

Herding: A strategy for managing livestock that maintains the animals in a "herd", and moves them from area to area.

Hydrophytic Plant: A perennial vascular aquatic plant having its over-wintering buds underwater.

I

Impaired Soil Condition: Indicators signify a reduction in soil quality. The ability of the soil to function properly has been reduced and/or there exists an increased vulnerability to irreversible degradation. An impaired category should signal land managers that there is a need to investigate the ecosystem further to determine the cause and degree of decline in soil functions. Changes in management practices or other preventative actions may be appropriate.

Important Bird Area (IBA): an internationally recognized place on the landscape that provides exceptionally valuable or essential habitat for one or more species of birds, including breeding, wintering or migratory habitat.

Indirect Effects: Effects caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable (40 CFR § 1508.8).

Interdisciplinary Team (IDT): A group of individuals with skills from different disciplines. An interdisciplinary team is assembled because no single scientific discipline is sufficient to adequately identify, analyze, and resolve issues or problems.

Issue: A subject, question, or conflict of widespread public discussion or interest regarding management of National Forest System lands.

K

Key Area: A portion of rangeland selected because of its location, grazing or browsing value, or use. It serves as a monitoring and evaluation point for range condition, trend, or degree of grazing use. Properly selected key areas reflect the overall acceptability of current grazing management over the rangeland. A key area guides the genereal management of the entire area of which it is a part.

L

Lane: A fenced pathway that allows livestock access, typically to a water source.

M

Management Area (MA): As defined in the "Coconino National Forest Plan." An area that has common direction throughout and that differs from neighboring areas. The entire forest is divided into management areas where common standards and guidelines apply.

Management Indicator Species: Any species, group of species, or species habitat element selected to focus management attention for the purpose of resource production, population recovery, maintenance of population viability, or ecosystem diversity (FSM 2605).

Microphytic Soil Crust: Formed when all or some of a diverse array of photosynthetic blue-green algae, fungi, bacteria, lichens, and mosses bind together with inorganic particles in the first few millimeters of a soil (also called cryptogamic crust).

Mitigation Measures: Actions that are taken to lessen the severity of effects of other actions.

N

Nongame Species: Animal species that are not usually hunted.

Nonpoint source (NPS) pollution is water pollution affecting a water body from diffuse sources, rather than a point source which discharges to a water body at a single location.

O

Old-Growth: Stand of timber that is past full maturity and well into old age and is the last stage in forest succession.

Overstory: That portion of trees, in a stand of trees of more than one story, forming the upper or canopy layer.

P

Permittee: An individual who has been granted a Federal permit to graze livestock for a specific period of time on a range allotment.

Prescribed Fire: Fires set under conditions specified in an approved plan to dispose of fuels, control unwanted vegetation, stimulate growth of desired vegetation, and change successional stages to meet range, wildlife, recreation, wilderness, watershed, or timber management objectives.

Present Net Benefit: Future benefits "discounted" to the present by an interest rate that reflects the changing value of a dollar over time. The assumption is that dollars today are more valuable dollars in the future.

Present Net Cost: Future costs "discounted" to the present by an interest rate that reflects the changing value of a dollar over time. The assumption is that dollars today are more valuable dollars in the future.

Present Net Value: "The difference between the discounted value (benefits) of all outputs to which monetary values or established market prices are assigned and the total discounted costs of managing the planning area." (36 CFR 219.3)

Proper Functioning Condition (PFC): A methodology for assessing the physical functioning of riparian and wetland areas. The term PFC is used to describe both the assessment process, and a defined, on-the-ground condition of a riparian-wetland area. In either case, PFC defines a minimum or starting point. The PFC assessment provides a consistent approach for assessing the physical functioning of riparian-wetland areas through consideration of hydrology, vegetation, and soil/landform attributes. The PFC assessment synthesizes information that is foundational to determining the overall health of a riparian-wetland area. The on-the-ground condition termed PFC refers to *how well* the physical processes are functioning. PFC is a state of resiliency that will allow a riparian wetland system to hold together during a 25- to 30-year flow event, sustaining that system's ability to produce values related to both physical and biological attributes.

Proposed Action (PA): In terms of the National Environmental Policy Act, the proposed action is the project, activity, or action that a Federal agency proposes to implement or undertake. The PA is sent to the public and interested agencies for their review and comment.

Protected Activity Center (PAC): An area established around a Mexican spotted owl nest or roost site for the purpose of protecting the area. Management of these areas is largely restricted to managing for forest health objectives.

R

Range Allotment: A designated area of land available for livestock grazing. Usually a grazing permit is issued designating a specified number and kind of livestock to be grazed according to direction found in an allotment management plan. It is the basic land unit used in the management of livestock on National Forest System lands, and associated lands administered by the Forest Service.

Rangeland (Range): All land producing, or capable of producing, native forage for grazing and browsing animals, and lands that have been revegetated naturally or artificially to provide a forage cover that is managed like native vegetation. It includes all grasslands, forblands, shrublands, and those forested lands which can – continually or periodically, naturally or through management – support an understory of herbaceous or shrubby vegetation that provides forage for grazing or browsing animals.

Raptor: Any predatory bird such as a falcon, hawk, eagle, or owl.

Reservoir Wetland: Human-made deep perennial water pool most years, no significant hydrophytic vegetation (except for submergents) because of deep pool and/or fluctuations of pool level.

Rest: To leave an area of grazing land ungrazed or unharvested for a specific time, such as a year, a growing season, or a specified period required within a particular management practice.

Rest-Rotation Management: A grazing management system in which an individual pasture(s), or grazing unit(s), is given complete rest from livestock grazing for an entire year. The rested pasture will be rotated annually to provide all pastures on an allotment with a rest period.

Revegetation: Re-establishing and developing plant cover. This may take place naturally through the reproductive processes of existing flora or artificially by planting.

Riparian Area: Riparian ecosystems are distinguished by the presence of free water within the common rooting depth of native perennial plants during at least a portion of the growing season. Riparian ecosystems are normally associated with seeps, springs, streams, marshes, ponds, or lakes. The potential vegetation of these areas commonly includes a mixture of water (aquatic) and land (phreatic) ecosystems.

Recreation Opportunity Spectrum (ROS): A land classification system that categorizes National Forest land into six classes, each class being defined by its setting and by the probable recreation experiences and activities it affords. The six classes in the spectrum are: primitive, semi-primitive nonmotorized, semi-primitive motorized, roaded natural, rural, and urban (see individual definitions).

Semi-Primitive Motorized ROS Class (SPM): –Characterized by moderately dominant alterations by people, with strong evidence of primitive roads and/or trails.

Roaded Natural ROS Class (RN): Characterized by a predominantly natural environment with evidence of moderate permanent resource use. Evidence of sights and sounds of people is moderated but in harmony with the natural environment. Opportunities exist for both social interaction and moderate isolation from sights and sounds of people.

S

Satisfactory Soil Condition: Indicators signify that soil quality is being sustained and the soil is functioning properly and normally. Ability of the soil to maintain resource values, sustain outputs and recover from impacts is high.

Seasonal Utilization: The percentage of the forage produced in the current season, to date of measurement, removed by grazing. This percentage is different from utilization because it does not account for subsequent growth of either the ungrazed or grazed plants.

Sediment: Solid material, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by air, water, gravity, or ice, and has come to rest on the earth's surface either above or below sea level.

Sensitive Species: Plant and animal species identified by a regional forester for which population viability is a concern, as evidenced by significant current or predicted downward trends in population numbers or density, or significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution (FSM 2670.5(19)).

Seral: One stage in a series of steps in the process of ecological succession.

Snag: Standing dead tree from which the leaves or needles have fallen.

Stand: A plant community sufficiently uniform in cover type, age class, risk class, vigor, size class, and stocking class to be distinguishable from adjacent communities thus forming an individual management or silviculture unit. This term is most commonly used when referring to forested areas.

Stock Tank: An earthen tank for providing water for livestock and wildlife.

Structural Improvement (Range and Wildlife): Any type of range or wildlife improvement that is human-made such as fences, water developments, corrals, and waterfowl islands.

Succession: An orderly process of biotic community development that involves changes in species, structure, and community processes with time.

Suitability: "The appropriateness of applying certain resource management practices to a particular area of land, as determined by an analysis of the economic and environmental consequences and the alternative uses foregone. A unit of land may be suitable for a variety of individual or combined management practices." (36 CFR 219.3)

T

Terrestrial Ecosystem Survey Terrestrial Ecosystem Unit Inventory: (TES/TEUI): is the systematic examination, description, classification, mapping and interpretation of terrestrial ecosystems. A terrestrial ecosystem is an integrated representation of soil, climate and vegetation as modified by geology, geomorphology, landform and disturbance processes.

Threatened and Endangered Species (TES): Species identified by the Secretary of the Interior in accordance with the 1973 Endangered Species Act, as amended.

> *Threatened Species* - Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.
>
> *Endangered Species* - Any species that is in danger of extinction throughout all or a significant portion of its range.
>
> *Proposed Species* - Any species of fish, wildlife, or plant that is proposed in the Federal Register to be listed under Section 4 of the Endangered Species Act (50 CFR 402.02).

Transition Zone: As used for forest planning purposes, is the area of transition between ponderosa pine and pinyon-juniper. Includes the area where alligator juniper commonly occurs.

Trend: The direction of change in resource value ratings or attributes as observed over time. Apparent trend is an interpretation of trend based on observations and professional judgment at a single point in time. Measured trend is quantitative changes in vegetative or soil conditions over time, which can be measured in terms of plant communities or resource value ratings.

U

Understory: The trees and other woody species growing under a more or less continuous cover of branches and foliage formed collectively by the upper portion of adjacent trees and other woody growth.

Unsatisfactory Soil Condition: Indicators signify that degradation of soil quality has occurred. Impairment of vital soil functions results in inability of the soil to maintain resource values, sustain outputs and recover from impacts. Soils rated in the

unsatisfactory category are candidates for improved management practices or restoration designed to recover soil functions.

Utilization: The proportion or degree of current year's forage production by weight that is consumed or destroyed by animals (including insects). The term may refer either to a single plant species, a group of species, of the vegetation community as a whole. It is a comparison of the amount of herbage left compared with the amount of herbage produced during the year. Utilization is measured at the end of the growing season when the total annual production can be accounted for and the effects of grazing in the whole management unit can be assessed.

Utilization Guidelines: Guidelines developed for utilization that are intended to indicate a level of use or desired stocking rate to be achieved over a period of years.

Utilization Level: Descriptors for utilization levels as determined at the end of the growing season (FSH, R3-2209.13-2007-1).

Light to non-use	0-30 percent
Conservative	31-40 percent
Moderate	41-50 percent
Heavy	51-60 percent
Severe	61+ percent

V

Viable Populations: A wildlife or fish population of sufficient size to maintain its existence overtime in spite of normal fluctuations in population levels.

Visual Quality Objectives (VQOs): A desired level of visual quality based on physical and sociological characteristics of an area. Refers to the degree of acceptable alterations of the characteristic landscape.

- Retention (R). In general, management activities are not evident to the casual Forest visitor.
- Partial Retention (PR). In general, management activities may be evident but must remain subordinate to the characteristic landscape.
- Modification (M). Management activity may dominate the characteristic landscape but must, at the same time, use naturally established form, line, color, and texture. It should appear as a natural occurrence when viewed in middleground or background.

W

Waterlot: A range improvement usually constructed of fencing materials that enclose a watering structure that is used to hold livestock or to close the water off to livestock.

Watershed: An entire area that contributes water to a drainage or stream.

Wetlands: Areas with shallow standing water or seasonal to yearlong saturated soils including bogs, marshes, and wet meadows. Wetlands must have the following three attributes to be considered wetlands: (1) hydric soils, (2) hydrophytic vegetation, and (3) evidence of frequent inundation.

Wild and Scenic Rivers (WSR): Those rivers or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted (Wild and Scenic Rivers Act usage).

Wildfire: Any wildland fire that requires a suppression action. This includes all fires not meeting the requirements of a prescribed fire.

Woodland: Plant communities with a variety of stocking comprised of various species of pinyon pine and juniper, typically growing on drier sites

References Cited

Adler, P.B. and W.K. Lauenroth. 2000. Livestock Exclusion Increases the Spatial Heterogeneity of Vegetation in Colorado Shortgrasss Steppe. Applied Vegetation Science, v. 3 (2) p. 213-222.

Anderson, P. G. 1996. Sediment generation from forestry operations and associated effects on aquatic ecosystems, *in* Proceedings of the Forest-Fish Conference: Land Management Practices Affecting Aquatic Ecosystems, Calgary, Alberta. 23 p.

Archer, S. and F.E. Smeins. 1991. Ecosystem-Level Processes, *in* Grazing Management: An Ecological Perspective. R.K. Heitschmidt and J.W. Stuth (eds.), Timber Press, Portland, OR, p. 109-134.

Argent, D. G., and P. A. Flebbe. 1999. Fine sediment effects on brook trout eggs in laboratory streams. Fisheries Research v. 39: p. 253-262.

Arizona Department of Commerce, 2007a. Camp Verde Community Profile, 2 p.

Arizona Department of Commerce, 2007b. Lake Montezuma/Rimrock/McGuireville community Profile, 2 p.

Arizona Department of Environmental Quality (ADEQ), 2006. DRAFT 2006 Status of Surface Water Quality in Arizona Arizona's Integrated 305(b) Assessment and 303(d) Listing Report. Publication Number EQR 07-02. Available online at http://www.azdeq.gov/environ/water/assessment/download/2006/verde.pdf

Arizona Public Service. 2003. Noxious Weed Survey and Mapping for the Childs and Irving Hydroelectric Power Plant Site. Prepared by W.L. Bouchard & Associates, Inc.

Baker J.M., Waights V. 1994. The effects of nitrate on tadpoles of the tree frog (Litoria caerulea). Journal of Herpetology, v. 4 p. 106-108.

Barnett, L. O., and R. H. Hawkins. 2002. Reconnaissance watershed analysis on the upper and middle Verde Watershed. School of Renewable Natural Resources, University of Arizona, Tucson, Arizona. 117 p.

Belsky, A. J. and D. M. Blumenthal. 1997. Effects of livestock grazing on upland forests, stand dynamics, and soils of the interior West: livestock and the forest health crisis. Conservation Biology, v. 11(2) p. 315-327.

Belsky, A.J., A. Matzke, and S. Uselman. 1999. Survey of Livestock Influences on Stream and Riparian Ecosystems in the Western United States. Journal of Soil and Water Conservation., v. 54 (1) p. 419-431.

Bisson, P. A., and R. E. Bilby. 1982. Avoidance of suspended sediment by juvenile Coho salmon. North American Journal of Fisheries Management, v. 4: 371-374.

Bock, C.E. and J.H.Bock. 1984. Responses of Birds, Rodents, and Vegetation to Livestock Exclosure in a Semidesert Grassland Site. Journal of Range Management, v. 37(3) p. 239-242.

Bock, C.E. and J.H. Bock. 1990. The effect of livestock grazing upon abundance of the lizard, Sceloporus scalaris, in Southeastern Arizona. Journal of Herpetology, v. 24, No. (4), p. 445-446.

Bock, C.E., H.M.Smith, and J.H.Bock. 1990. The Effect of Livestock Grazing Upon Abundance of the Lizard, *Sceloporus scalaris*, in Southeastern Arizona. Journal of Herpetology, v. 24, (4), p. 445-446.

Bock, C.E. and J.H.Bock. 1993. Cover of perennial grasses in southeastern Arizona in relation to livestock grazing. Conservation Biology, v. 7, (2) p. 371 to 377.

Bredy et al. 1989, in Bock, C.E., H.M.Smith, and J.H.Bock. 1990. The Effect of Livestock Grazing Upon Abundance of the Lizard, *Sceloporus scalaris*, in Southeastern Arizona. Journal of Herpetology, v. 24, (4) p. 445-446.

Bridges, C.M., F. J. Dwyer, D. K. Hardesty and D.W. Whites. 2002. Comparative contaminant toxicity: Are amphibian larvae more sensitive than fish? Bulletin of Environmental Contamination and Toxicology, v. 69, p. 562-569

Briske D.D. 1991. Developmental Morphology and Physiology of Grasses, *in* Grazing Management: An Ecological Perspective. R.K. Heitschmidt and J.W. Stuth (eds.), Timber Press, Portland, OR. p. 85-108.

Buffington and Herbel, 1965, in Bock, C.E., H.M.Smith, and J.H.Bock. 1990. The Effect of Livestock Grazing Upon Abundance of the Lizard, *Sceloporus scalaris*, in Southeastern Arizona. Journal of Herpetology, v. 24, (4), p. 445-446.

Burgett, Amber A., Christian D. Wright, Geoffrey R. Smith, Doran T. Fortune, and Samuel L. Johnson. 2007. Impact of ammonium nitrate on wood frog (Rana sylvatica) tadpoles: Effects of survivorship and behavior. Herpetological Conservation and Biology v. 2(1), p. 29-34.

Chaney, E. W. Elmore, and W.S. Platts. 1990. Livestock grazing on Western riparian areas. Northwest Resource Information Center, Inc., Eagle, ID.

Chew 1982, in Bock, C.E., H.M.Smith, and J.H.Bock. 1990. The Effect of Livestock Grazing Upon Abundance of the Lizard, Sceloporus scalaris, in Southeastern Arizona. Journal of Herpetology, v. 24, (4), p. 445-446.

Clary, W.P. and W.C. Leininger. 2000. Stubble height as a tool for management of riparian areas. Journal of Range Management, v. 53 (6), p. 562-573.

Courtois, D.R., B.L. Perryman, and H.S. Hussein. 2004. Vegetation change after 65 years of grazing and grazing exclusion. Journal of Range Management, v. 57 p. 574-582.

De Solla, Shane R., Karen E. Pettit, Christine A. Bishop, Kimberly M. Cheng and John E. Elliott. 2002. Effects of agricultural runoff on native amphibians in the lower Fraser River Valley, British Columbia, Canada. Environmental Toxicology and Chemistry, v. 21, (2), February, p. 353.

Duff, 1979 in Fleischner 1994. Duff, Donald A. 1979. Riparian habitat recovery on Big Creek, Rich County, Utah. In Proceedings: Forum—Grazing and Riparian/Stream Ecosystems. Trout Unlimited, Inc. p. 91.

Elliot, W.J. 2002. Predicting sediment TMDLs for forest conditions with the WEPP model, in: Saleh, A., ed., Total Maximum Daily Load (TMDL) Environmental Regulations: Proceedings of the March 11-13 ASAE Conference, Fort Worth, TX. ASAE Publication Number 701P0102. p. 554-559.

Eneboe. E.J., B.F. Sowell, R.K. Heinschmidt, M.G. Karl and M.R. Haferkamp. 2002. Drought and Grazing: IV. Blue grama and western wheatgrass. Journal of Rangeland Management, v. 55, p. 73-79.

Fleischner, T. L. 1994. Ecological costs of livestock grazing in Western North America. Conservation Biology, v. 8, p. 629-644.

Galt, D., F. Molinar, J. Navarro, J. Joseph, and J. Holecheck. 2000. Grazing Capacity and Stocking Rate. Rangelands, v. 22(6) p. 6-11.

Gifford GF, R. H. Hawkins. 1978. Hydrologic impact of grazing on infiltration: A critical review. Water Resources Research, v. 14 p.305-13.

Godfrey, K., J. Holechek, M.Thomas, F.Molinar. 2007. Long-term vegetation productivity and Trend under two stock levels on Chihuahuan Desert Rangeland. Rangeland Ecology and Management, v. 50:165-171.

Gottfried, G. J., and R. D. Pieper. 2000. Pinyon-juniper rangelands. Pages 153-212 in Livestock Management in the American Southwest: Ecology, Society, and Economics (R. Jemison and C. Raish, Eds.). Elsevier, New York. In Milchunas, Daniel G. 2006. Responses of plant communities to grazing in the southwestern

United States. Gen. Tech. Rep. RMRS-GTR-169. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 126 p.

Haines, W.T. 1993. Watershed condition assessment of the Kehl, Leonard Canyon and Upper Willow Creek sub-watersheds of the East Clear Creek watershed on the Apache-Sitgreaves and Coconino National Forests. Hydro Science. Davis, CA. Contract for Coconino National Forest, Contract # 43-8167-2-0500.

Hatch, Audrey C. and Andrew R. Blaustein 2000. Combined effects of UV-B, nitrate, and low pH reduce the survival and activity level of larval cascades frogs (Rana cascadae). Archives of Environmental Contamination and Toxicology, v. 39, p. 494-499.

Hatch, Audrey C. and Andrew R. Blaustein 2003. Combined effects of UV-B radiation and nitrate fertilizer on larval amphibians. Ecological Applications, v. 13(4), p. 1083-1093.

Hayward, B., E.J.Heske, C.W.Painter. 1997. Effects of livestock grazing on small mammals at a desert cienaga. Journal of Wildlife Management, v. 61, (1) p. 123-129.

Heady, Harold F. 1984. Concepts and principles underlying grazing systems, *in* Developing strategies for rangeland management. Boulder, CO: Westview Press p. 885-902.

Hecnar, S.J. 1996. Acute and chronic toxicity of ammonium nitrate fertilizer to amphibians from southern Ontario. Environmental Pollution, v. 93, (3) p. 1996: 365.

Heino, J., P. Louhi, and T. Muotka. 2004. Identifying the scales of variability in stream macroinvertebrate abundance, functional composition and assemblage structure. Freshwater Biology, v. 49, p. 1230-1239.

Heinschmidt R.K. M.R. Haferkamp, M.G. Karl and A.L Hild. 1999. Drought and Grazing: I. Effects on quantity of forage produced. Journal of Range Management. 52:440-446.

Heske, E.J., M.Campbell, 1991. Effects of an 11-Year Livestock Exclosure on rodent and Ant numbers in the Chihuahuan Desert, Southeastern Arizona. The Southwest Naturalist, v. 36, (1) p. 89-93.

Holechek, Jerry L. 1981. Livestock grazing impacts on public lands: A viewpoint. Journal of Range Management, v. 34(3), p. 251-254.

Holecheck, J., H. Gomez, F. Molinar, and D. Galt. 1999. Grazing studies: what we've learned. Rangelands, v. 21(2), p. 12-16.

Holechek, J.L., R.D. Pieper, and C.H.Herbel. 1998. Range management principles and practices. 3rd edition. Prentice Hall. 542 p.

Holechek J.L., R.D. Pieper, and C.H. Herbel. 2001. Range Management: Principles and Practices. 4th Edition. Upper Saddle River, N.J.

Holechek, J.L., R.D. Pieper, and C.H. Herbel. 2004. Range management: principles and practices. 5th ed. Upper Saddle River, NJ: Prentice-Hall. 607 p.

Holechek, J.L., M.Thomas, F.Molinar, and D.Galt. 1999. Stocking desert rangelands: what we've learned. Rangelands, v. 21(6) , p. 8-12.

Holecheck, J., D.Galt, J.Joseph, J. Navarro, G. Kumalo, F. Molinar, and M. Thomas. 2003. Moderate and light cattle grazing effects on Chihuahuan desert rangelands. Journal of Range Management, v. 52, p. 440-446.

Howery, L. 1999. Rangeland Management Before, During, and After Drought. University of Arizona Cooperative Extension Publication 7/99, AZ1136. 6 p.

Hutchings and Stewart, 1953. Increasing forage yields and sheep production on intermountain winter ranges. U.S. Dept. Agric. Circ. 925.

Johansson, Markus, Katja Rasanen and Juha Merila. 2001. Comparison of nitrate tolerance between different populations of the common frog, Rana temporaria. Aquatic Toxicology, v., Issues 1-2, p. 1-14.

Jones, Allison. 2000. Effects of cattle grazing on North American arid ecosystems: A quantitative review. Western North American Naturalist, v. 60 (2), p. 155-164.

Jones, A.L. and W.S.Longland. 1999. Effects of Cattle Grazing on Salt Desert Rodent Communities. The American Midland Naturalist, v. 141, p. 1-11.

Jones, K.B. 1981. Effects of grazing on lizard abundance and diversity in western Arizona. The Southwestern Naturalist , v. 26(2), p. 107-115.

Jones K.B. 1988. Comparison of herpetofaunas of a natural and altered riparian ecosystem. *in* R.C. Szaro, K.E. Severson, and D.R. Patton, technical coordinators. Management of amphibians reptiles and small mammals in North America. General Technical Report RM-166. U.S. Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado, p. 222-227.

Keim, R. F., A. E. Skaugest, and D. S. Bateman. 2002. Physical Aquatic Habitat II. Pools and cover affected by large woody debris in three Western Oregon streams. North American Journal of Fisheries Management , v. 22, p. 151-164.

Khumalo, G., Holechek, J., Thomas, M., and Molinar, F. 2007. Long-term vegetation productivity and trend under two stocking levels on Chihuahuan Desert Rangeland. Rangeland Ecology and Management, *v.* 60. p. 165-171.

Knutson,M.G., W.B. Richarson, D.M.Reineke, B.Jeffrey, R.Parmelee, and S.E.Weick. 2004. Agriculural ponds support amphibian populations. Ecological Applications, v. 14 (3), 2004. p. 669-684.

Latta, M.J., C.J. Beardmore, and T.E. Corman. 1999. Arizona Partners in Flight Bird Conservation Plan. Version 1.0. Nongame and Endangered Wildlife Program Technical Report 142. Arizona Game and Fish Department, Phoenix, Arizona.

Lee, R. M., J. D.Yoakum, B.W. O'Gara, T. M. Pojar and R. A. Ockenfels, eds. 1998. Pronghorn Management Guidelines. 18th Pronghorn Antelope Workshop, Prescott, Arizona.

Lisle, T. E. 1989. Sediment transport and resulting deposition in spawning gravels, north coastal California. Water Resources Research, v. 25, p. 1303-1319.

Loeser, Matt R., Crews, T.E. and T. D. Sisk, 2004. Defoliation increased above-ground productivity in a semi-arid grassland. Journal of Range Management, v. 57(5), p. 442-447.

Macias, Guadalupe, Adolfo Marco and Andrew R. Blaustein 2007. Combined exposure to ambient UVB radiation and nitrite negatively affects survival of amphibian early life stages. Science of the Total Environment, v. 385, p. 55-65.

Magilligan, F. J., and P. F. McDowell. 1997. Stream channel adjustments following elimination of cattle grazing. Journal of the American Water Resources Association v. 33, p. 867-878.

Marco, Adolfo, Consuelo Quilchano and Andrew R. Blaustein 1999. Sensitivity to nitrate and nitrite in pond-breeding amphibians from the Pacific northwest, USA. Environmental Toxicology and Chemistry, v. 18, (12) p. 2836

Marks, J. C., G. A. Haden, E. Dinger, and K. Adams. 2005. A Survey of the Aquatic Community at Fossil Creek. Northern Arizona University. 103 p.

Martin, S.C. and D.R. Cable. 1974. Managing semidesert grass-shrub ranges: Vegetation responses to precipitation, grazing, soil texture, and mesquite control. U.S. Dept. Agric. Tech. Bull. 1480.

Milchunas, D.G., W.K. Lauenroth, and I.C.Burke. 1998. Livestock grazing: animal and plant biodiversity of shortgrass steppe and the relationship to ecosystem function. OIKOS, v. 83, p. 65-74.

Miller, D. J., and L. E. Benda. 2000. Effects of punctuated sediment supply on valley-floor landforms and sediment transport. Geological Society of America Bulletin, v. 112, p. 1814-1824.

Miller, G., Ambos, N., Boness, P., Reyher, D., Robertson, G.., Scalzone, D., Steinke, R., and T. Subirge, 1995. Terrestrial Ecosystem Survey of the Coconino National Forest, USDA – Forest Service, Southwestern Region, 405 pp.

Miller, Rick. 2007. AZ Game and Fish Department. Personal communication with Janie Agyagos regarding drought in Northern Arizona. August 2007.

Mosconi, S.L. and R.L. Hutto. 1982. The effect of grazing on the land birds of a western Montana riparian habitat, *in* L.Nelson, J.M.Peek, and PlD. Dalke, editors. Proceedings of the wildlife-livestock relationships symposium. U.S. Forest, Wildlife and Ranger Experiment Station., University of Idaho, Moscow, Idaho, p. 221-223.

Nebeker, Alan V. and Gerald S. Schuytema. 2000. Effects of ammonium sulfate on growth of larval Northwestern salamanders, red-legged frog and Pacific treefrog tadpoles, and juvenile fathead minnows. Bulletin of Environmental Contamination and Toxicology, v. 64: (2), p. 271-278.

Ohmart R.D. 1996. Historical and present impacts of livestock grazing on fish and wildlife resources in western riparian habitats, *in* P.R. Krausman (ed.), Rangeland Wildlife. Society for Range Management: Denver CO, p. 245-279.

Platts, W.S. 1981. Influence of forest and rangeland management on anadromous fish habitat in Western North America, No. 7. Effects of livestock grazing. General Technical Report PNW-124, US. Forest Service, Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

Prichard, D., H. Barrett, J. Cagney, R. Clark, J. Fogg, K. Gebhart, Dr. P. L. Hansen, B. Mitchell, D. Tippy. 1998. Riparian Area Management, Process for Assessing Proper Functioning Condition. U.S. Department of the Interior Bureau of Land Management—Service Center, GTR 1737-9. 57 p.

Pyle, R.M. 1981. The Audubon Society Field Guide to North American butterflies. A.A. Knopf, NY. 916 p.

Reynolds T.D., and C.H. Trost. 1980. The response of native vertebrate populations to crested wheatgrass planting and grazing by sheep. Journal of Range Management, v. 33, p. 122-125.

Rinne, J. N., and D. Miller. 2006. Hydrology, geomorphology and management: Implications for sustainability of native Southwestern fishes. Reviews in Fisheries Science, v. 14, p. 91-110.

Robinson, A. T. 2007. Verde River and Horseshoe Reservoir Fish Surveys: Final Report to the Salt River Project, April 11, 2007. Arizona Game and Fish Department, Phoenix, AZ. 32 p.

Roughan, Christa, 2003, Fossil Creek Watershed Analysis Existing condition of Recreation Opportunities and Activities, 2002. USDA – Forest Service, Coconino National Forest, 22 p.

Rouse, Jeremy David, Christine A. Bishop and John Struger. 1999. Nitrogen pollution: An assessment of its threat to amphibian survival. Environmental Health Perspectives, v. 107, (10), p. 799-803.

Rosgen, D. 1996. Applied river morphology. Printed Media Companies, Minneapolis, MN, USA.

Ruyle, G. B. editor, 1997. Some methods for monitoring rangelands and other natural area vegetation. USDA Cooperative Extension Report 9043, University of Arizona, Tucson.

Saab, V.A., C.E. Bock, T.D. Rich and D.S. Dobkin. 1995. Effects of livestock grazing on neotropical migratory land birds in western North America. In: Finch, D.M. and P.W. Stangel, eds. Status and management of neotropical migratory birds. RM-GTR-229. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado.

Smith, L., G. Ruyle, J.Maynard, S.Barker, W.Meyer, D.Stewart, B.Coulloudon, S.Williams, and J.Dyess. 2005. Principles of obtaining and interpreting Utilization data on southwest rangelands. The University of Arizona College of Agriculture and Life Sciences, Tucson, Arizona. AZ1375.

Semmartin, M., M.R. Aquiar, R.A. Distel, A.S. Moretto and C.M Ghersa. 2004. Litter quality and nutrient cycling affected by grazing-induced species replacements along a precipitation gradient. OIKOS, v. 107, p. 148-160.

Sovell, L.A., Vondracek, B., Frost, J.A. and K. G. Mumford 2000. Impacts of rotational grazing and riparian buffers on physicochemical and biological characteristics of southeastern Minnesota USA streams. Environmental Management v. 25 (6) p. 669-641.

Spangler, R. E., and D. L. Scarnecchia. 2001. Summer and fall microhabitat utilization of juvenile bull trout and cutthroat trout in a wilderness stream, Idaho. Hydrobiologia v. 452, p. 145-154.

Szaro, R.C., and S.C. Belfit, J.K.Aitkin, and J.N. Rinne. 1985. Impact of grazing on a riparian garter snake, *in* R.R. Johnson, CD. Ziebell, D.R. Patton, P.F. Ffolliott, and F.H. Hamre, technical coordinators, Riarian ecosstems and their management: Reconciling conflicting uses. General Technical Report RM-120. U.S. Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado, p. 359-363.

Szaro, R.C., N.C. Johnson, W.T. Sexton, and A.J. Malke (Ed.). 1999. Ecological Stewardship – A Common Reference for Ecosystem Management. Volume II. Elsevier Science Ltd. Kidlington, Oxford OX5 1GB, UK.

Thomas, M., J.Hawkes, G.Khumalo, and J.L.Holecheck. 2007. Brangus cow-calf performance under two stocking levels on Chihuahua Desert Rangeland. Rangeland Ecology & Management, v. 60 , p. 110-114.

Trimble, S.W. and A.C. Mendel. 1995. The cow as a geomorphic agent--a critical review. Geomorphology, v. 13, p. 233-253.

U.S. Census Bureau, 2007. State and County Quick Facts, Yavapai County. http://quickfacts.census.gov/qfd/states/04/04025.html

USDA – Forest Service. Forest Service Manual 2200: Range Management.

USDA – Forest Service. Forest Service Handbook 2200.13: Grazing Permit Administration Handbook.

USDA – Forest Service Handbook 2209.13, Chapter 90 (Grazing Permit Administration; Rangeland Management Decisionmaking).

USDA – Forest Service. 1987. Coconino National Forest Land Management Plan, and all subsequent amendments.

USDA – Forest Service 1993. Resource Information Report. Potential Wild-Scenic-Recreational River Designation. National Forests of Arizona. USDA Forest Service, Southwestern Region. 375pp.

USDA – Forest Service. 1994. Decision Notice and Finding of No Significant impact (FONSI) Verde Wild and Scenic River Comprehensive River Management Plan, Coconino, Prescott and Tonto National Forests. 22 p.

USDA – Forest Service. 1997. Rangeland Analysis and Training Guide, Southwestern Region 3.

USDA – Forest Service. 2002. Management Indicator species status Report for the Coconino National Forest, Coconino National Forest Working Draft, 99 p.

USDA – Forest Service. 2005a. Final Environmental Impact Statement for Integrated Treatment of Noxious or Invasive Weeds, Coconino , Kaibab, and Prescott National forests within Coconino, Gila, Mojave, and Yavapai Counties, Arizona. 589 p.

USDA – Forest Service. 2005b. Framework for Streamlining Informal Consultation for Cattle Grazing Activities. Southwestern Region. Albuquerque, NM. 112 p.

USDA – Forest Service and USDI – National Park Service, December 1999. The Wild & Scenic River Study Process: A Technical Report Prepared for the Interagency Wild and Scenic Rivers Coordinating Council, by J. Diedrich (U.S. Forest Service) and C. Thomas (National Park Service). 50 p.

USDI – Fish and Wildlife Service. 1995. Recovery plan for the Mexican spotted owl: Vol. I. Albuquerque, New Mexico. 172 pp.

Valentine, K.A. 1970. Influence of grazing intensity on improvement of deteriorated black grama range. Las Cruces, N.M. New Mexico Agricultural Experimental Station. Bulletin 553. 21 p.

Valone, T.J. and P.Sauter. 2004. Effects of long-term cattle exclosure on vegetation and rodents at a desertified arid grassland site. Journal of Arid Environments, v. 61, p. 161-170.

Vavra, M., W.A. Laycock, and R. D. Pieper. 1994. Ecological Implications of Livestock Herbivory in the West. Society for Range Management. Denver, CO.

Warren S. D., T. L. Thurow, W.H. Blackburn, and N.E. Garza. 1986. The influence of livestock trampling under intensive grazing on soil hydrologic characteristics. Journal of Range Management. 39 (6): 491-495.

Wilzbach, M. A. 1985. Relative roles of food abundance and cover in determining the habitat distribution of stream dwelling cutthroat trout (Salmo clarki). Canadian Journal of Fisheries and Aquatic Science, v. 42, p. 1668-1672.

Wood, P. J., and P. D. Armitage. 1997. Biological effects of fine sediment in the lotic environment. Environmental Management, v. 21, p. 203-217.

Wyman, S., D. Bailey, M. Borman, S. Cote, J. Eisner, W. Elmore, B. Leinard, S. Leonard, F. Reed, S. Swanson, L. Van Riper, T. Westfall, R. Wiley, and A. Winward. 2006. Riparian area management: Grazing management processes and strategies for riparian-wetland areas. Technical Reference 1737-20. BLM/ST/ST-06/002+1737. U.S. Department of the Interior, Bureau of Land Management, National Science and Technology Center, Denver, CO. 105 p.

Ziemer, R. R., J. Lewis, T. E. Lisle, and R. M. Rice. 1991. Long-term sedimentation effects of different patterns of timber harvesting. Sediment and Stream Water Quality in a Changing Environment: Trends and Explanation. IAHS, Vienna, Austria. p. 143-150.