United States Department of Agriculture

Forest Service

Southwestern Region

Riparian Specialist Report

Forest Plan Revision EIS

Submitted by: __/s/ _____

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Introduction

This report evaluates and discloses the potential environmental consequences on the riparian resource that may result with the adoption of a revised land management plan. It examines, in detail, four different alternatives for revising the 1987 Apache-Sitgreaves NFs land management plan (1987 forest plan).

Relevant Laws, Regulations, and Policy that Apply

Federal Statutes

The following is a partial listing of relevant laws which have been enacted by Congress. A Federal statute, or law, is an act or bill which has become part of the legal code through passage by Congress and approval by the President (or via congressional override). Although not specified below, many of these laws have been amended.

Bankhead-Jones Farm Tenant Act of July 22, 1937 - Directed the Secretary of Agriculture to develop a program of land conservation and utilization in order to correct maladjustments in land use and thus assist in such things as control of soil erosion, reforestation, preservation of natural resources, and protection of fish and wildlife.

Clean Water Act (see Federal Water Pollution Control Act)

Emergency Flood Prevention (Agricultural Credit Act) Act of August 4, 1978 - Authorizes the Secretary of Agriculture to undertake emergency measures for runoff retardation and soil-erosion prevention, in cooperation with land owners and users, as the Secretary deems necessary to safeguard lives and property from floods, drought, and the products of erosion on any watershed whenever fire, flood, or other natural occurrence is causing or has caused a sudden impairment of that watershed.

Endangered Species Act of 1973, as amended - Authorizes the determination and listing of species as endangered and threatened; prohibits unauthorized taking, possession, sale, and transport of endangered species; authorizes the assessment of civil and criminal penalties for violating the Act or regulations; and, authorizes the payment of rewards to anyone furnishing information leading to arrest and conviction for any violation of the Act or any regulation issued there under. Section 7 of the Act requires Federal agencies to use their authorities to carry out programs for the conservation of endangered and threatened species and to insure that any action authorized, funded, or carried out by them is not likely to jeopardize the continued existence of listed species or modify their critical habitat.

Section 4 of the Act directs the development and implementation of recovery plans for threatened and endangered species and the designation of critical habitat. Several species listed under the Act are found on the Apache-Sitgreaves NFs, some with recovery plans and some with designated critical habitat. Those with a recovery plan and/or a critical habitat designation as of 2010 are listed below:

- Southwest Willow Flycatcher, Recovery Plan and Critical Habitat
- Mexican Spotted Owl, Recovery Plan and Critical Habitat
- Chiricahua Leopard Frog, Recovery Plan and pending Critical Habitat
- Little Colorado River Spinedace, Recovery Plan and Critical Habitat
- Arizona Trout (Apache Trout), Recovery Plan

- Spikedace, Recovery Plan and Critical Habitat
- Gila Trout, Recovery Plan
- Gila Chub, Critical Habitat
- Loach Minnow, Recovery Plan and Critical Habitat
- Mexican Wolf, Recovery Plan

Federal Land Policy and Management Act of October 21, 1976 - Requires that public lands be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values; that, where appropriate, will preserve and protect certain public lands in their natural condition; that will provide food and habitat for fish and wildlife and domestic animals; and that will provide for outdoor recreation and human occupancy and use. Also states that the United States shall receive fair market value of the use of the public lands and their resources unless otherwise provided for by law.

Federal-State Cooperation for Soil Conservation Act of December 22, 1944 - Authorized the adoption of eleven watershed improvement programs in various states for the improvement of water runoff, water flow retardation, and soil erosion prevention.

Federal Water Pollution Control Act and Amendments of 1972 (Clean Water Act) - Enacted to restore and maintain the chemical, physical, and ecological integrity of the Nation's waters. Provides for measures to prevent, reduce, and eliminate water pollution; recognizes, preserves, and protects the responsibilities and rights of States to prevent, reduce, and eliminate pollution, and to plan the development and use (including restoration, preservation, and enhancement) of land and water resources; and provides for Federal support and aid of research relating to the prevention, reduction, and elimination of pollution, and Federal technical services and financial aid to state and interstate agencies and municipalities for the prevention, reduction, and elimination of pollution.

Established goals for the elimination of water pollution; required all municipal and industrial wastewater to be treated before being discharged into waterways; increased Federal assistance for municipal treatment plant construction; strengthened and streamlined enforcement policies; and expanded the Federal role while retaining the responsibility of States for day-to-day implementation of the law.

Federal Water Project Recreation Act of July 9, 1965 - Requires that recreation and fish and wildlife enhancement opportunities be considered in the planning and development of Federal water development.

Forest and Rangeland Renewable Resources Planning Act of August 17, 1974 - Directs the Secretary of Agriculture to prepare a Renewable Resource Assessment every ten years; to transmit a recommended Renewable Resources Program to the President every five years; to develop, maintain, and, as appropriate, revise land and resource management plans for units of the National Forest System; and to ensure that the development and administration of the resources of the National Forest System are in full accord with the concepts of multiple use and sustained yield.

Healthy Forests Restoration Act of 2003 (H.R. 1904) - Purposes are to reduce wildfire risk to communities and municipal water supplies through collaborative hazardous fuels reduction projects; to assess and reduce the risk of catastrophic fire or insect or disease infestation; to enhance efforts to protect watersheds and address threats to forest and rangeland health (including wildfire) across the

landscape; to protect, restore, and enhance forest ecosystem components such as biological diversity, threatened/endangered species habitats, enhanced productivity.

Joint Surveys of Watershed Areas Act of September 5, 1962 - Authorizes and directs the Secretaries of the Army and Agriculture to make joint investigations and surveys of watershed areas in the United States, Puerto Rico, and the Virgin Islands, and to prepare joint reports setting forth their recommendations for improvements needed for flood prevention, for the conservation, development, utilization, and disposal of water, and for flood control.

Knutson-Vandenberg Act of June 9, 1930 -Authorizes the Secretary of Agriculture to establish forest tree nurseries; to deposit monies from timber sale purchasers to cover the costs of planting young trees, sowing seed, removing undesirable trees or other growth, and protecting and improving the future productivity of the land; and to furnish seedlings and/or young trees for the replanting of burned-over areas in any National Park.

Land and Water Conservation Fund Act of September 3, 1964 - Authorizes the appropriation of funds for Federal assistance to States in planning, acquisition, and development of needed land and water areas and facilities and for the Federal acquisition and development of certain lands and other areas for the purposes of preserving, developing, and assuring accessibility to outdoor recreation resources.

National Forest Management Act of October 22, 1976 - The National Forest Management Act reorganized, expanded, and otherwise amended the Forest and Rangeland Renewable Resources Planning Act of 1974, which called for the management of renewable resources on National Forest System lands. The National Forest Management Act requires the Secretary of Agriculture to assess forest lands, develop a management program based on multiple-use, sustained-yield principles, and implement a resource management plan for each unit of the National Forest System. It is the primary statute governing the administration of National Forests.

National Forest Roads and Trails Act of October 13, 1964 - Authorizes the Secretary of Agriculture to provide for the acquisition, construction, and maintenance of forest development roads within and near the National Forests through the use of appropriated funds, deposits from timber sale purchasers, cooperative financing with other public agencies, or a combination of these methods. The Act also authorizes the Secretary to grant rights-of-way and easements over National Forest System lands.

Organic Administration Act of June 4, 1897 - Authorizes the President to modify or revoke any instrument creating a national forest; states that no national forest may be established except to improve and protect the forest within its boundaries, for the purpose of securing favorable conditions of water flows, and to furnish a continuous supply of timber for the use and necessities of citizens of the United States. It authorizes the Secretary of Agriculture to promulgate rules and regulations to regulate the use and occupancy of the national forests.

Multiple-Use Sustained-Yield Act of June 12, 1960 - States that it is the policy of Congress that the national forests are established and shall be administered for outdoor recreation, range, timber, watershed, and wildlife and fish purposes, and authorizes and directs the Secretary of Agriculture to develop and administer the renewable surface resources of the national forests for the multiple use and sustained yield of products and services.

Mining and Minerals Policy Act of December 31, 1970 - States that it is the policy of the Federal government to foster and encourage the development of economically sound and stable domestic

mining, minerals, metal, and mineral reclamation industries; the orderly and economic development of domestic mineral resources, reserves, and reclamation of metals and minerals to help assure satisfaction of industrial, security, and environmental needs; mining, mineral, and metallurgical research to promote the wise and efficient use of our natural and reclaimable mineral resources; and the study and development of methods for the disposal, control, and reclamation of mineral waste products and the reclamation of mined land.

National Environmental Policy Act of January 1, 1970 - Directs all Federal agencies to consider and report the potential environmental impacts of proposed Federal actions, and established the Council on Environmental Quality.

Safe Drinking Water Amendments of November 18, 1977 - Amended the Safe Drinking Water Act to authorize appropriations for research conducted by the Environmental Protection Agency relating to safe drinking water; Federal grants to states for public water system supervision programs and underground water source protection programs; and grants to assist special studies relating to the provision of a safe supply of drinking water.

Sikes Act of October 18, 1974, as amended - This Act authorizes the Forest Service to cooperate with state wildlife agencies in conservation and rehabilitation programs for fish, wildlife, and plants considered threatened or endangered.

Soil and Water Resources Conservation Act of November 18, 1977 - Provides for a continuing appraisal of the United States' soil, water and related resources, including fish and wildlife habitats, and a soil and water conservation program to assist landowners and land users in furthering soil and water conservation.

Surface Mining Control and Reclamation Act of August 3, 1977 - Authorizes the Secretary of Agriculture to enter into agreements with landowners, providing for land stabilization, erosion, and sediment control, and reclamation through conservation treatment, including measures for the conservation and development of soil, water, woodland, wildlife, and recreation resources, and agricultural productivity of such lands.

U.S. Mining Laws (Public Domain Lands) Act of May 10, 1872 - Provides that all valuable mineral deposits in lands belonging to the United States, both surveyed and unsurveyed, are free and open to exploration and purchase, and the lands in which they are found to occupation and purchase by citizens of the United States and those who have declared their intention to become such, under regulations prescribed by law, and according to the local customs or rules of miners, so far as the same are applicable and not inconsistent with the laws of the United States. There are a number of Acts which modify the mining laws as applied to local areas by prohibiting entry altogether or by limiting or restricting the use which may be made of the surface and the right, title, or interest which may pass through patent.

Water Quality Improvement Act of April 3, 1970 - Amends the prohibitions of oil discharges, authorizes the President to determine quantities of oil which would be harmful to the public health or welfare of the United States; to publish a National Contingency Plan to provide for coordinated action to minimize damage from oil discharges. Requires performance standards for marine sanitation device and authorizes demonstration projects to control acid or other mine pollution, and to control water pollution within the watersheds of the Great Lakes. Requires that applicants for Federal permits for activities involving discharges into navigable waters provide state certification that they will not violate applicable water quality standards

Water Resources Planning Act of July 22, 1965 - Encourages the conservation, development, and utilization of water and related land resources of the United States on a comprehensive and coordinated basis by the Federal government, states, localities, and private enterprises.

Watershed Protection and Flood Prevention Act of August 4, 1954 - Establishes policy that the Federal government should cooperate with states and their political subdivisions, soil or water conservation districts, flood prevention or control districts, and other local public agencies for the purposes of preventing erosion, floodwater, and sediment damages in the watersheds of the rivers and streams of the United States; furthering the conservation, development, utilization, and disposal of water, and the conservation and utilization of land; and thereby preserving, protecting, and improving the Nation's land and water resources and the quality of the environment.

Regulations

Below is a partial listing of relevant regulations. Federal executive departments and administrative agencies write regulations to implement laws. Regulations are secondary to law. However, both laws and regulations are enforceable.

33 CFR 323 Permits for Discharges of Dredged or Fill Material into Waters of the United States - This regulation prescribes those special policies, practices and procedures to be followed by the Corps of Engineers in connection with the review of applications for permits to authorize the discharge of dredged or fill material into waters of the United States.

36 CFR 212.5 (b) Roads - ...the responsible official must identify the minimum road system needed for safe and efficient travel and for administration, utilization, and protection of National Forest System lands. ... The minimum system is the road system determined to be needed to meet resource and other management objectives adopted in the relevant land and resource management plan (36 CFR 219), to meet applicable statutory and regulatory requirements, to reflect long-term funding expectations, to ensure that the identified system minimizes adverse environmental impacts associated with road construction, reconstruction, decommissioning, and maintenance.

Identification of unneeded roads. Responsible officials must review the road system on each National Forest and Grassland and identify the roads on lands under Forest Service jurisdiction that are no longer needed to meet forest resource management objectives and that, therefore, should be decommissioned or considered for other uses, such as for motorized routes.

Regional Forester’s direction: Roads analysis process (RAP) for all other existing roads should be completed in conjunction with implementation of the off-highway vehicle (OHV) Record of Decision, watershed analyses, other project level activities or Forest Plan revisions.

Travel Management Rule - On December 9, 2005, the Forest Service published the TMR. The agency rewrote direction for motor vehicle use on National Forest Service (NFS) lands under 36 CFR, Parts 212, 251, and 261, and eliminated 36 CFR 295. The rule was written to address at least in part the issue of unmanaged recreation. The rule provides guidance to the Forest Service on how to designate and manage motorized recreation on the Forests. The rule requires each National Forest and Grassland to designate those roads, motorized trails, and Areas that are open to motor vehicle use.

36 CFR 219 Planning - Sets forth a process for developing, adopting, and revising land and resource management plans for the National Forest System.

36 CFR 241 Fish and Wildlife - Sets forth the rules and procedures relating to the management, conservation, and protection of fish and wildlife resources on National Forest System lands.

40 CFR 121-135 Water Programs - Sets forth the provisions for the administration of water programs including: state certification of activities requiring a Federal license or permit; EPA administered permit programs; state program requirements; procedures for decision making; criteria and standards for the National Pollutant Discharge Elimination System; toxic pollutant effluent standards; water quality planning and management; water quality standards; water quality guidance for the Great Lakes System; secondary treatment regulation; and, prior notice of citizen suits. See Title 40 (Protection of Environment), Chapter 1 (Environmental Protection Agency), subchapter D (Water Programs).

40 CFR 1500 Council on Environmental Quality - Council on Environmental Quality regulations implementing the National Environmental Policy Act.

Executive Orders

Below is a partial listing of relevant executive orders. Executive orders are official documents by which the President provides instructions to executive departments and agencies. An executive order may be used to reassign functions among executive branch agencies. It may adopt guidelines, rules of conduct, or rules of procedure for government employees or units of government. It can also establish an advisory body or task force.

EO 11988 Floodplain Management, 1977 - Requires each Federal agency to provide leadership and to take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities for acquiring, managing, and disposing of Federal lands and facilities; providing federally undertaken, financed, or assisted construction and improvements; and conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities.

EO 11990 Protection of Wetlands, 1977 - Requires each Federal agency to provide leadership and to take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities for acquiring, managing, and disposing of Federal lands and facilities; providing federally undertaken, financed, or assisted construction and improvements; and conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities.

Policy

The Forest Service Manual (FSM) contains legal authorities, goals, objectives, policies, responsibilities, instructions, and the necessary guidance to plan and execute assigned programs and activities.

Forest Service Handbooks (FSH) are directives that provide instructions and guidance on how to proceed with a specialized phase of a program or activity. Handbooks either are based on a part of the FSM or they incorporate external directives.

FSM 2500 Watershed and Air Management

- **FSM 2520** Watershed Protection and Management
    - FSH 2509.25 Watershed Conservation Practices Handbook, Southwestern Region
- **FSM 2540** Water Uses and Development, Southwestern Region supplement

FSM 7700 Transportation System

- **FSM 7710** Travel Planning
    - FSH 7709.55 Travel Analysis

Methodology and Analysis Process

This section describes the methodology and analysis processes used to determine the environmental consequences on riparian resources from implementing the alternatives. Environmental consequences are not site-specific at the broad forest planning level and will be described with qualitative descriptions supported by past studies and observations. Much of the background information is found in the Ecological Sustainability Report (Forest Service 2008) and it's supporting specialists' reports.

Riparian vegetation condition was determined for the four riparian/wetland PNVTs; cottonwood-willow riparian forest, mixed broadleaf deciduous riparian forest, montane willow riparian forest and wetland/ cienega riparian areas. The Vegetation Specialist's Report contains descriptions and effects of implementation of alternatives. These effects will be summarized briefly within following sections of this report.

Since the mid-1990s, the forests have utilized Proper Functioning Condition (PFC) (USDI 1998, 2003) to determine condition of riparian areas. The PFC inventory for the forests was derived from either on-site evaluation (collected on about 25 percent) of known forest riparian areas from 1995-2007, or from visual estimates from site visits made by forest personnel trained in the PFC protocol. The protocol is a consistent approach to determine how well physical processes are functioning. It is a qualitative assessment based on quantitative science.

PFC lotic (streams) and lentic (wetlands) classes are defined as follows:

Proper Functioning Condition (PFC): Riparian and wetland areas are functioning properly when adequate vegetation, landform, or large woody debris is present to:

- dissipate stream energy associated with high flows, thereby reducing erosion and improving water quality,
- filter sediment, capture bedload, and aid in floodplain development,
- improve flood-water retention and ground-water recharge,
- develop root masses that stabilize streambanks,
- develop diverse ponding and channel characteristics to provide habitat for fish, waterfowl and other uses, and support greater biological diversity.

Functioning-at-risk (FAR): Riparian and wetland areas that are in functional condition, but an existing soil, water, or vegetation attribute makes them susceptible to degradation.

Non-functioning (NF): Riparian and wetland areas that clearly are not providing adequate vegetation, landform, or large woody debris to dissipate stream energy associated with high flows, and this are not reducing erosion, improving water quality, etc.

Unknown: Riparian and wetland areas that managers lack sufficient information on to make any form of determination.

A qualitative estimate of the trend of riparian condition was made by reviewing actual and apparent trend from forest data, estimated of change in upland soil condition (Soil Specialist's Report), estimated change in upland and riparian vegetation condition (Vegetation Specialist's Report), pertinent research, in light of proposed standards and guidelines throughout the proposed LMP.

Assumptions

- For estimating the effects of alternatives at the programmatic forest plan level, the assumption has been made that the kinds of resource management activities allowed under the prescriptions will occur to the extent necessary to achieve the goals and objectives of each alternative. The actual location, design and extent is not known at this time and will be a site specific (project by project) decision. Therefore this analysis refers to potential of the effect to occur, realizing that in many cases, these are only estimates. The effects analysis is useful in comparing and evaluating alternatives on a forestwide basis but is not to be applied to specific locations on the forests. Some resources are not within the Agencies ability to control; these will be noted.
- Riparian area vegetation condition and projected effects by alternative for the four riparian and wetland PNVTs are described in detail within the Vegetation Specialist's Report. The analysis was based on conditions of riparian areas large enough to map at the planning level as derived from the Terrestrial Ecosystem Survey for the Apache-Sitgreaves NFs (ASTES)(Laing et.al. 1987) (about 10 acre minimum size polygon). Although the acreage analysis is based on the mapped areas, the effects described translate to all riparian areas.
- Riparian functional condition for all known riparian areas were mapped as linear segments using the forests' GIS stream layer as a base, assigning Proper Functioning Condition (PFC) inventoried and estimated condition attributes to each. This information was derived from actual PFC surveys (inventoried) and from local knowledge or anecdotal assessments in the field (estimated).
- There are a few important considerations to note to put describing the environmental effects of implementing the alternatives into context with regard to ecological restoration. Each alternative is described as having a range of treatment objectives, from low to high[1]. Each alternative has a different treatment emphasis by vegetation type as well. The benefits and effects to forest resources at a low objective level may be quite similar to each other in some alternatives on a forest scale, and quite different at a high objective level. The benefits and effects to forest resources within each particular vegetation type may be similar or different

[1] The low objective level is based on a minimum program of work to treat only areas of highest priority, such as treatment or maintenance of vegetation near communities where fire risk is high, or treatments in critical wildlife habitats. The high objective level is an estimate of the forest's highest capability to accomplish treatments using the current workforce and assuming funding is not limiting.

as well. As an example, Alternative C proposes high emphasis the ponderosa pine vegetation type for treatment, where alternatives B and D treatment emphasis are geared more towards restoration of all vegetation types that are currently departed from desired condition. At the low level treatment objectives, the resulting improvement in vegetative condition for Alternative B and D are very similar, and somewhat lower than C as modeled by the VDDT. At the high level of treatment objectives there are greater differences noted between the alternatives. In all cases with regard to Alternative A, which does not emphasize restoration treatments but fuel treatment around communities, there is little improvement towards desired conditions for vegetation condition, even with similar treatment levels. Table 3 summarizes differences in emphasis and effects to watershed condition and soil, water and riparian resources.

- Motorized cross-country vehicle use in riparian areas would be limited to occasional crossing on designated roads and trails in all alternatives.
- The term degraded means "a decline in the viability of ecosystem functions and processes" (Armantrout, 1998).

Revision Topics Addressed in this Analysis

Riparian Conditions

- Indicator – Projected Trend of Riparian Condition (Qualitative) of vegetation condition and riparian function (PFC) as affected by typical resource management treatments or activities.

Summary of Alternatives

A summary of alternatives, including the key differences among alternatives, is outlined in the Draft Environmental Impact Statement.

Description of Affected Environment (Existing Condition)

Riparian Resources

Riparian areas are terrestrial ecosystems characterized by hydric (wet) soils[2] and plant species that are hydrophilic or dependent on the water table or its capillary fringe zone (Forest Service FSM 2526.05). Riparian areas include springs, seeps, streams, ponds, lakes and their associated wet areas and floodplains. Riparian areas collect and transport water, soil, and organic material from upslope and upstream. They comprise the most potentially productive and diverse components of forest and range ecosystems. Fish, wildlife, and many plant species depend on riparian areas for their existence. Riparian areas are basic to the hydrologic function of watersheds.

Four riparian vegetation types (PNVTs) were classified within the Apache-Sitgreaves NFs: cottonwood-willow, montane willow, and mixed broadleaf deciduous riparian forests, and wetland/cienega riparian areas. These PNVTs are described in detail within the vegetation specialist's

[2] A hydric soil is a soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic (without oxygen) conditions in the upper part.

report. The current condition and trends in vegetation condition and soil condition in all four PNVTs are displayed in the following table.

Table 1. Riparian vegetation and soil conditions and trends.

PNVT	Vegetation Condition Trend (Current)*	Soil Condition Trend (Current)#
Cottonwood-Willow Riparian Forest	Away	Away
Mixed Broadleaf Riparian Forest	Away	Away
Montane Willow Riparian Forest	Away	Away
Wetland/Cienega Riparian Areas	Away	Away
* See Vegetation Specialist's Report, # See Soil Specialist's Report		

Desired conditions for riparian and wetlands are described in the PFC protocol which are based on the function of riparian vegetation through hydrologic, vegetation and erosion/deposition processes and attributes. In general, the desired condition is for riparian areas and wetlands to be in proper functioning condition. The following conditions pertain to the forests' riparian function as defined and inventoried by Proper Functioning Condition protocols (USDI 1998, 2003).

Streams (Lotic)

The forests' PFC inventory shows there are about 2,822 linear miles of riparian areas on the forests. The assessment estimates that 24 percent of riparian areas are in proper functioning condition (PFC), 68 percent are functioning-at-risk (FAR), and 8 percent are non-functioning (NF). Past effects of grazing, logging and roads, flooding and periods of drought have degraded riparian conditions (US Forest Service 2008). In general, the current trend (actual and apparent) of areas that are properly functioning are expected to remain in that condition based on BMP implementation for road, timber, and grazing management. The current trend of areas functioning at risk will remain static or show downward trend in areas where activities are not managed to existing forest plan standards, or upward, where BMPs and other mitigations are effectively protecting riparian values.

Although there is a public perception that riparian areas are fragile, current information indicates that riparian systems are often resilient. Once stresses are relieved, these riparian systems can regain their equilibrium within a few years because of resilient, native, herbaceous, riparian plants, such as those of the genus *Carex*, *Eleocharis*, *Juncus*, and *Scirpus* (Baker et al. 1999). Non-native bluegrass bottoms have converted to native sedges where stressors have been reduced (AZGFD monitoring data 1980-present). In other cases, such as in large systems, such as the Blue River, where a large wood matrix is needed to overcome accelerated channel dynamics, riparian system may take many decades to reach PFC, even with removal of direct impacts (NRST, 2000). Upland watershed conditions can also affect recovery of riparian and stream channels. Upland watershed areas that have been altered by high severity fire or intensive management treatments can reduce resistance to flow and water storage onsite and lead to increased and often damaging runoff.

Wetlands (lentic)

All wetlands have been mapped, however, not all wetlands have been assessed in detail on the Apache-Sitgreaves NFs. There are about 7,000 acres of wetlands on the forest (USGS 2004). Conditions of a limited number of wetlands have been determined through the use of the PFC protocol. Others have been described and evaluated for suitability for waterfowl and threatened and endangered species habitat. Many of the forests' wetlands are small and only seasonally wet. These

maintain some characteristics of wetlands, such as soil mottling, but have portions that may lack hydrophytic[3] vegetation as water levels recede. Little more than anecdotal information is available to document the historic range of variation, extent, and conditions of wetland and riparian areas. Cline (1976) inferred past conditions based on knowledge of current conditions. Wetland conditions prior to Euro-American settlement (early 1800's) was probably dominated by "proper functioning condition" because there was little human disturbance compared to today. Prior to Euro-American settlement wetland extent is largely unknown except for anecdotal excerpts from a few publications. Data sets from 1915-17 describe what are today various reservoirs as large wetlands, such as Sierra Blanca lake (Riblitt et al, 1915). More recent aerial photo analysis (post about 1940) indicates wetland extent was about the same as it is today, but water levels fluctuate according to annual precipitation. Current disturbances are similar to those listed in the streams section above. Non-functional wetlands include those that have been artificially drained by the practice of creating pit tanks for livestock watering. Others have been enhanced through watershed and wildlife improvement projects.

The following assessment is based on miles of riparian streams, which may not have been captured in the PNVT delineations due to scale in mapping (PNVT mapping is expressed in acres versus miles used for this riparian assessment).

Table 1 displays the riparian stream length and proportional extent by Proper Functioning Condition (PFC) class for Apache-Sitgreaves NFs' watersheds at the 4th and 5th Hydrologic Unit Code level[4].

[3] Hydrophytic vegetation is defined herein as the sum total of macrophytic plant life that occurs in areas where the frequency and duration of inundation or soil saturation produce permanently or periodically saturated soils of sufficient duration to exert a controlling influence on the plant species present. (USArmyCoE, 1987)

[4] The United States is divided and sub-divided into successively smaller hydrologic units which are classified into six levels: regions (1st), sub-regions (2nd), accounting units (3rd), cataloging units or sub-basins (4th), watersheds (5th) and subwatersheds (6th). The hydrologic units are arranged within each other, from the smallest (subwatersheds) to the largest (regions). Each hydrologic unit is identified by a unique hydrologic unit code (HUC) consisting of two to twelve digits based on the six levels of classification (two digits each) in the hydrologic unit system.

Table 2. Riparian stream length and proportional extent by proper functioning condition class for Apache-Sitgreaves NFs fourth and fifth hydrologic unit code watersheds (HUC 4 and 5) (Forest Service 2008).

Fourth Hydrologic Unit Code (HUC) Watershed	Fifth Hydrologic Unit Code (HUC) Watershed	Riparian Condition† (miles & percent)						
		PFC	%	FAR	%	NF	%	Total miles
Little Colorado Riv Headwaters	Nutrioso Ck	58	42	81	58	0	0	139
	South Fork Little Colorado Riv-Little Colorado Riv Headwaters	79	58	54	40	3	2	137
	Coyote Ck	4	15	21	82	1	3	25
	Carnero Ck-Little Colorado Riv Headwaters	2	15	10	85	0	0	12
Upper Little Colorado Riv	Big Hollow Wash	0	0	2	100	0	0	2
	Oso Draw	5	10	50	90	0	0	55
Silver Ck	Show Low Ck	4	7	53	88	3	5	60
	Upper Silver Ck	0	0	11	54	10	46	21
	Cottonwood Ck	8	5	136	80	27	16	171
Middle Little Colorado Riv	Phoenix Park Wash-Dry Lake	0	0	38	88	5	12	43
	Upper Clear Ck	49	29	84	50	34	21	167
	Lower Clear Ck	14	100	0	0	0	0	14
Chevelon Canyon	Upper Chevelon Canyon	123	53	92	40	16	7	231
	Black Canyon	0	0	60	49	64	51	124
	Lower Chevelon Canyon	0	0	3	74	1	26	4
Mangus Ck-Upper Gila Riv	Apache Ck-Upper Gila Riv	8	29	19	71	0	0	26
San Francisco Riv	Centerfire Ck-San Francisco Riv	8	11	58	84	3	5	69
	Upper Blue Riv	86	28	195	65	21	7	302
	Pueblo Ck-San Francisco Riv	0	0	12	100	0	0	12
	Lower Blue Riv	92	29	200	64	21	7	312
	Mule Ck-San Francisco Riv	27	22	86	70	9	8	123
	Chase Ck-San Francisco Riv	22	36	32	51	8	13	62
Upper Gila Riv-San Carlos Reservoir	Upper Eagle Ck	61	34	109	61	11	6	181
	Lower Eagle Ck	56	43	66	51	7	6	129
Black Riv	Upper Black Riv	54	15	299	81	14	4	368
	Middle Black Riv	23	45	28	55	0	0	51
White Riv	Upper North Fork White Riv	0	0	1	100	0	0	1
Upper Salt Riv	Canyon Ck	8	60	5	40	0	0	13
Carrizo Ck	Carrizo Ck (local drainage)	0	0	3	100	0	0	3
Total Miles & Average Percent		791	24	1,808	68	258	8	2,857

† Riparian condition ratings are: PFC = proper functioning condition; FAR = functioning-at-risk; & NF = non-functioning

Environmental Consequences of Alternatives

The land management plan provides a programmatic framework that guides site-specific actions but does not authorize, fund, or carryout any project or activity. Because the land management plan does not authorize or mandate any site-specific projects or activities (including ground-disturbing actions) there can be no direct effects. However, there may be implications, or longer term environmental consequences, of managing the forests under this programmatic framework.

Riparian Resources

Many of the forests' streams have been altered to the point where the change in stream channel morphology has resulted in a drop in water tables and loss of floodplains where excess sediment can be stored. This change negatively affects the abundance, distribution and reproduction of native riparian vegetation, especially willows and cottonwoods. This legacy of past activities has reduced the overall potential of the riparian resource to provide wildlife habitat needed for species viability.

In all alternatives, environmental consequences within the foreseeable future to riparian areas and wetland ecosystems from management activities conducted within the planning area are expected to be minor. This is due to the fact that riparian areas and wetland ecosystems would be avoided in most cases. Future timber harvesting/restoration treatments would occur over the next 15 years; however, their impacts to riparian areas and wetland ecosystems may be minor. This is because project design incorporating BMPS, aquatic management zones and wildlife habitat mitigation would be implemented, riparian areas and wetland ecosystems would be avoided, and because new road construction related to timber harvesting would be not occur. Livestock grazing would continue into the foreseeable future throughout the planning area; therefore, continued impacts to riparian areas and wetland ecosystems may occur.

Trends

The current trend is away from desired conditions in all riparian PNVTs (Vegetation Specialist's Report). There are no specific objectives regarding treating riparian vegetation structure or composition in Alternative A, therefore the trend is estimated to be away. Alternatives B and D have objectives to directly treat riparian areas as well as remove roads contributing to reducing condition and therefore, some positive trend is expected. Although alternative C treatments do not have specific objectives to treat the riparian vegetation, it does contain objectives to remove unauthorized routes; therefore some improvement is expected. All alternatives in most PNVTs, would result an improved upland watershed conditions, which would result in improvement in riparian condition.

Table 3. Riparian and wetland objectives description by Alternative.

	Alternative A	Alternative B	Alternative C	Alternative D
Riparian Treatment Objectives across all riparian vegetation types	Opportunity Basis	200 – 500 Acres	Opportunity Basis	300 – 600 acres

	Alternative A	Alternative B	Alternative C	Alternative D
Riparian Road Removal Objectives	Opportunity Basis	Up to 4 miles of road removed and obliterated	Opportunity Basis	Up to 4 miles of road removed and obliterated
Wetland/Cienega Objective	Opportunity Basis	Restore 5 to 25 wetlands in planning period	Opportunity Basis	Restore 5 to 25 wetlands in planning period
Benefit from Adjacent Upland Condition Improvement and unneeded road removal	Yes	Yes	Yes	Yes
Overall Riparian Vegetation Treatment Emphasis	No	Yes	No	Yes

Reduction in canopy cover is expected to improve forage conditions in most vegetation types (see the Vegetation and Livestock Grazing section below) resulting in less demand by grazers to use riparian areas. Alternatives B and D additionally provide for direct treatment in riparian streams and roads currently impacting riparian areas. Alternative A and C provide for improvement of upland conditions which would indirectly contribute to riparian improvement.

Forest Restoration Activities

Improvements of 2 to 6 percent in overstory vegetation condition towards desired conditions in Alternatives B and D are estimated due to planned treatments (mechanical and wildland fire) in riparian areas; while no reductions in departure from desired conditions are expected in Alternatives A and C which lack riparian treatment objectives. Improvements to riparian areas under Alternatives A and C would occur as opportunities arise and as a result of general vegetation and soil condition improvements in upland portions of watersheds

Mechanical

Since all alternatives may have timber harvest and restoration treatment activities, there is the potential to adversely affect riparian habitats. Haul routes, skid trails, log landings, and stream crossings used to remove timber may impact riparian vegetation, soils and stream function. In addition to erosion and sedimentation within the riparian area, these impacts can cause an effective extension of the channel network through the roads and skid trails connecting upstream disturbances to streams and can often overload the sediment filtering and storage ability of riparian areas. Effectiveness monitoring and research have shown that proper implementation of Best Management Practices (BMPs) and Soil and Water Conservation Practices (FSH 2209.23) greatly reduce erosion, compaction, displacement, and loss of soil

structure by limiting heavy equipment access to riparian areas. Aquatic management zones or vegetative filters would be prescribed for riparian areas minimizing impacts from all ground disturbing activities as they are currently. The width of these filter strips vary based on stream order, type, slope, erosion hazard of adjacent uplands, and the existing riparian area condition (U.S. Forest Service, 2008).

Alternative comparison

Beneficial effects from mechanical treatments include the removal of competing non-riparian vegetation to allow for re-establishment of native riparian species, the direct treatment of invasive species, and the potential to remove unneeded roads within riparian corridors.

Wildland Fire

Wildland fire may be used as a management tool in all alternatives. Fire is a common disturbance in riparian ecosystems and surrounding hill slopes (Neary, 2005). Fire may affect riparian function through loss of protective vegetation, which can lead to erosion and sedimentation, loss of stream stability, loss of large woody debris, and higher water temperatures due to loss of shade. Fire may also lead to burning of surrounding uplands within the watershed resulting in higher sediment input, higher degree of stream damaging peak flows and a general decrease in basin stability (Neary, 2005).

The magnitude of the effects of fire on riparian areas is primarily driven by fire intensity. As fire burns across the landscape, burn intensity is generally lower in riparian areas than surrounding upland vegetation as riparian areas have higher moisture contents of vegetation and soils. Severe wildfires can cause profound damage to plant cover and can increase stream flow velocity, sedimentation rates, and stream water temperatures, as contrasted to low intensity, cool-burning prescribed fires, which have less severe consequences. BMPs are prescribed for all wildland fires, and have shown to be effective in reducing damage to riparian areas through the use of filter strips and implementation strategies. As an example, ignition techniques, such as mid-slope ignition, are used to protect riparian areas, allowing a lower intensity fire to burn down-slope towards riparian areas, and achieving other objectives up-slope. Streamside management zones are also implemented for prescribed fire projects. The benefits for prescribed fire in riparian areas are similar to those listed for mechanical treatments.

Alternative comparison

Beneficial effects from wildland fires would include the removal of competing non-riparian vegetation to allow for re-establishment of native riparian species, the direct treatment of invasive species, and the potential to remove unneeded roads within riparian corridors. Reductions of two to six percent in departure from desired conditions in Alternative B and D are estimated, while no reductions in departure from desired conditions are expected in Alternative A or C. Improvements to riparian areas under Alternative A and C would occur on an opportunity basis.

Motorized Routes

Traditionally, in early years of resource extraction, roads were located adjacent to water bodies and crossed them frequently. These traditional road location, design, construction, and maintenance activities have considerable negative impact on riparian areas across the forests. Besides direct removal of productive riparian land to road bed and ditches, some of these effects include the following (DeBano and Schmidt 1989):

- riparian areas are de-watered due to lowered channel bed nick points and gully formation and advance upstream from compaction and reduction of effective channel width

- plant composition change, with a shift from riparian dependant plants to drier and less productive upland species
- accelerated runoff caused increased flood peaks and related damages
- base flows decreased in volume and duration, causing streams to dry up earlier in the year
- perennial streams reduced to non-perennial flow
- increased channel bed and bank erosion; eroded soil increased downstream sedimentation
- and reduced habitat for riparian dependent wildlife species

Alternative comparison

All alternatives address these effects from roads and motorized trails to riparian function to some degree. All alternatives provide standards and guidelines that reduce road impacts through BMPs and Soil and Water Conservation Practices. All alternatives strive to improve long-term upland condition through forest restoration treatments, reducing the effects of high flows responsible for channel damage. Alternatives B and D provide objectives for the removal of roads that reduce the area of productive lands, reducing road sediment and allowing channels to re-occupy width necessary to reduce stream energy. The action alternatives also provide for restoration of focus watersheds, where concentrated efforts to inventory, plan and rehabilitate roads can make positive change in riparian function.

Recreation Activities

Common recreation activities within riparian areas include hiking, camping, fishing, swimming, biking, and motorized vehicle use. All of these activities can impact riparian condition by affecting vegetation and soils through soil compaction and displacement and destruction or damage to riparian vegetation. Off-highway vehicle use is limited in riparian areas to occasional crossing on approved roads and trails in all alternatives. In the action alternatives, there is guidance to locate dispersed campsites away from streams or sensitive areas, and facilities or developments would be provided for protection of the environment rather than for convenience of visitors. Alternative A does not contain this guidance and would allow campsites to be located in close proximity to the forests' waters. This concentrated unmanaged recreation use could cause damage to vegetation; soil compaction and erosion; and water pollution from human and animal waste, dishwashing, trash, and vehicle fluids.

Grazing Activities

Livestock (cattle and sheep) and wildlife grazing occurs throughout many perennial streams, riparian areas, and some wetlands. Overgrazing has been observed to reduce effective vegetative ground cover and riparian vegetation, which contributes to accelerated erosion and soil compaction (U.S Forest Service 1991; Tellman 1997; Knutson and Naef 1997), as well as sedimentation into connected perennial waters. Due to ample soil moisture, riparian and wetland areas have the capacity to produce very large amounts of forage and provide most of the forage when associated with closed canopy forests. Riparian area conditions of high moisture content of forage, cool temperatures, and available water causes concentration of herbivore use in riparian areas and can lead to the overuse of vegetation necessary to protect streambanks from the effects of high flows. Open forests can also produce large amounts of forage and can relieve pressure on adjacent riparian and wetland areas. All allotments management plans direct the use of best management practices (BMPs) and site specific mitigation to reduce effects to riparian function, such as compaction from trampling or overutilization of forage.

Elk grazing is largely uncontrolled and elk have been observed in riparian areas, especially in unfenced wetlands. Currently, the forests do not permit livestock grazing on federal lands along the mainstem portions of the Blue and San Francisco Rivers and Eagle Creek. Many other grazing allotments have reduced livestock use along perennial streams and limited livestock access to hardened areas or to times when grazing pressure does not adversely affect riparian area condition.

The height and density of herbaceous vegetation in riparian areas is important for maintaining streambank stability needed for proper riparian condition and function. Areas of high concern are those areas with actively eroding stream banks or high erosion potential. Restoring native species in riparian areas is key to long-term riparian condition. As an example, Kentucky bluegrass (P. pratenis), and Canadian bluegrass (*P. canadensis*) have spread into many riparian areas as a result of widespread settlement and livestock management. These bluegrass species are far less productive that native grasses and willows, and do not have root masses capable of withstanding streamflows required for streambank protection.

Alternative Comparison

All alternatives prescribe treatments that improve the vegetation conditions on uplands to more open conditions. By reducing tree canopy there would be an increase in available forage for grazing animals. This would provide an opportunity for reduced grazing pressure on riparian areas from both domestic and wild animals. "Riparian area and wetland protection strategies should be integrated with upland management strategies. The health of the riparian and wetland ecosystems, receiving waterbody quality, and stream base flow levels are often dependent on the use, management and condition of adjacent uplands. Proper management of uplands can reduce grazing pressure on riparian areas and also increase forage productivity due to increased water table height and stream base flow. Increased forage productivity and overall upland health can result in increased economic benefits to the landowner or grazing management entity" (USEPA, 2003). Many riparian areas are very resilient and respond quickly to removal or reduction of degrading factors such as overgrazing. Recovery of functioning-at-risk riparian areas could occur as a result within the planning period of 15 years in alternatives B and D if high treatment objective levels are implemented. Because there are no or fewer planned treatments to improve riparian conditions in alternatives A and C, there is less likelihood of recovering functioning-at-risk riparian areas.

Special Uses

Water developments and road access are common special uses that affect riparian areas. In all alternatives, site specific mitigation, BMPs, and maintenance requirements are written into each permit along with periodic monitoring to protect riparian areas. All alternatives would allow the authorization of occupancy and use of NFS land based on public need when services or uses cannot be met on private or other Federal lands.

Climate Change

Research predicts that as climate changes, water inputs are expected to decline due to reduced precipitation, and subsequently reducing water in riparian zones. Water losses are also likely to increase due to elevated evapotranspiration rates at higher temperatures and greater run-off losses associated with increased frequencies of high intensity convectional storms. Urban expansion will also increase human demand for water and further reduce water availability for wildland ecosystems. Decreased water availability will affect riverine and riparian ecosystem function, due to modifications in geomorphological processes and an overall reduction in the availability of moisture to plant communities. Although these areas comprise less than three percent of the Apache-Sitgreaves NFs lands, they provide critical habitat

for vertebrates, invertebrates, migratory birds, and other riparian dependent species. Reduced water inputs will cause riparian ecosystems to contract in size. Furthermore, lowered water availability will stress riparian plants and increase the ecosystem susceptibility to invasion by non-native plants, such as salt cedar and Russian olive, which in turn will disrupt the natural wildlife community (Archer and Predick 2008).

Climate change is likely to alter wetland/cienega, fen and bog ecosystems (Karl et al. 2009). There are roughly 11,800 acres of wetland/cienega riparian areas on the Apache-Sitgreaves NFs. Wetland/cienegas create unique habitats and microclimates that support diverse wildlife and plant communities. Wetland/cienegas can exist with little or no water for long periods, or have several wet/dry cycles each year. When it rains, what appeared to be only a few clumps of short, dry grasses just a few days earlier suddenly teems with aquatic plants and animals. Wetland/cienegas perform two important functions in relation to climate. They have mitigation effects through their ability to sink carbon, and they have adaptation effects through their ability to store and regulate water flows. Due to their ability to store and slowly release water, properly functioning wetland/cienegas are imperative in periods of extreme droughts.

In light of the changes indicated above, there is a need to reduce vulnerability by maintaining and restoring resilient native ecosystems. Restoring and maintaining resilience in all ecosystems are part of the basic elements of forestwide desired conditions, and objectives and management approaches would be most provided for in order in Alternatives B, D, C then A. Restoring and maintaining resilience would likely improve the potential for ecosystems to retain or return to desired conditions after being influenced by climate change related impacts and variability. Management practices (e.g. thinning for age class diversity and structure, and reclaiming and restoring native grasslands) that sustain healthy plant and animal communities, and provide adequate nutrients, soil productivity, and hydrologic function promote resilience and reduce opportunities for disturbance and damage.

Cumulative Environmental Consequences

Riparian areas and wetlands have been impacted heavily through development of agricultural uses, townsites and road construction for wood extraction. Construction of dams for irrigation off-forest has resulted in clearing and loss of riparian habitat as well. However, no new dams or impoundments are known at this time

Population growth impacts to riparian areas could increase, as demand for water and water based recreation grows. Restriction of vehicles to roads and travelways will minimize impacts to riparian areas over existing conditions, where few restrictions are in place. Urban demand for water may increase pressure on forests to reduce on forest water use, although obtaining instream flow water rights on the forests' most valuable streams will help protect base flows to retain riparian function. Groundwater pumping is not regulated outside of Arizona's Active Management Areas in southern and western Arizona. There are documented studies of effects of groundwater pumping on the Colorado Plateau that predict that stream flow will be reduced which would affect water for riparian vegetation (Hart et.al. 2002). Several components of air pollution generated off forest can affect riparian vegetation (Blankenship, 1991) (see air quality section). Implementation of forest plan alternatives B, C and D are expected to increase slightly in the long term the amount of water available for bank storage recharge, and provide more water for aquifer recharge due to the expected reduction of upland vegetation transpiration and interception (Brewer, 2008; Baker, et.al. 1999). Alternative A would likely show only short term gains in riparian improvement.

Other Planning Efforts

Little Colorado River Plateau RC & D and Apache Natural Resource Conservation District are developing a plan to restore function to Coyote Creek through the Coyote Creek Watershed Improvement Committee.

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