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Coconino National Forest

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Riparian Specialist Report

Forest Plan Revision DEIS

Submitted by: __/s/ _____

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Preface

The information in this specialist report reflects analysis that was completed prior to and in conjunction with the completion of the Draft Environmental Impact Statement (DEIS) for the revision of the 1987 Coconino National Forest Land Management Plan (the Plan). The primary purpose of specialist reports associated with the DEIS is to provide detailed information to assist in the preparation of the DEIS. As the DEIS was prepared, review-driven edits to the broader DEIS resulted in modifications to some of the information contained in some of the specialist reports. As a result, some reports no longer contain information and analysis that was updated through an interdisciplinary review process and is included in the DEIS in its entirety. This is a complete specialist report which includes all the information that was summarized in the DEIS and other supplemental information. Efforts have been made to ensure that the retained information in the specialist reports is consistent with the DEIS. If inconsistencies exist between specialist reports and the DEIS, the DEIS should be regarded as the most current, accurate source of analysis.

Contents

Introduction

This specialist report evaluates and discloses the potential environmental consequences riparian (streams, wetlands and springs) resources that may result with the adoption of a revised land management plan. It examines, in detail, four different alternatives for revising the 1987 Coconino National Forest Land Management Plan (USDA Forest Service, 1987).

Executive Summary of Affected Environment and Environmental Effects

Affected Environment

Riparian Areas of the Coconino National Forest

Riparian areas on the forest include riparian forest stream systems (lotic), wetland/cienegas (lentic), springs and seeps. These areas are characterized by vegetation that is adapted to flooding as a natural disturbance and is highly associated with water.

There are four riparian forest PNVTs on the Coconino National Forest: Cottonwood Willow, Montane Willow, Mixed Broadleaf, and Gallery Coniferous. The Wetland/Cienega PNVT encompasses discrete bodies of water such as wetlands, cienegas, lakes, and reservoirs and their associated vegetation composition and structure. Wetlands may be saturated with water year-round, seasonally, or on a less than annual basis. Cienegas are linear streams associated with spring recharge that are primarily herbaceous and do not have woody vegetation (as the riparian forest types do). The dominant vegetation in Wetland/Cienega PNVT on the Coconino National Forest is hydrophytes, or “water-loving” plants (see Affected Environment for further description). None of these vegetation types are fire-adapted, but wetlands are occasionally burned to maintain open water for waterfowl.

Springs can be a sub-PNVT feature of wetlands, cienegas, and some streams. They are pools of water, running water, or a combination of both, and generally support lush and diverse aquatic or riparian vegetation, as well as a variety of invertebrates. There are several types of springs on the forest, including hanging gardens and seeps. Hanging gardens refer to the vegetation associated with springs that emerge from cliffs and ledges. Seeps are low-volume springs typically supporting herbaceous vegetation and forming a small puddle or pool.

Forest RASES inventory shows there are about 778 miles of riparian areas on the Forest including those miles located on Private lands. There are 588 miles of riparian areas on Forest administered lands (see Table 5 for miles by PNVT on Forest administered lands).

Riparian function was evaluated from on-site assessments and, at a finer scale than midscale vegetation analysis used for other PNVTs, integrates the contributions to ecosystem resiliency and threats for soil, water, and vegetation interactions. This section describes the departure and trend of each of the riparian forest PNVTs, the Wetlands Cienega PNVT, and springs, in terms of their riparian function, which is tied to properly functioning condition. Comparatively, there is not as much information available for cienegas and springs as other topics discussed in this section.

Properly functioning condition (PFC) was evaluated using the Riparian Area Survey and Evaluation System (RASES) which is a site-specific riparian survey method. RASES is used to

map and evaluate riparian reaches, including the type and location of stream riparian areas; in this case, riparian forest PNVTs. It measures vegetation, soil, stream channel, and water characteristic and delineates riparian type. Another consideration in assigning PFC classes to riparian reaches was the data collected on-site. The Coconino National Forest riparian PNVT GIS layer has been updated using RASES data and more recent Regional Riparian Mapping Project (RMAP) mapping. This resulted in more accurate mapping and the consequent identification of additional cienegas in the Wetland/Cienega PNVT, additional acres of Montane Willow Riparian PNVT, and the additional Gallery Coniferous Riparian Forest, a PNVT not previously identified in the Ecological Sustainability Report (USDA Forest Service 2009). RASES uses a narrower geographical extent than RMAP, and therefore, interpolating these two data sources requires the assumption that the larger, regionally mapped area is proportionally in the same condition as the RASES on-site evaluation. Little riparian condition information, however, has been collected for Gallery Coniferous Riparian Forest and the cienegas. Given that Gallery Coniferous Riparian Forest is largely inaccessible, as are some of the cienegas, it was assumed that the inaccessible portions are not impacted enough by human activities, including permitted livestock grazing, to impair their functional characteristics.

Subsequent PFC sampling indicates about 44% are in PFC, 23% are Functional- At Risk, 6% are Non-Functional and about 26% are unknown (using all lands within Forest boundary). The percentages on Forest administered lands is about the same (all classes within 1%).

Cottonwood Willow Riparian Forest

From a riparian functional condition standpoint, overall, this PNVT is highly departed from reference conditions. There is a high gap between historic and current riparian functional condition depending on stream and watershed. Please see final ESR, 2009 for details). Overall, about 49% of this PNVT has functional at risk or non functional riparian areas for a total of about 1,228 acres departed from reference condition

Projected trend is variable by stream and watershed ranging from away to slowly towards. Areas trending away are as a result of high recreational impact including Fossil Creek and other accessible areas of West Clear Creek, Beaver Creek Oak Creek, the Verde River and associated tributaries. Projected future litter and vegetation conditions (nutrient cycling function) should improve and approach historic under current Plan grazing guidelines as long as allowable use levels in Forest Plan are met.

Mixed Broadleaf Deciduous Riparian Forest

Overall, most riparian areas are in PFC, and has overall has low departure but there are appreciable areas within both PNVTs assessed as Functional-At-Risk. About 26% of this PNVT is functional at risk or non functional for a total of about 939 acres. These Functional-At-Risk and non functional areas include portions of Wet Beaver and Oak Creeks within the Mixed Broadleaf Deciduous Riparian PNVT.

Montane Willow Riparian Forest

About 28% of this PNVT is departed from reference riparian functional condition or about 1,072 acres. Departure is low except in Upper Clear Creek 5th HCU watershed and Hart Prairie area. These Functional-At-Risk and non functional areas include many areas of the Upper Clear Creek 5th HUC watershed on the Mogollon Rim and the Fern Mountain Botanical Area.

Gallery Coniferous Riparian Forest

Riparian functional condition assessments are very limited (only 2.5 miles) but are at PFC and most of the remainder of the PNVT is probably at PFC because most reaches are located in inaccessible areas to humans and animals.

Wetland/ Cienega

Wetland/ Cienega encompasses basin and swale wetlands ranging from seasonally to permanently wet and unmapped perennial springs or headwater streams where groundwater intersects the surface, creating pools or channels. Wetland functional condition and trend are discussed in the wetland section. The Cienega portion of this PNVT occupies linear streams associated with spring recharge without woody vegetation and is primarily herbaceous. Cienegas are highly departed with about 80% departure.

Wetlands

There are 78 known wetlands on the Forest. Overall, most wetland acres are in Proper Functioning Condition. A few large wetlands account for the majority of the acreage. 30 wetlands are functional at risk riparian condition and 43 are properly functioning. Based on the number of wetlands, 41% are functional at risk and therefore, this PNVT is highly departed.

Springs

Knowledge about the functional and ecological condition of the over 200 springs on the Forest is limited. However, where information has been collected, a majority of unfenced springs and springs that have been modified with pipelines and tanks or have been heavily grazed by livestock or elk are classified as either Non-Functional or Functional-At-Risk.

Forest springs are located in the Middle Little Colorado River, Canyon Diablo, Lower Little Colorado River, Upper Verde River and Lower Verde River 5th code watersheds. Unfenced accessible springs are considered at risk because of the increased potential for excessive use from recreationists, livestock, and wildlife.

Areas in PFC contribute the best conditions of ecological diversity and provide the best riparian area habitat for those plant and animal species that rely on it for their survival. Riparian areas in Functional-At Risk condition provide fairly diverse ecological conditions (including plants) but have the capability of providing improved plant composition and diversity and quality riparian habitat. Riparian areas that are Non-Functional have the lowest level of plant diversity and contribute the least towards ecological sustainability compared to PFC and Functional-At Risk classes.

Environmental Consequences Forest-Wide

Summary of Comparison of Alternatives Forest-wide

Overall, implementing plan direction in alternatives B, C, and D have about the same, and the greatest, potential to improve riparian resources and trend toward desired conditions.

This is based on predicted implementation of plan components, including objectives. The least potential for improvement to riparian resources is through implementation of plan direction in alternative A. The primary differences between plan direction in alternative A versus alternatives B, C, and D are additional plan objectives that prescribe realistic riparian resource restoration projects for streams. Examples of these include upland soil and watershed improvement projects that would improve riparian functional condition and projects to naturalize and decommission roads that would reduce riparian habitat fragmentation, alteration of riparian habitats, erosion, and sediment delivery into streams.

At the PNVT scale, continuing implementation of alternative A would slowly move the Cottonwood-Willow, Mixed Broadleaf Forest riparian areas to the desired condition of properly functioning, resilient riparian areas while Montane Willow would remain static and Gallery Coniferous forests would remain static. However, there would be variability in trend in some watersheds (table 9) where trend would be slower or remain static under Alternative A compared to B, C, and D. Under alternative A, management of riparian resources would continue in accordance with direction in the 1987 plan (as amended). Direction under alternative A, generally does not distinguish between the four riparian forest PNVTs.

Under alternative A, management of riparian resources would continue in accordance with direction in the 1987 plan (as amended). Direction under alternative A, generally does not distinguish between the four riparian forest PNVTs.

Management emphasis of the 1987 plan has outdated language and lacks direction for how to accomplish riparian recovery. Implementation goals and objectives within the 1987 plan—to have 80 percent of riparian recovery by the year 2030 and the remaining 20 percent would be significantly improved—are not realistic under current and expected future budgets. Over the last 10 years, only about 75 to 150 acres (or 3 percent of total riparian acreage) were improved with structural and nonstructural treatments (e.g., fencing or removal of grazing, respectively). This has resulted in moderate to low departure and, overall, a trend that is likely to remain static or slowly move toward desired conditions.

Continuing implementing current plan direction (Alternative A) treatments including riparian treatments, road removal and upland watershed treatments would occur only on an opportunity basis and would not improve riparian function or promote riparian habitat connectively or reduce riparian fragmentation appreciably. Based on average treatments over the last 10 years, continuing implementation of Alternative A would continue to slowly move a small percentage of riparian areas to the desired condition of properly functioning, resilient riparian forests, wetlands and spring riparian areas. Compared to Alternatives B, C, and D, wetlands and springs would improve at a faster rate than A while riparian forest PNVTs would improve at about the same rate as A.

This is based on predicted implementation of plan components, including objectives. The least potential for improvement to riparian resources is through implementation of plan direction in alternative A. The primary differences between plan direction in alternative A versus alternatives B, C, and D are additional plan objectives that prescribe realistic riparian resource restoration projects for streams. Examples of these include upland soil and watershed improvement projects that would improve riparian functional condition and projects to naturalize and decommission roads that would reduce riparian habitat fragmentation, alteration of riparian habitats, erosion, and sediment delivery into streams

The primary differences between Plan direction in Alternatives A versus B, C, and D are updated and more accurately defined desired conditions, including managing for fire, vegetative diversity and riparian function. In addition, B, C, and D include more site-specific streamside management zone flexible guidelines protecting water quality and objectives that would realistically result in more site-specific riparian restoration projects in wetlands and springs and about the same number of riparian forest projects at the PNVT level. Overall, about 10% of riparian forest PNVTs not in PFC could be improved through implementation of B, C, and D, similar to Alternative A. Compared to Alternative A, implementation of Alternatives B, C, and D would improve about 15-30% of wetlands and about 10% of springs

Compared to Alternative A, implementation of Alternatives B, C, and D plan direction could include more wetland, spring, and upland soil and watershed improvement projects and about the same number of riparian forest restoration projects as Alternative A. Overall, this would result in improved riparian forest (stream) , wetland, and spring riparian functional condition, more road naturalization and decommissioning which reduces riparian destruction, erosion and sediment delivery into stream which collectively decrease riparian fragmentation while improving habitat connectivity.

There are no measurable differences between alternatives B, C and D in plan component objectives for riparian improvement except in the proposed addition of 13 new Wilderness Areas. The addition would restrict active management actions such as mechanized equipment and would result in less disturbance to riparian areas and improved riparian function. In Alternative C, few roads and trails are present in newly proposed Wilderness Areas, Wildlife areas, management areas and RNA's and grazing would be allowed therefore predicted riparian improvement would still be similar to Alternatives B and D.

Under Alternative D, mechanized recreation on designated trails in botanical and geologic areas would probably not affect riparian condition because there are very few acres of riparian areas present and trails would not be designated within streamside management zones and BMP's would be followed.

Overall, implementing plan direction in alternatives B, C, and D have about the same, and the greatest, potential to improve resources and trend toward desired conditions. **For a detailed analysis by riparian type, please see body of this specialist report.**

Relevant Laws, Regulations, and Policy that Apply

Summary of Alternatives

All alternatives are designed to guide the Coconino NF's management activities in meeting all applicable Federal and State laws, regulations, and policies

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.

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.

The National Environmental Policy Act of 1969 - This act declares a national policy that encourages productive and enjoyable harmony between people and their environment, promotes efforts that will prevent or eliminate damage to the environment and biosphere, and enriches the understanding of the ecological systems and natural resources important to the nation.

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. 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.

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.

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.

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.

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
    - FSH 7709.56 Chapter 2 – Road Location

FSH 2509.22 (Soil and Water Conservation Practices Handbook) and Draft **FSH 2509.25** when finalized, or more current guidance.

Best management practices to control nonpoint source pollution for ground disturbing activities should be mitigated through identification and implementation of best management practices identified by the interdisciplinary team and guided by FSH 2509.22

Intergovernmental Agreements

Intergovernmental Agreement 16-R3-91-033 between the State of Arizona Department of Environmental Quality and the USDA Forest Service SW Region

To respond to the objectives defined by Congress in the Federal Water Pollution Control Act, as amended (1987). This objective is to restore and maintain the chemical, physical and biological integrity of the nation's waters in Arizona by attaining the goal of water quality which provides for the protection and propagation of fish, and wildlife, and provides for safe recreation in and on the waters of the State of Arizona;

To manage all resources and operate all programs for which they are responsible in a manner that seeks to achieve federal water quality goals and state water quality standards;

That the most practical and effective means of controlling potential nonpoint pollution sources from forests and rangelands is through development of preventative or mitigating land management practices, generally referred to as Best Management Practices (BMP's), and to ensure control of such nonpoint sources through the implementation of BMP's;

To develop and implement procedural methods to minimize duplication of effort and facilitate complementary nonpoint source pollution control and abatement programs;To jointly identify existing or potential nonpoint source pollution problems on National Forest System lands;

To designate the Forest Service as the designated Planning and Management Agency for National Forest System lands within the context of the Arizona Water Quality Management Program pursuant to Section 208;

Methodology and Analysis Process

Riparian Areas (Wetlands, Streams, and Springs)

This section describes the methodology and analysis processes used to determine the environmental consequences on riparian resources including stream systems, wetlands and springs 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 (USDA Forest Service 2009) and it's supporting specialists' reports.

The Riparian Area Survey and Evaluation System (RASES) USDA, FS, SW Regional July, 1989 (USDA Forest Service, 1989) is a Coconino Forest-specific riparian area survey that inventoried stream (lotic) riparian areas on the Forest. This survey was used to identify and map all forest riparian stream reaches. It offers the best spatial information of riparian area location, type, condition and future potential for ecosystem diversity analysis at the Forest planning unit level and below. Recent additions to the riparian PNVT layer stemming from more accurate riparian mapping include a new PNVT called the gallery coniferous riparian area and also identified several cienegas associated with the wetland PNVT. As a result, no riparian condition information was collected in the RASES inventory and therefore, is not included in this analysis. Another forest condition assessment was later performed and assessed the functional condition of RASES stream reaches (described below).

Riparian vegetation condition was determined and summarized by PNVT and 4th and 5th HUC watersheds that are located within the five riparian/wetland PNVTs; cottonwood-willow riparian forest, mixed broadleaf deciduous riparian forest, montane willow riparian forest, gallery coniferous forest and wetland/ cienega riparian areas.. The effects of implementing the alternatives to riparian condition will be summarized in this report.

Since the mid-1990s, the forest has utilized Proper Functioning Condition (PFC) (USDI 1998, 2003) to determine condition of riparian areas including streams and wetlands. The PFC inventory for the forests was derived from on-site evaluation collected on more than 95 percent of known forest riparian areas from 1989-2007. 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 biodiversity.

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 from reference to current riparian condition was made by reviewing forest data and projecting trend estimated change in upland and riparian vegetation condition.

Assumptions

In the analysis for the **riparian resource**, the following assumptions have been made:

- The land management plan provides a programmatic framework for future site-specific actions.
- Land management plans do not have direct effects. They do not authorize or mandate any site-specific projects or activities (including ground-disturbing actions).
- Land management plans may have implications, or environmental consequences, of managing the forests under a programmatic framework.
- The plan decisions (desired conditions, objectives, standards, guidelines, management areas, monitoring) will be followed when planning or implementing site-specific projects and activities.
- Laws, regulations, and policies will be followed when planning or implementing site-specific projects and activities.
- Monitoring will occur and the land management plan will be amended, as needed.
- We will be funded similar to past budget levels (past 5 years).
- The planning timeframe is 10 years; other timeframes may be analyzed depending on the resource (usually a discussion of anticipated trends into the future).
- 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 Assumptions

- Riparian functional condition for all known riparian areas were mapped as linear segments or reaches using the forests' RASES 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).

Summary of Alternatives

A summary of alternatives, including the key differences among alternatives, is outlined in the Draft Environmental Impact Statement. Four alternatives are analyzed in detail in this Specialist Report: Alternatives A through D. Alternative A is the current 1987 Coconino National Forest Plan, and Alternative B is the Preferred Alternative/Proposed Action, drafted over the past several months and refined with several tranches of internal and informal public feedback. Alternative C considers increases in the amount of wilderness and special areas, as well as increased opportunities for quiet semi-primitive recreation, while Alternative D considers slightly fewer restrictions than Alternatives B and C on human access and use of the Forest and its resources.

- Alternative A is the "1987 Plan
- Alternative B is the " Proposed Revised Plan"
- Alternative C
- Alternative D

Description of Affected Environment

Forest wide

Riparian areas on the forest include stream systems (lotic), wetland/cienegas (lentic), springs and seeps.

Riparian resources on the Coconino National Forest include riparian forests, wetlands/cienegas, and springs. These areas are characterized by vegetation that is adapted to flooding as a natural disturbance and is highly associated with water.

There are four riparian forest PNVTs on the Coconino National Forest: Cottonwood Willow, Montane Willow, Mixed Broadleaf, and Gallery Coniferous. The Wetland/Cienega PNVT encompasses discrete bodies of water such as wetlands, cienegas, lakes, and reservoirs and their associated vegetation composition and structure. Wetlands may be saturated with water year-round, seasonally, or on a less than annual basis. Cienegas are linear streams associated with spring recharge that are primarily herbaceous and do not have woody vegetation (as the riparian forest types do). The dominant vegetation in Wetland/Cienega PNVT on the Coconino National Forest is hydrophytes, or "water-loving" plants (see Affected Environment for further description). None of these vegetation types are fire-adapted, but wetlands are occasionally burned to maintain open water for waterfowl.

Springs can be a sub-PNVT feature of wetlands, cienegas, and some streams. They are pools of water, running water, or a combination of both, and generally support lush and diverse aquatic or riparian vegetation, as well as a variety of invertebrates. There are several types of springs on the forest, including hanging gardens and seeps. Hanging gardens refer to the vegetation associated with springs that emerge from cliffs and ledges. Seeps are low-volume springs typically supporting herbaceous vegetation and forming a small puddle or pool.

Forest RASES inventory shows there are about 778 miles of riparian areas on the Forest including those miles located on Private lands. There are 588 miles of riparian areas on Forest administered lands (see Table 5 for miles by PNVT on Forest administered lands).

Threats common to all riparian forest PNVTs that are within Forest Service control are:

- **Uncharacteristic fire** in watersheds of fire-adapted PNVTs. The increased risk of uncharacteristic fire results from past fire exclusion which allowed forest conditions to become denser and more prone to fires that burn into the tree canopy, rather than predominantly in the understory. Uncharacteristic fires can result in high burn severity, accelerated erosion and excessive sedimentation to connected streamcourses, excessive or increased water flow, and uncharacteristic flooding, which can result in scouring of the stream channel and the removal of vegetation and coarse woody debris in the riparian PNVTs. Uncharacteristic fire can also spread from adjacent fire-adapted PNVTs into riparian PNVTs, especially during drought. These conditions result in loss of vegetation and drying of the riparian area, and it can facilitate establishment or spread of invasive non-native vegetation.
- **Evapotranspiration rates** are increased by overly dense forests drawing more water, resulting in reduced water yield and stream flow to downstream riparian forests that depend on that water. The risk of uncharacteristic fire of adjacent fire-adapted PNVTs is evaluated in the Vegetation and Fire section of this chapter.
- **Dispersed recreation** has the potential to disturb riparian vegetation and bank stability. In doing so, it creates areas of bare soil that leads to erosion and sedimentation into streams and reduces riparian function and water quality.

The threats listed above are discussed under environmental consequences for riparian PNVTs to the extent that the Forest Service can influence them.

Riparian function was evaluated from on-site assessments and, at a finer scale than midscale vegetation analysis used for other PNVTs, integrates the contributions to ecosystem resiliency and threats for soil, water, and vegetation interactions. This section describes the departure and trend of each of the riparian forest PNVTs, the Wetlands Cienega PNVT, and springs, in terms of their riparian function, which is tied to properly functioning condition. Comparatively, there is not as much information available for cienegas and springs as other topics discussed in this section.

Properly functioning condition (PFC) was evaluated using the Riparian Area Survey and Evaluation System (RASES) which is a site-specific riparian survey method. RASES is used to map and evaluate riparian reaches, including the type and location of stream riparian areas; in this case, riparian forest PNVTs. It measures vegetation, soil, stream channel, and water characteristic and delineates riparian type. Another consideration in assigning PFC classes to riparian reaches was the data collected on-site. The Coconino National Forest riparian PNVT GIS layer has been updated using RASES data and more recent Regional Riparian Mapping Project (RMAP) mapping. This resulted in more accurate mapping and the consequent identification of additional

cienegas in the Wetland/Cienega PNVT, additional acres of Montane Willow Riparian PNVT, and the additional Gallery Coniferous Riparian Forest, a PNVT not previously identified in the Ecological Sustainability Report (USDA Forest Service 2009). RASES uses a narrower geographical extent than RMAP, and therefore, interpolating these two data sources requires the assumption that the larger, regionally mapped area is proportionally in the same condition as the RASES on-site evaluation. Little riparian condition information, however, has been collected for Gallery Coniferous Riparian Forest and the cienegas. Given that Gallery Coniferous Riparian Forest is largely inaccessible, as are some of the cienegas, it was assumed that the inaccessible portions are not impacted enough by human activities, including permitted livestock grazing, to impair their functional characteristics.

Subsequent PFC sampling indicates about 44% are in PFC, 23% are Functional- At Risk, 6% are Non-Functional and about 26% are unknown (using all lands within Forest boundary). The percentages on Forest administered lands is about the same (all classes within 1%).

Areas in PFC are presumed resilient to a range of natural disturbances and provide a variety of conditions that contribute to ecological diversity. The conditions evaluated to determine PFC, when they are present to the extent possible at a given site, are assumed to provide fully functional riparian area habitat for those plant and animal species that rely on it for their survival. There is a diverse composition and distribution of plants and the quality of the habitat supports the native species that rely on it.

Twenty-three percent of the riparian forest areas (excluding Gallery Coniferous) are classified as Functional-At-Risk, which means that they are in functional condition, but they have an existing soil, water, or vegetation attribute that is evaluated to determine PFC to make them susceptible to degradation. Areas that are Functional-At-Risk are less resilient to threats to their vegetation types. However, riparian areas in Functional-At-Risk condition still provide enough diverse ecological conditions (including plants) to support wildlife, fish, and rare plants, and have the capability to improve plant and soil composition, structure, and function.

Six percent of the riparian forest areas (excluding Gallery Coniferous) are classified as Non-Functional. This means they lack adequate vegetation, landform, or large woody debris to dissipate stream energy associated with high flows, and thus, they are not reducing erosion or improving water quality. Riparian areas that are Non-Functional have the lowest level of plant diversity, are most vulnerable to threats, and comparatively, contribute the least toward ecological sustainability compared to PFC and Functional-At-Risk classes.

The remaining 26 percent of stream riparian areas lack information, and therefore, are in unknown condition, because they are too remote to provide on-site evaluation. However, inaccessibility also means there is probably low impact from human disturbances and threats. There are no PFC data for Gallery Coniferous Riparian Forest, but it is likely at PFC because it is largely inaccessible to humans and livestock.

Riparian PNVTs

Cottonwood Willow Riparian

Cottonwood Willow Riparian Forest currently covers about 2,507 acres of the Coconino NF. It is located on the Red Rock Ranger District between 2,500 and 4,300 feet in elevation. It is patchily distributed along the lower elevation and low gradient reaches of perennial streams including the

Verde River, Oak Creek, West Clear Creek, Wet Beaver Creek, Dry Beaver Creek, and Fossil Creek as well as other perennial and intermittent streams and tributaries. Much of this PNVT along the Verde River, lower Oak Creek and lower Wet Beaver Creek is either privately owned or managed by Arizona State Parks. In general, riparian vegetation occurs along the stream channel and associated higher stream terraces that support a mix of riparian and upland vegetation, including mesquite and desert willow. Dominant vegetation includes: Fremont cottonwood, willow, ash, box elder, alder and others. Various grasses and forbs are usually present. This PNVT is not a fire-adapted system; instead, fire enters from adjoining PNVTs. Flooding is the primary disturbance. The seasonality and the quantity of water in floods are key factors in the germination and establishment of riparian vegetation.

Overall, the riparian functional condition for this PNVT is moderately departed (46 percent) from reference conditions and is slowly trending toward reference conditions. There are localized areas that have a static trend relative to reference conditions (either Functional-At-Risk or Non-Functional conditions) as a result of high dispersed recreational impact. These areas include Fossil Creek, most of the Verde River and associated tributaries, and other easily accessible areas of the lower reaches of West Clear Creek, Beaver Creek, Oak Creek, Fossil Creek, and Lower Oak Creek have been the most impacted by the ground disturbance and vegetation removal from high intensity unmanaged recreation. Lower Oak Creek is most impacted by degraded water quality resulting from unmanaged sanitation.

In addition to those threats common to all riparian forest PNVTs, Cottonwood Willow Riparian Forest PNVT is also impacted by excessive or poorly timed livestock grazing in localized areas, which can remove excessive amounts of vegetation, contribute to a loss of soil function, and alter vegetation structure and composition within the vegetation type.

There are few weed species, but some such as Russian knapweed, yellow starthistle and Malta starthistle, tamarisk, tree of Heaven and giant reed rank high for invasiveness, so this PNVT is considered moderately departed from reference condition for weeds. Riparian-dependent invasive exotic plant species are also anticipated to cause a decline in quality of native species regeneration and potential reduction in instream flows. The projected trend for noxious and/or invasive exotic weeds is away from reference conditions under current management.

Plants such as tamarisk, giant reed, and tree of Heaven will limit and eventually cause a decline in quality of existing vegetation by reducing native cottonwood and willow regeneration potential. Instream flows may be reduced as a result, because these exotic, woody plants draw more water from the water table than native trees (USDA Forest Service 2009). In addition, there have been significant increases in fire intensity and severity in Cottonwood Willow Riparian Forest in the Southwest due to invasive species, primarily tamarisk and Russian olive. Severe fires remove cottonwoods from burn areas and can convert these sites to a nonnative species mix.

Mixed Broadleaf Deciduous Riparian Forest

Mixed Broadleaf Deciduous Riparian Forest covers about 3,612 acres of the Coconino NF. Found between 3,300 and 6,400 feet in elevation, it is patchily distributed across the forest and includes Sycamore Canyon, mid-elevation portions of West Clear Creek, Oak Creek, Beaver Creek, and Fossil Creek, and associated tributaries. It consists of a vegetation mix of riparian woodlands and shrublands with various dominant species, depending on site-specific characteristics. Vegetation can include: Arizona sycamore, thin leaf alder, willow, Arizona cypress, conifers, box elder, narrow leaf or Fremont cottonwoods, velvet ash, and Arizona walnut. It often contains oaks and

conifers, including Arizona cypress, from adjacent uplands. This PNVT is not a fire-adapted system, but is susceptible to fire entering from adjoining PNVTs, particularly during drought years. Ponderosa Pine and Dry Mixed Conifer PNVTs are adjacent to this PNVT in numerous locations. Flooding and drought are the primary disturbances.

Overall, Mixed Broadleaf Deciduous has a low departure (23 percent) from reference conditions with a slow trend toward reference conditions. Localized portions of this PNVT in upper reaches of Red Tank Draw, Beaver Creek, Dry Beaver Creek, and Oak Creek have moderate departures (Functional-At-Risk) with a static trend. These Functional-At-Risk areas include the accessible upper portions of Beaver Creek and Oak Creek, which are at risk because of impacts from high levels of dispersed recreation. Impacts include soil compaction, damage to vegetation, and sanitation issues, particularly from swimming.

In addition to those threats common to all riparian forest PNVTs, Mixed Broadleaf Deciduous Riparian Forest PNVT is also affected by invasive exotic species. This PNVT has few weed species, but some, such as diffuse knapweed, yellow starthistle and Malta starthistle rank high for invasiveness. Exotic annual grasses, such as red and ripgut brome, are widely dispersed at variable densities and can cause major changes in ecosystem integrity if not controlled. This PNVT has low departure for weeds, but it is projected to move away from reference conditions. Fire occurrence could increase as a result, and the plants of this ecosystem are not adapted to the frequency at which exotic annuals burn (USDA Forest Service 2009). The presence of Himalayan blackberry, a very competitive species, is a relic of past homesteading within this PNVT. Himalayan blackberry reproduces vegetatively and its fruits are spread by humans and wildlife; thus, control is difficult.

Furthermore, Mixed Broadleaf Riparian Forest PNVT is also potentially impacted by excessive or poorly timed livestock grazing, which can remove excessive amounts of vegetation, contribute to a loss of soil function, and alter vegetation structure and composition within the vegetation type.

Montane Willow Riparian Forest

Montane Willow Riparian Forest is located mainly from 4,700 to 8,600 feet in elevation. It is scattered along perennial streams such as Upper Clear Creek and its tributaries, seasonally intermittent streams, wet meadows, and isolated springs at higher elevations. It covers about 3,829 acres. Trees include Bebb's willow, narrowleaf cottonwood, velvet ash, cherry, box elder, Arizona walnut, and Arizona alder. Dominant shrubs include red osier dogwood, willows, and woods rose. The understory consists of a variety of grass and grass-like species, including sedge, spikerush, and deergrass. Outlying populations of this vegetation type may have unique genetic components. Flooding is the primary disturbance in stream systems. This PNVT is not a fire-adapted system; instead, fire enters from adjoining PNVTs.

Montane Willow Riparian Forest has a low departure from reference conditions and is moving toward reference conditions or has a static trend depending on location. There are localized areas of high departures from reference with a static trend. These Functional-At-Risk or Non-Functional areas include the Upper Clear Creek 5th HUC watershed (which contains East Clear Creek and most of its tributaries) and the Fern Mountain Botanical Area. These departures from reference are primarily due to vegetative impacts from elk, managed grazing, non-point sources of sediment from roads, and water diversions to private land (Fern Mountain).

In addition to those threats common to all riparian forest PNVTs, Montane Willow Riparian Forest PNVT also faces a threat of excessive or poorly timed livestock grazing, which can remove excessive amounts of vegetation, contribute to a loss of soil function, and alter vegetation structure and composition within the vegetation type. Additionally, excessive wildlife herbivory occurs at levels that prevent attainment of desired conditions in this PNVT. Herbivory at this level can substantially modify the structure and composition of herbaceous and woody understory and negatively influence ecosystem processes, such as properly functioning soil. The Forest Service is not responsible for managing wildlife populations.

Furthermore, this PNVT faces a moderate threat of invasive exotic plant species by the introduction of weeds from those adjacent PNVTs that contain higher abundance and diversity of weeds. Invasive exotic plant species are a threat because riparian-dependent invasive weeds would limit and eventually cause a decline in quality of native species regeneration potential.

About 25% of this PNVT is departed from reference riparian functional condition or about 1,072 acres. Departure is low except in Upper Clear Creek 5th HCU watershed and Hart Prairie area. These Functional-At-Risk and non functional areas include many areas of the Upper Clear Creek 5th HUC watershed on the Mogollon Rim and the Fern Mountain Botanical Area.

Gallery Coniferous Riparian Forest

Gallery Coniferous Riparian Forest covers about 200 acres of the Coconino NF. This “canyon bottom forest” is located in areas such as Jack’s Canyon (north of State Highway 87) on the Mogollon Rim Ranger District and the upper end of the West Fork of Oak Creek. Dominant tree species typically include: sub-alpine fir, Engelmann spruce, Douglas-fir, quaking aspen, narrowleaf cottonwood, bigtooth maple; box elder, alder, willows, Gambel oak, ponderosa pine, and Rocky Mountain juniper. Dominant shrubs include willows and woods rose. The understory consists of a variety of grass and grass-like species including sedge, Baltic rush, spikerush, and deergrass. This PNVT experiences periodic flooding and high water tables. This PNVT is not a fire-adapted system; instead, fire enters from adjoining PNVTs.

All of this PNVT for which there is available data is in properly functioning condition with a low departure and a static trend. Riparian functional condition assessments are very limited (only 2.5 miles) but are at PFC

The remainder of the PNVT is assumed to be in properly functioning condition with a similar departure, because most reaches are inaccessible to humans and animals, and thus, it should have relatively low disturbance compared to the ones for which data are available. Because of the inaccessibility, few management activities are expected to occur under current management, resulting in a static trend.

This PNVT has those threats common to all riparian forest PNVTs.

Wetland/ Cienega

Wetland/ Cienega encompasses basin and swale wetlands ranging from seasonally to permanently wet and unmapped perennial springs or headwater streams where groundwater intersects the surface, creating pools or channels. Wetland functional condition and trend are discussed in the wetland section. The Cienega portion of this PNVT occupies linear streams associated with

spring recharge without woody vegetation and is primarily herbaceous. Cienegas are highly departed with about 80% departure.

Wetlands

There are 78 known wetlands on the Forest. Overall, most wetland acres are in Proper Functioning Condition. A few large wetlands account for the majority of the acreage. 30 wetlands are functional at risk riparian condition and 43 are properly functioning.
Based on the number of wetlands, 41% are functional at risk and therefore, this PNVT is highly departed.

Springs

Knowledge about the functional and ecological condition of the over 340 springs on the Forest is limited. However, where information has been collected, a majority of unfenced springs and springs that have been modified with pipelines and tanks or have been heavily grazed by livestock or elk are classified as either Non-Functional or Functional-At-Risk.

Forest springs are located in the Middle Little Colorado River, Canyon Diablo, Lower Little Colorado River, Upper Verde River and Lower Verde River 5th code watersheds. Unfenced accessible springs are considered at risk because of the increased potential for excessive use from recreationists, livestock, and wildlife.

Areas in PFC contribute the best conditions of ecological diversity and provide the best riparian area habitat for those plant and animal species that rely on it for their survival. Riparian areas in Functional-At Risk condition provide fairly diverse ecological conditions (including plants) but have the capability of providing improved plant composition and diversity and quality riparian habitat. Riparian areas that are Non-Functional have the lowest level of plant diversity and contribute the least towards ecological sustainability compared to PFC and Functional-At Risk classes.

Methods used to derive departures for riparian forests PNVTs and the Wetland/Cienega PNVT are described in appendix C.

All of the stream riparian areas classified as Functional-At-Risk are in Cottonwood Willow, Mixed Broadleaf Deciduous, and Montane Willow Riparian Forest PNVTs, and all of the Non-functional stream miles are in Cottonwood Willow and Montane Willow Riparian Forest PNVTs. All of the riparian forest PNVTs are predicted to either retain their current low departures or move slowly toward reference condition under current management, with the exception of particular 5th HUC watersheds. The 5th-code HUCs of most concern are Upper Clear Creek, Beaver Creek, Oak Creek, and portions of Fossil Creek-Lower Verde River.

The perennial streams of most concern are portions of East Clear Creek and its tributaries, Beaver Creek, Oak Creek, Fossil Creek, Dry Beaver Creek, Red Tank Draw, Walker Creek, and the Verde River.

The Upper Clear Creek HUC is at risk because of dispersed recreation, legacy of improperly located and poorly maintained roads (especially user-created roads), legacy off-highway vehicle use, and ungulate herbivory, which is under the control of Arizona Game and Fish Department. This HUC includes East Clear Creek, its tributaries and intermittent streamcourses with riparian habitat. The areas of most concern are those that are accessible to human activities.

The accessible areas of the Beaver Creek 5th-code HUC are at risk because of legacy off-highway vehicle use, dispersed recreation, legacy of improperly located and poorly maintained roads (especially user-created roads), and legacy grazing. This HUC includes Beaver Creek, Dry Beaver Creek, Red Tank Draw, Walker Creek, and some intermittent stream courses with riparian vegetation.

The accessible areas of the Oak Creek 5th-code HUC are threatened by dispersed recreation, a legacy of improperly located and poorly maintained roads (especially user-created roads and social trails). The lower portion of Oak Creek is affected by legacy grazing issues and legacy off-highway vehicle use. This HUC includes Oak Creek, Spring Creek, and intermittent streamcourses with riparian vegetation. Water quality in Oak Creek is also affected by *E. coli* from septic systems associated with private development, wildlife, and swimming. Only swimming in localized areas is in Forest Service control. Legacy road, off-highway vehicle use, and grazing issues refer to vegetation removal, soil compaction, soil loss and erosion associated with past grazing practices; with areas that were open to off-highway vehicles prior to implementation of the Travel Management Rule; and issues with past road maintenance. Although some of the causes of the departures have been addressed, particularly with the Travel Management Rule, the sedimentation into connected water courses, and the soil and vegetation issues should gradually decrease as the affected areas heal.

Fossil-Lower Verde River HUC is at risk of high amounts of dispersed recreation, legacy off-highway vehicle, poorly located and maintained roads (especially user-created roads).

Stream Systems by Watershed

Current Condition

Table 1 shows riparian areas are currently fairly well represented and present in three out of seven watersheds: Middle Little Colorado River (48% of the riparian acres in the watershed are on the Forest), Upper Verde River (36%) and Lower Verde River (21%),

Table 1. Proportional Extent of Riparian Acres by 4th HUC Watershed and Ownership

4th Code Watershed	Percent watershed on the Forest	Riparian acres in watershed	Percent watershed riparian acres on Forest
Havasu Creek	0.16%	0	0
Middle Little Colorado River	15%	1404	48%
Canyon Diablo	57%	0	0
Lower Little Colorado River	15%	0	0
Tonto Creek	0.2%	4585	0
Upper Verde River	40%	5425	36%
Lower Verde River	24%	8237	21%
Forest Totals at 4th Code Scale	**19.7%**	**19,651**	**22%**

Table 2 shows that Forestwide riparian conditions and trends from historic to current conditions are variable. Most of the perennial stream miles in the Middle Little Colorado River 4th code watershed are in Functional at risk. The Upper Clear Creek 5th code watershed is highly departed from reference condition due to the percentage of inventoried riparian areas that are Functional-At-Risk or Non-functional, primarily in response to excessive wildlife herbivory. Less than half of the inventoried riparian areas in the Canyon Diablo 4th code watershed are in PFC. Walnut Creek has low departure. Slightly over half (113 miles) of inventoried riparian in the Upper Verde 4th code watershed is Functional-At-Risk or Non-functional. Highly departed 5th codes are Grindstone Wash-Upper Verde River, Beaver Creek, and Cherry Creek-Upper Verde River.

Table 2. Riparian Functional Condition Streams, Wetlands, Departure and Trend by Watershed

4th code watersheds	5th Code watersheds	Stream Riparian Condition Departure and Trend	Dominant Wetland Riparian Condition Departure and Trend
Middle Little Colorado River	Upper Clear Creek[1]	High/Static	FAR – static
	Jacks Canyon	No streams	PFC – static
Canyon Diablo	Rio de Flag	No streams	FAR - static
	Walnut Creek	No streams	PFC – static
	San Francisco Wash	No streams	FAR –static
Lower Little Colorado River	Upper Cedar Wash	No streams	FAR – static

1

4th code watersheds	5th Code watersheds	Stream Riparian Condition Departure and Trend	Dominant Wetland Riparian Condition Departure and Trend
Upper Verde River	Sycamore Creek	Mostly Unknown	FAR – static
	Grindstone Wash-Upper Verde River	Low/Static (rec)	No wetlands
	Oak Creek	Low/Static (rec)	No wetlands
	Beaver Creek	High/Slowly Towards	PFC –static
	Cherry Creek-Upper Verde River	Low/Static to Slowly Towards	No wetlands
Lower Verde River	West Clear Creek	Low/Slowly Towards	PFC – static
	Fossil Creek-Lower Verde River	Low/Away for rec areas) and slowly towards	FAR – static

See ESR, (USDA, 2009) and water specialist report (USDA, 2007) for initial analysis and more details. DEIS and EIS information is the most current.

Evaluation of trend is toward the desired conditions of functional riparian areas by 2030.

Current Condition by Stream PNVT, Departure and Trend

Table 3 displays wetland and cienaga riparian condition, departure and projected trend by PNVT on Forest administered lands.

Table 3. Wetland and Cienaga Riparian Condition, Departure and projected Trend on Forest Administered Land by PNVT

PNVT	AT RISK Miles	NON-FUNCTIONAL	PFC	Unknown	Percent Departure	Riparian Functional Condition Departure	Projected Trend Current Management and Forest Plan Direction
Cienega	14.1	2.2	4.1		80	Unknown	Static
Wetlands by Number	30	0	43	5	70	Moderate	Slowly towards

Table 4 displays riparian forest condition, departure and trend on forest administered lands

Table 4. Riparian forest condition, departure and trend on forest administered land, by PNVT

PNVT	Acres on the Forest	% of Forest	PFC (Miles)[a]	Functional-at-Risk (Miles)	Non-Functional (Miles)	Unknown (Miles)	% of area Departed from Reference Condition[b]	Riparian Functional Condition Departure[c]	Projected Trend Current Management
Cottonwood Willow Riparian Forest	2,507	0.1%	42.5	35.8	4.7	2.4	46	Moderate	Slowly toward except for portions of the Fossil Creek-Lower Verde River and Oak Creek 5th-code HUCs or Fossil Creek, most of West Clear Creek, most of Verde River, Beaver Creek, Lower Oak Creek) which have a static trend
Mixed Broadleaf Deciduous Riparian Forest	3,612	0.1%	86.5	30.8	0	19.4	26	Low	Majority is slowly toward except portions of Beaver Creek and Oak Creek 5th HUC, (Upper Red Tank Draw, Beaver Creek, Dry Bever Creek and Oak Creek) which is moderate/static trend toward reference.

PNVT	Acres on the Forest	% of Forest	PFC (Miles)[a]	Functional-at-Risk (Miles)	Non-Functional (Miles)	Unknown (Miles)	% of area Departed from Reference Condition[b]	Riparian Functional Condition Departure[c]	Projected Trend Current Management
Montane Willow Riparian Forest	3,829	0.2%	189.7	57.8	15.4	4.5	28	Low	Slowly toward to dtatic except portions of Upper Clear Creek 5th HUC, (East Clear Creek and its tributaries and Fern Mtn Botanical Area) which has a high departure and a static trend
Gallery Coniferous Riparian Forest	200	<0.1%	2.5	0	0	Unknown	Unknown	Low	Static

[a] Values are approximate. Note that some segments of riparian PFC mapped were outside of riparian PNVT polygons and therefore, total miles of 513.9 is less than the overall Forest RASES stream layer of 588 miles. However, values are reliable enough to interpret wide ranges of riparian functional condition departure. Gallery Coniferous Forest reaches are generally located in riparian areas not easily accessible to humans, elk, or permitted livestock and are therefore inferred to be without those associated disturbances and likely at PFC and static trend.

[b] Provide this represents the percentage of total known acres not in PFC, including unknown miles.

[c] Riparian and wetland condition is considered highly departed from reference conditions when 66 percent or more of inventoried riparian areas are Functional-At-Risk or Non-Functional. Low departure is when less than 33 percent of inventoried riparian areas are Functional-At-Risk or Non-Functional. Moderate is between low and high.

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Cottonwood Willow Riparian Forest

Cottonwood Willow Riparian Forest currently covers about 2,507 acres of the Coconino National Forest. It is located on the Red Rock Ranger District between 2,500 and 4,300 feet in elevation. It is patchily distributed along the lower elevation and low gradient reaches of perennial streams including the Verde River, Oak Creek, West Clear Creek, Wet Beaver Creek, Dry Beaver Creek, and Fossil Creek as well as other perennial and intermittent streams and tributaries. Much of this PNVT along the Verde River, lower Oak Creek and lower Wet Beaver Creek is either privately owned or managed by Arizona State Parks. In general, riparian vegetation occurs along the stream channel and associated higher stream terraces that support a mix of riparian and upland vegetation, including mesquite and desert willow. Dominant vegetation includes: Fremont cottonwood, willow, ash, box elder, alder and others. Various grasses and forbs are usually present. This PNVT is not a fire-adapted system; instead, fire enters from adjoining PNVTs. Flooding is the primary disturbance. The seasonality and the quantity of water in floods are key factors in the germination and establishment of riparian vegetation.

Overall, the riparian functional condition for this PNVT is moderately departed (49 percent) from reference conditions and is slowly trending toward reference conditions. There are localized areas that have a static trend relative to reference conditions (either Functional-At-Risk or Non-Functional conditions) as a result of high dispersed recreational impact. These areas include Fossil Creek, most of the Verde River and associated tributaries, and other easily accessible areas of the lower reaches of West Clear Creek, Beaver Creek, Oak Creek, Fossil Creek, and Lower Oak Creek have been the most impacted by the ground disturbance and vegetation removal from high intensity unmanaged recreation. Lower Oak Creek is most impacted by degraded water quality resulting from unmanaged sanitation.

In addition to those threats common to all riparian forest PNVTs, Cottonwood Willow Riparian Forest PNVT is also impacted by excessive or poorly timed livestock grazing in localized areas, which can remove excessive amounts of vegetation, contribute to a loss of soil function, and alter vegetation structure and composition within the vegetation type.

There are few weed species, but some such as Russian knapweed, yellow starthistle and Malta starthistle, tamarisk, tree of Heaven and giant reed rank high for invasiveness, so this PNVT is considered moderately departed from reference condition for weeds. Riparian-dependent invasive exotic plant species are also anticipated to cause a decline in quality of native species regeneration and potential reduction in instream flows. The projected trend for noxious and/or invasive exotic weeds is away from reference conditions under current management.

Plants such as tamarisk, giant reed, and tree of Heaven will limit and eventually cause a decline in quality of existing vegetation by reducing native cottonwood and willow regeneration potential. Instream flows may be reduced as a result, because these exotic, woody plants draw more water from the water table than native trees (USDA Forest Service 2009). In addition, there have been significant increases in fire intensity and severity in Cottonwood Willow Riparian Forest in the Southwest due to invasive species, primarily tamarisk and Russian olive. Severe fires remove cottonwoods from burn areas and can convert these sites to a non-native species mix.

Current major disturbances: Water diversions and increasing human development in the watersheds have affected quantity and seasonality of historical flood regimes, eliminating or reducing native species that provide competition to non-native plants and livestock grazing.

Riparian Functional Condition Departure and Projected trend (historic to current)

From a riparian functional condition standpoint, overall, this PNVT is highly departed from reference conditions. There is a high gap between historic and current riparian functional condition depending on stream and watershed. Please see final ESR, 2009 for details). Overall, about 49% of this PNVT has functional at risk or non functional riparian areas for a total of about 1228 acres departed from reference condition

Projected trend is variable by stream and watershed ranging from away to slowly towards. Areas trending away are as a result of high recreational impact including Fossil Creek and other accessible areas of West Clear Creek, Beaver Creek Oak Creek, the Verde River and associated tributaries. Projected future litter and vegetation conditions (nutrient cycling function) should improve and approach historic under current Plan grazing guidelines as long as allowable use levels in Forest Plan are met.

Mixed Broadleaf Deciduous Riparian Forest

Mixed Broadleaf Deciduous Riparian Forest covers about 3,612 acres of the Coconino National Forest. Found between 3,300 and 6,400 feet in elevation, it is patchily distributed across the forest and includes Sycamore Canyon, mid-elevation portions of West Clear Creek, Oak Creek, Beaver Creek, and Fossil Creek, and associated tributaries. It consists of a vegetation mix of riparian woodlands and shrublands with various dominant species, depending on site-specific characteristics. Vegetation can include: Arizona sycamore, thin leaf alder, willow, Arizona cypress, conifers, box elder, narrow leaf or Fremont cottonwoods, velvet ash, and Arizona walnut. It often contains oaks and conifers, including Arizona cypress, from adjacent uplands. This PNVT is not a fire-adapted system, but is susceptible to fire entering from adjoining PNVTs, particularly during drought years. Ponderosa Pine and Dry Mixed Conifer PNVTs are adjacent to this PNVT in numerous locations. Flooding and drought are the primary disturbances.

Overall, Mixed Broadleaf Deciduous has a low departure (26 percent) from reference conditions with a slow trend toward reference conditions. Localized portions of this PNVT in upper reaches of Red Tank Draw, Beaver Creek, Dry Beaver Creek, and Oak Creek have moderate departures (Functional-At-Risk) with a static trend. These Functional-At-Risk areas include the accessible upper portions of Beaver Creek and Oak Creek, which are at risk because of impacts from high levels of dispersed recreation. Impacts include soil compaction, damage to vegetation, and sanitation issues, particularly from swimming.

In addition to those threats common to all riparian forest PNVTs, Mixed Broadleaf Deciduous Riparian Forest PNVT is also affected by invasive exotic species. This PNVT has few weed species, but some, such as diffuse knapweed, yellow starthistle and Malta starthistle rank high for invasiveness. Exotic annual grasses, such as red and ripgut brome, are widely dispersed at variable densities and can cause major changes in ecosystem integrity if not controlled. This PNVT has low departure for weeds, but it is projected to move away from reference conditions. Fire occurrence could increase as a result, and the plants of this ecosystem are not adapted to the frequency at which exotic annuals burn (USDA Forest Service 2009). The presence of Himalayan blackberry, a very competitive species, is a relic of past homesteading within this PNVT. Himalayan blackberry reproduces vegetatively and its fruits are spread by humans and wildlife; thus, control is difficult.

Furthermore, Mixed Broadleaf Riparian Forest PNVT is also potentially impacted by excessive or poorly timed livestock grazing, which can remove excessive amounts of vegetation, contribute to a loss of soil function, and alter vegetation structure and composition within the vegetation type.

Montane Willow Riparian Forest

Montane Willow Riparian Forest is located mainly from 4,700 to 8,600 feet in elevation. It is scattered along perennial streams such as Upper Clear Creek and its tributaries, seasonally intermittent streams, wet meadows, and isolated springs at higher elevations. It covers about 3,829 acres. Trees include Bebb's willow, narrowleaf cottonwood, velvet ash, cherry, box elder, Arizona walnut, and Arizona alder. Dominant shrubs include red osier dogwood, willows, and woods rose. The understory consists of a variety of grass and grass-like species, including sedge, spikerush, and deergrass. Outlying populations of this vegetation type may have unique genetic components. Flooding is the primary disturbance in stream systems. This PNVT is not a fire-adapted system; instead, fire enters from adjoining PNVTs.

Montane Willow Riparian Forest has a low departure from reference conditions and is moving toward reference conditions or has a static trend depending on location. There are localized areas of high departures from reference with a static trend. These Functional-At-Risk or Non-Functional areas include the Upper Clear Creek 5th HUC watershed (which contains East Clear Creek and most of its tributaries) and the Fern Mountain Botanical Area. These departures from reference are primarily due to vegetative impacts from elk, managed grazing, non-point sources of sediment from roads, and water diversions to private land (Fern Mountain).

In addition to those threats common to all riparian forest PNVTs, Montane Willow Riparian Forest PNVT also faces a threat of excessive or poorly timed livestock grazing, which can remove excessive amounts of vegetation, contribute to a loss of soil function, and alter vegetation structure and composition within the vegetation type. Additionally, excessive wildlife herbivory occurs at levels that prevent attainment of desired conditions in this PNVT. Herbivory at this level can substantially modify the structure and composition of herbaceous and woody understory and negatively influence ecosystem processes, such as properly functioning soil. The Forest Service is not responsible for managing wildlife populations.

Furthermore, this PNVT faces a moderate threat of invasive exotic plant species by the introduction of weeds from those adjacent PNVTs that contain higher abundance and diversity of weeds. Invasive exotic plant species are a threat because riparian-dependent invasive weeds would limit and eventually cause a decline in quality of native species regeneration potential.

Gallery Coniferous Riparian Forest

Gallery Coniferous Riparian Forest covers about 200 acres of the Coconino National Forest. This "canyon bottom forest" is located in areas such as Jack's Canyon (north of State Highway 87) on the Mogollon Rim Ranger District and the upper end of the West Fork of Oak Creek. Dominant tree species typically include: sub-alpine fir, Engelmann spruce, Douglas-fir, quaking aspen, narrowleaf cottonwood, bigtooth maple; box elder, alder, willows, Gambel oak, ponderosa pine, and Rocky Mountain juniper. Dominant shrubs include willows and woods rose. The understory consists of a variety of grass and grass-like species including sedge, Baltic rush, spikerush, and deergrass. This PNVT experiences periodic flooding and high water tables. This PNVT is not a fire-adapted system; instead, fire enters from adjoining PNVTs.

All of this PNVT for which there is available data is in properly functioning condition with a low departure and a static trend. The remainder of the PNVT is assumed to be in properly functioning condition with a similar departure, because most reaches are inaccessible to humans and animals, and thus, it should have relatively low disturbance compared to the ones for which data are available. Because of the inaccessibility, few management activities are expected to occur under current management, resulting in a static trend.

This PNVT has those threats common to all riparian forest PNVTs.

Table 5 displays PFC miles and percent by 4th and 5th HUC watershed

Table 5. PFC Classes by Stream Riparian Length in 4th and 5th HUC Watersheds

4th Code watershed	5th Code watershed	Proper Functioning Condition (miles & percent)										
		PFC	%	FAR	%	NF	%	Non-Riparian	%	Unk[2]	%	Total miles
Havasu Creek	Spring Valley Wash	0	0	0	0	0	0	0	0	0	0	0
Middle Little Colorado R.		144	68	48	23	21	10	0.2	0	0	0	213
	Upper Clear Creek	130.2	65	48	24	21	11	0.2	0	0.6	<1	200
	Lower Clear Creek	14.1	100	0	0	0	0	0	0	0	0	14
	Jacks Canyon	0	0	0	0	0	0	0	0	0	0	0
Canyon Diablo		6	16	7	18	3	8	2	5	20	50	38
	Rio de Flag	1.8	44	0	0	0	0	0	0	2.3	56	4.1
	Walnut Creek	4.2	12	7.1	21	2.6	8	2.4	7	17.6	52	33.9
	San Francisco Wash	0	0	0	0	0	0	0	0	0	0	0

[2] Unknown areas were not inventoried for PFC because access is difficult. It is probable that many areas are PFC because access by people and livestock is limited and, therefore, riparian areas are not greatly disturbed.

4th Code watershed	5th Code watershed	Proper Functioning Condition (miles & percent)										
		PFC	%	FAR	%	NF	%	Non-Riparian	%	Unk[2]	%	Total miles
	Canyon Diablo	0	0	0	0	0	0	0	0	1.9	100	1.9
Lower Little Colorado R.		0	0	0	0	0	0	0	0	0	0	0
	Kana-a Wash-Lower Little Colorado R.	0	0	0	0	0	0	0	0	0	0	0
	Deadman Wash	0	0	0	0	0	0	0	0	0	0	0
	Citadel Wash-Lower Little Colorado R.	0	0	0	0	0	0	0	0	0	0	0
	Upper Cedar Wash	0	0	0	0	0	0	0	0	0	0	0
	Lower Cedar Wash	0	0	0	0	0	0	0	0	0	0	0
Tonto Creek		0	0	0	0	0	0	0	0	0	0	0
	Haigler Creek-Tonto Creek	0	0	0	0	0	0	0	0	0	0	0
Upper Verde R.		104	28	90	24	22	6	0	0	158	42	374

4th Code watershed	5th Code watershed	Proper Functioning Condition (miles & percent)										
		PFC	%	FAR	%	NF	%	Non-Riparian	%	Unk[2]	%	Total miles
	Sycamore Creek	4.1	9	0	0	0	0	0	0	40.5	91	44.6
	Grindstone Wash-Upper Verde River	0	0	6.5	100	0	0	0	0	0	0	6.5
	Oak Creek	71.6	48	19.1	13	0	0	0	0	58.4	39	149.1
	Beaver Creek	28.2	20	31.5	23	21.4	15	0	0	59.1	42	140.3
	Cherry Creek-Upper Verde River	0	0	33	100	0.1	0	0	0	0	0	33.1
Lower Verde R.		89	18	34	76	2	0.4	5	1	25	5	152
	West Clear Creek	45.7	73	10.5	17	1.9	3	4.5	7	0	0	62.5
	East Verde River	0	0	0	0	0	0	0	0	0	0	0
	Fossil Creek-Lower Verde R.	42.5	49	23.1	26	0	0	0	22	25	0	87.4
Total miles & Average Percent		**342**	**44**	**179**	**23**	**47**	**6**	**7**	**1**	**202**	**26**	**778**

[1] Unknown areas were not inventoried for PFC because access is difficult. It is probable that many areas are PFC because access by people and livestock is limited and, therefore, riparian areas are not greatly disturbed.

PFC by 4th and 5th HUC Watershed

Forest-wide, 44 percent (342 miles) of riparian stream miles on the Forest are in Proper Functioning Condition, 23 percent (179 miles) are classified as Functional-at-risk which means they are functioning properly yet have an existing soil, water, or vegetation attribute that makes them susceptible to degradation. Another 6 percent (47 miles) are Non-functional.

Slightly over half (113 miles) of the inventoried riparian miles in the Upper Verde 4th code watershed is Functional-at-risk or Non-functional. Its most highly departed 5th code watersheds are Grindstone Wash-Upper Verde River, Beaver Creek, and Cherry Creek-Upper Verde River. This is due to excessive past and current livestock grazing and wildlife herbivory, and off-highway vehicle and recreation disturbance.

Although most of the perennial stream miles in the Middle Little Colorado River 4th code watershed are in Proper Functioning Condition, the Upper Clear Creek 5th code watershed is highly departed from reference conditions. There are 48 Functional-at-risk miles and 21 Non-functional miles primarily due to excessive wildlife herbivory.

Twenty-nine percent of the inventoried stream miles in the Walnut Creek 5th code watershed (Canyon Diablo 4th code) are either Functional-at-risk or Non-functional. In the Lower Verde River 4th code, 20 percent of the West Clear Creek 5th code and 26 percent of the Fossil Creek-Lower Verde River 5th codes are also either Functional-at-risk or Non-functional. This is due to excessive past and current livestock grazing and wildlife herbivory, and off-highway vehicle and recreation disturbance.

The remaining miles, have not been inventoried because of difficult access (which also limits both people and livestock access). These areas are probably in Proper Functioning Condition due to limited human and animal impact. Inaccessible areas and areas that are currently functioning properly are expected to remain functional because Best Management Practices are being implemented or livestock grazing and recreation use is low. Areas susceptible to degradation and areas currently not functioning will improve over time where Best Management Practices are used. Improvement will be slower in areas with wildlife or livestock or high recreation use.

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).

Wetland/Cienegas and Springs

Wetlands/ Cienegas range from seasonally to permanently wet and unmapped perennial springs or headwater streams where groundwater intersects the surface, creating pools or channels. Wetlands are areas that are inundated by water with a frequency sufficient to support and under normal precipitation supports a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions (i.e., presence of hydric soil) for growth and reproduction.

On the Coconino National Forest, the Wetlands/Cienegas primarily occur at elevations ranging from 6,200 to 7,200 feet and cover about 9,879 acres which includes 20 acres of cienegas. Wetlands on the Coconino National Forest are generally disconnected from groundwater and

perched above regional groundwater tables, and thus are completely reliant on precipitation for water input. Therefore, standing water and vegetation in wetlands can fluctuate greatly—from basically non-existent in dry periods to highly productive wetlands in wet periods. Other key processes include the development and presence of hydric soils, decomposition, and nutrient cycling, as well as the topography. The combination of these processes result in unique vegetative components such as rushes, sedges, flat sedges, spike rushes, and aquatic vegetation in pools. Natural disturbances are drought and flooding. Natural fire is an infrequent disturbance, entering from adjacent vegetation types during drought conditions, but fire may be used as a tool to maintain wetland conditions that are beneficial to specific wildlife.

There are approximately 78 identified wetlands (9,859 acres) on the forest. There are several wetland types: semi-permanent, seasonal, ephemeral, and reservoir/lakes. Many of the wetlands have been modified by dams and stock tanks to increase water permanency. Most wetlands are in the vicinity of Anderson Mesa which is on the east-central side of the forest; they range in size from Mormon Lake at about 5,500 acres to less than 10 acres in size; however, most wetlands on the forest are relatively small. Larger-sized wetlands are associated with reservoirs, such as Upper and Lower Lake Mary, or with natural lakes such as Stoneman and Mormon Lakes. Larger wetlands are more resilient to threats and are more likely to be in PFC as a result. Therefore, the number of wetlands in PFC may under-represent the acres in PFC and the number of wetlands that are departed may over-represent the acres impacted.

Eighty-one percent of the identified wetland acres (55 percent of total wetlands) on the Forest are at PFC. Nine percent of the identified wetland acres (38 percent of total wetlands) are classified as Functional-At-Risk. Thirty wetlands are Functional-At-Risk riparian condition, 43 are Properly Functioning, and none are Non-Functioning. The remaining wetlands are reservoirs. Given that 38 percent of wetlands are Functional-At-Risk, this PNVT is considered moderately departed.

The forest contains 20 acres of cienegas, a linear stream associated with groundwater/spring recharge that is primarily herbaceous and does not have woody vegetation (as the riparian forest types do). An example of a cienega is Buck Springs on the Mogollon Rim Ranger District. Most cienega areas now have stock tanks or dams associated with them that were constructed many years ago. Stock tanks and dams have altered vegetation composition and structure and soil condition, because water persistence and depth has changed, negatively affecting riparian function. Most cienegas do not have PFC condition data, but those assessed were moderately departed.

Historically, Wetland/Cienega soil condition was mostly satisfactory as soil productivity was high overall, with both high surface litter and understory and forage production. Currently, most of the Wetland/Cienega PNVT on the forest has moderate (considering number of wetlands)/ low (considering acres of wetlands) departure from reference condition with a trend of slowly toward desired conditions. Unsatisfactory soils are present due to a combination of effects from legacy livestock grazing that goes back to the early 1900s, wildlife herbivory, and managed grazing to a lesser extent. Soils are commonly compacted with reduced porosity, litter, vegetative cover, and production that impair nutrient cycling functions.

Threats to Wetland/Cienega include excessive wildlife herbivory, legacy off-highway vehicle use, dispersed recreation in localized and accessible areas, drought, and managed grazing in localized areas. Springs have the same threats as Wetland/Cienega. In addition, springs are threatened by

fire exclusion in fire-adapted PNVTs in their associated watersheds and well pumping in localized areas. Groundwater pumping, however, is outside of Forest Service authority to control.

There are different kinds of springs on the forest such as seeps, and hanging gardens. Springs occur where groundwater is forced to the soil surface, offering sufficient moisture to support hydrophytic or riparian vegetation. Water from springs may be found in pools or streams or seep from cracks in cliffs or the ground, or a combination of these. In addition, water flow can vary between years and within years. Water chemistry can be unique. Springs can support both herbaceous and woody riparian vegetation.

Wetland types differ from each other by water permanency, wetland vegetation, and size (USDA, 1993). These types are semi-permanent, seasonal, temporary or ephemeral wetlands, and reservoirs and are described in Table 6.

Table 6. Wetland Type Characteristics on the Forest

Wetland Type	Flooding Regime	Plant Species Occupying Deepest Zone	Flooding Frequency
Reservoir/lakes, open water	Permanent water	submergent vegetation; bare soil	every year
Semi-permanent	6-12 months	Hardstem bulrush, Cattail; submerged aquatics	>7 of 10 years
Seasonal	3-6 months	Manna grass, spikerush, sedges.	<7 of 10 years
Temporary	1-2 months	Alpine timothy, Foxtail barley	3 of 10 years
Ephemeral	2-6 weeks	bare soil, dock, western wheat grass, deergrass	3-10 years

Natural disturbances are drought and flooding. Natural fire is an infrequent disturbance, entering from adjacent vegetation types during drought conditions, but fire may be used as a tool to maintain wetland conditions that are beneficial to specific wildlife or for social purposes.

Vegetation can include rushes, sedges, flat sedges, spike rushes, and aquatic vegetation in pools.

Wetland functional condition is displayed in table 7 below The Cienega portion of this PNVT is assumed to be highly departed.

Table 7. Wetland Acres and PFC on Forest

Wetland riparian condition class on Coconino National Forest Condition class	Number of acres	Number of wetlands
Proper functioning condition	7986 (81%)	43 (55%)
Functional-at-risk	887 (9%)	30 (38%)
Unknown (includes reservoir wetlands)	986	7
Total	9859	78

All acres are approximate.

In the Canyon Diablo 4th code watershed, the San Francisco Wash 5th code watershed has the most inventoried Functional-at-risk wetlands on the Coconino (490 acres in ten wetlands). In the Middle Little Colorado River 4th code, the Upper Clear Creek 5th code has 114 acres (3 wetlands) classified as Functional-at-risk, and in the Upper Verde River 4th code, the Sycamore Creek 5th code watershed has 100 acres (1 wetland). This risk status is because livestock and wildlife use is higher in unfenced areas which consequently impacts soil condition (as described for Wetland Cienega PNVT) and vegetation production.

Most Wetland/Cienega riparian areas now have stock tanks or dams associated with them. These were constructed many years ago. Vegetation composition and structure, and soil condition have been altered because water persistence and depth has changed, negatively affecting riparian function. Livestock and wildlife concentrate around these waters, compact the soil and affect vegetation structure and composition unless they are fenced.

Springs and Seeps

The National Hydrologic Dataset was used to describe the number of springs and seeps. The proportional extent are displayed in Table 8 and does not include wetlands. This information shows that the Forest has high percentages of seeps, springs, in the Middle Little Colorado River, Canyon Diablo, and Lower Little Colorado River 4th codes.

Knowledge about the functional and ecological condition of the approximate 340 springs on the forest is limited and, therefore, their departure is unknown. Given what is known about the conditions of observed springs and the threat of falling groundwater levels near Flagstaff and in the Verde Valley, springs on the Coconino National Forest are assumed to be highly departed where they are not fenced off to ungulate herbivory. Many springs occur in inaccessible areas protected from herbivory, and therefore, they are assumed to be in functional condition and not

departed. Where information has been collected, a majority of unfenced springs and springs that have been modified with pipelines and tanks or have been heavily grazed by livestock or elk are classified as either Non-Functional or Functional-At-Risk. Forest springs are located in the Middle Little Colorado River, Canyon Diablo, Lower Little Colorado River, Upper Verde River, and Lower Verde River 5th-code watersheds. Unfenced accessible springs are considered at risk because of the increased potential for excessive use from recreationists, livestock, and wildlife.

Tanks and pipelines alter natural flow, filtering, ground-water recharge, and vegetation.

Springs are also projected to remain at risk or non-functional due to drought, adjacent domestic well use, and conditions of the surrounding landscape

Table 8. Proportional Extent of Springs and Seeps by 4th HUC Watershed

4th Code Watershed	% watershed on the Forest	% springs and seeps within watershed on Forest
Havasu Creek	0.16%	0%
Middle Little Colorado River	15%	63%
Canyon Diablo	57%	79%
Lower Little Colorado River	15%	38%
Tonto Creek	0.2%	0%
Upper Verde River	40%	27%
Lower Verde River	24%	12%

Reference Condition - springs and seeps: Springs and seeps are inferred to have been distributed across numerous watersheds on the Forest because they currently exist in the five 4th code watersheds with the highest Forest extent. Although reference conditions are largely unknown, the fact that seeps and springs are well represented, or redundant, throughout all major watersheds assures the opportunity for a high level of sustainability as long as their condition is functional. They are natural water features that existed prior to Euro-American settlement and were probably functional due to lack of human disturbances. Native Americans and wildlife likely caused early disturbances. Disturbances became more extensive as homesites were developed and as livestock operations increased.

Current Condition - springs and seeps: Springs and seeps are located across five out of seven fourth code watersheds: Middle Little Colorado River, Canyon Diablo, Lower Little Colorado River, Upper Verde River, and Lower Verde River. A substantial number of the springs are developed, which probably occurred after the Homestead Act of 1862. Extent and flow of springs and seeps fluctuate in response to a lack of recharge in the associated aquifers due to drought, lack of fire, and closed forest canopies which increase evapotranspiration. Springs and seeps located adjacent to existing wells may experience reduced flow from pumping of wells on private

land like that in the Upper Verde River 4th code watershed near Verde Valley municipalities. The combined effects of spring development, adjacent well pumping and surrounding landscape condition on flows are unknown.

Proper functioning condition (PFC) assessments associated with springs and seeps are limited. Where information has been collected, unfenced areas are classified as either ‘functional at risk’ or ‘non functional’ due to disturbance mainly from livestock and wildlife herbivory and recreation.

Environmental Consequences Stream Riparian

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 long-term environmental consequences, of managing the forests under this programmatic framework.

Riparian Stream Type PNVTs

Includes: Cottonwood Willow, Mixed Broadleaf, Montane Willow, Gallery Coniferous Forest, Wetland/Cienega and Springs.

Overall, implementing plan direction in alternatives B, C, and D have about the same, and the greatest, potential to improve resources and trend toward desired conditions.

This is based on predicted implementation of plan components, including objectives. The least potential for improvement to riparian resources is through implementation of plan direction in alternative A. The primary differences between plan direction in alternative A versus alternatives B, C, and D are additional plan objectives that prescribe realistic riparian resource restoration projects for streams. Examples of these include upland soil and watershed improvement projects that would improve riparian functional condition and projects to naturalize and decommission roads that would reduce riparian habitat fragmentation, alteration of riparian habitats, erosion, and sediment delivery into streams.

Table 9 summarizes riparian function departure and trends by alternative.

Table 9. Summary of Riparian Function Departure values and trends

PNVT	Forest Acres	Percent of Forest	Existing Riparian Function Departure Percent/Trend	Alt. A. Riparian Function Departure Percent/Trend	Alts. B, D Riparian Function Departure Percent/Trend	Alt. C Riparian Function Departure Percent/Trend
Cottonwood Willow Riparian Forest	2,507	0.1	Moderate (49%)/ Slowly Toward	Moderate (46%)/ Slowly Toward		
Middle Fossil Creek			Moderate/ Static	Moderate/ Static	Low/ Toward	
Lower Oak Creek			Moderate/ Static	Moderate/ Static	Moderate/ Toward	
Mixed Broadleaf Riparian Forest	3,612	0.1	Low (26%)/ Slowly Toward	Low (23%)/ Slowly Toward		
Beaver Creek 5th code HUC			High/ Slowly Toward	High/ Slowly Toward	Moderate/ Toward	
Montane Willow Riparian Forest	3,829	0.2	Low (28%)/ Static to Slowly Toward	Low (25%)/ Static to Slowly Toward		
Upper Clear Creek 5th code HUC			High/ Static	High/ Toward	Moderate/ Toward	
Gallery Coniferous Riparian Forest	200	<0.1	Low/ Static	Low/ Static		

*Departure was assessed as low (0 to 33 percent), moderate (34 to 66 percent), or high (greater than 66 percent).

Summary of Comparison of Alternatives Forest-wide

At the PNVT scale, continuing implementation of alternative A would slowly move the Cottonwood-Willow, Mixed Broadleaf Forest riparian areas to the desired condition of properly functioning, resilient riparian areas while Montane Willow would remain static and Gallery Coniferous forests would remain static. However, there would be variability in trend in some watersheds (table 9) where trend would be slower or remain static under Alternative A compared to B, C, and D. Under alternative A, management of riparian resources would continue in accordance with direction in the 1987 plan (as amended). Direction under alternative A, generally does not distinguish between the four riparian forest PNVTs.

Management emphasis of the current forest plan has outdated language and lacks direction for riparian recovery especially in springs and wetlands. Implementation goals and objectives have not been accomplished and are not realistic under current and expected future budgets to have 80% of riparian recovery by 2030 and the remainder will be significantly improved. If implemented, current plan guidance would move at least 80% of all riparian areas towards functioning conditions but has not been implemented and unrealistic. Over the last 10 years, only about 330 acres of riparian forests were improved with structural treatments or about 3% of total riparian acreage while an additional 300 acres (about 3%) would improve through removal or deferral of livestock brazing. Although PFC assessments were not performed, it is highly likely that most acres were not in PFC which amounted to about 10% of non PFC acres. About 3240 acres are now identified as riparian forests not in PFC.

Continuing to implement direction in the 1987 plan (alternative A) for treatments, including riparian treatments and road removal and upland watershed treatments, would continue to occur on an opportunity basis and improve riparian function or promote riparian habitat connectivity and/or reduce riparian fragmentation commensurate with funding and workforce associated with the opportunity. Because of these opportunities to treat riparian areas and to naturalize or decommission roads, riparian vegetation would improve locally along streambanks, aiding in the ability to filter sediments; capture bedload and aid flood plain development; improve floodwater retention and groundwater recharge; develop root masses that stabilize streambanks against cutting action; and dissipate stream energy associated with high waterflow, thereby reducing erosion and improving water quality. This would be sufficient to allow a slow trend toward desired conditions at the landscape scale.

Based on average treatments over the last 10 years, continuing implementation of Alternative A would continue to slowly move a small percentage of riparian areas to the desired condition of properly functioning, resilient riparian forests, wetlands and spring riparian areas. Compared to Alternatives B, C, and D, wetlands and springs would improve at a faster rate than A while riparian forest PNVTs would improve at about the same rate as A.

Implementing plan direction in Alternatives B, C, and D have about the same and the greatest potential to improve riparian forests, wetlands and spring resources and trend towards desired condition based on predicted implementation of plan components including objectives. The least potential for improvement of wetland and spring riparian resources is through Alternative A.

The primary differences between Plan direction in Alternatives A versus B, C, and D are updated and more accurately defined desired conditions, including managing for fire, vegetative diversity and riparian function. In addition, B, C, and D include more site-specific streamside management zone flexible guidelines protecting water quality and objectives that would realistically result in more site-specific riparian restoration projects in wetlands and springs and about the same number of riparian forest projects at the PNVT level. Overall, about 10% of riparian forest PNVTs not in PFC could be improved through implementation of B, C, and D, similar to Alternative A. Compared to Alternative A, implementation of Alternatives B, C, and D would improve about 15-30% of wetlands and about 10% of springs

Compared to Alternative A, implementation of Alternatives B, C, and D plan direction could include more wetland, spring, and upland soil and watershed improvement projects and about the same number of riparian forest restoration projects as Alternative A. Overall, this would result in improved riparian forest (stream) , wetland, and spring riparian functional condition, more road naturalization and decommissioning which reduces riparian destruction, erosion and sediment

delivery into stream which collectively decrease riparian fragmentation while improving habitat connectivity.

There are slight differences between alternatives B, C, and D in plan component objectives for riparian improvement with the proposed addition of 13 new Wilderness Areas. The addition would restrict active management actions such as mechanized equipment and would result in less disturbance to riparian areas and improved riparian function. In Alternative C, few roads and trails are present in newly proposed Wilderness Areas, Wildlife areas, management areas and RNA's and grazing would be allowed therefore predicted riparian improvement would be similar to or a little better than Alternatives B and D.

Overall, implementing plan direction in alternatives B, C, and D have about the same, and the greatest, potential to improve resources and trend toward desired conditions.

This is based on predicted implementation of plan components, including objectives. The least potential for improvement to riparian resources is through implementation of plan direction in alternative A. The primary differences between plan direction in alternative A versus alternatives B, C, and D are additional plan objectives that prescribe realistic riparian resource restoration projects for streams. Examples of these include upland soil and watershed improvement projects that would improve riparian functional condition and projects to naturalize and decommission roads that would reduce riparian habitat fragmentation, alteration of riparian habitats, erosion, and sediment delivery into streams.

Under Alternative D, mechanized recreation on designated trails in botanical and geologic areas would probably not affect riparian condition because there are very few acres of riparian areas present and trails would not be designated within streamside management zones and BMP's would be followed.

Trends and Indirect Effects by Alternative

Existing trend from reference to current under the current plan for all stream system riparian PNVTs is slowly towards desired conditions or static from desired conditions in all riparian PNVTs (see table 9 and original data from Forest Service, 2007 and 2009). Some portions would remain static due to high levels of recreation impacts including dispersed camping, high levels of ungulate herbivory, (elk and livestock) and lack of specific forest plan guidance including objectives.

Existing trend from reference to current under the current plan for wetlands is static due to high levels of ungulate herbivory) elk and livestock) in past and lack of plan component wetland emphasis and objectives to manage and restore these areas (see table 3).

Common to All Alternatives

Current management on properly functioning condition riparian forest areas would maintain that riparian condition (resulting in a Static trend) because most of these sites are remote enough to be unaffected by human disturbance and/or would be protected by best management practices and other mitigations.

For all alternatives, best management practices used in trail maintenance and new trail construction would effectively reduce sediment and improve watershed conditions. In general, areas currently in properly functioning condition are expected to remain in that condition based on implementation of best management practices for managing roads, timber, and grazing management in all alternatives. Some of those areas are inaccessible to grazing or recreation, or they are areas in which grazing has been removed over the past 10 years. Riparian areas with a Functional-At-Risk rating would show an upward trend where best management practices and other mitigation efforts are effectively protecting riparian values. Areas on the Coconino National Forest where permitted livestock grazing has been removed (e.g., the Verde River) have improved and would continue to do so. Progress toward reference conditions would be slowed in areas of relatively high elk grazing in Montane Willow Riparian Forest or in localized areas of high dispersed recreation (e.g., Fossil Creek).

Riparian conditions are expected to improve with implementation of the Coconino National Forest Travel Management Decision issued in 2011, because it would reduce associated motorized recreational impacts in riparian areas such as accelerated soil erosion, soil compaction, and vegetation loss. These roads may continue to exist for administrative purposes, but would have less traffic that detaches soil particles and increases sedimentation. In addition, off-road motor vehicle use would be limited, which could also result in reduced sedimentation.

The Verde Wild and Scenic River Comprehensive River Management Plan states that vegetation recovery, development, and maintenance of riparian vegetation characteristics necessary for riparian-dependent species shall not be hindered by forest management activities (USDA Forest Service 2004c). The majority of Cottonwood Willow Riparian Forest on the Coconino National Forest is found along the Verde River, of which the southern segments are designated as a wild and scenic river. Vegetation management direction only includes inventory, mapping, and development of an integrated pest management plan for invasive plant species.

A significant portion of this PNVT would benefit from clear plan direction, but alternative A would not provide adequate direction to manage the PNVT as a whole. Functional-At-Risk areas along the Verde River (Cottonwood Willow Riparian Forest PNVT) where cattle have been removed (almost all of Coconino National Forest along the Verde River) show an upward trend and are expected to improve to properly functioning condition where excluded from livestock grazing. Non-functional areas should improve over time if plan grazing utilization guidelines are followed. If grazing exceeds plan guidelines, riparian conditions would remain static.

The ways in which these alternatives address threats to water quality and sedimentation from recreation impacts in riparian areas, especially Oak Creek (USDA,2011a) Effects to Fossil Creek would be addressed through the current development of the Fossil Creek Comprehensive River Management Plan, a process which is occurring on a parallel timeline to the forest plan revision process.

Gallery Coniferous Riparian Forest is currently at a low departure level for vegetation with a static trend. The location and inaccessibility of most of this vegetation type prevents active management, other than use of fire, more so than plan direction in any of the alternatives. Therefore, in the absence of an uncharacteristic wildfire, it is expected to remain at the current departure and trend under all alternatives, and there exists no known difference in expected outcomes among alternatives because of the inaccessibility of and lack of data for the Gallery Coniferous Riparian Forest PNVT.

All alternatives include measures to prevent, control, and eradicate priority infestations of invasive exotic weeds, and they are expected to have the same effects on the management of invasive weeds.

Alternative A for All Riparian PNVTs

Current direction is inadequate to address the following:

- No specific desired conditions in current plan. Current plan has management emphasis statements that lacks direction and does not focus on soil and riparian function. Current plan has a goal emphasizing 80% riparian recovery by 2030. Implementation of desired condition statements in Alternatives B, C, and D are required and should indirectly result in improved riparian condition and function.
- Maintenance and improvement of riparian areas. The goal or objectives to have 80% riparian recovery by 2030 above the rim and 90% below are unattainable and unrealistic under current workforce and budgets.
- Current plan has limited direction for wetlands and springs management. Standards and guidelines define conditions as a percentage of “natural” conditions, which themselves are undefined.
- The current plan has several standards and guidelines direction including procurement of instream flow water rights, protection of riparian areas though filter strips, maintaining 80% crown cover, 80% emergent vegetation cover and maintaining 3 age classes of woody riparian species.
- Alternative A has opportunity based objectives to construct 10 miles of fences per decade for the first two decades where necessary to protect key wet meadows, wetlands, and riparian regeneration from grazing. Construct 150 waterfowl islands per decade in

Decades 2 and 3 and create potholes in wetland areas to provide nesting habitat. Prioritize road closures where from roads within stream courses or wetlands (permanently or intermittently wet) reducing hydrologic function.

At the PNVT scale, continuing implementation of alternative A would slowly move the Cottonwood-Willow, Mixed Broadleaf Forest riparian areas to the desired condition of properly functioning, resilient riparian areas while Montane Willow would remain static and Gallery Coniferous forests would remain static. However, there would be variability in trend in some watersheds (table 9) where trend would be slower or remain static under Alternative A compared to B, C, and D. Under alternative A, management of riparian resources would continue in accordance with direction in the 1987 plan (as amended). Direction under alternative A, generally does not distinguish between the four riparian forest PNVTs.

Management emphasis of the 1987 plan has outdated language and lacks direction for how to accomplish riparian recovery. Implementation goals and objectives within the 1987 plan—to have 80 percent of riparian recovery by the year 2030 and the remaining 20 percent would be significantly improved—are not realistic under current and expected future budgets. Over the last 10 years, only about 75 to 150 acres (or 3 percent of total riparian acreage) were improved with structural and non-structural treatments (e.g., fencing or removal of grazing, respectively). This has resulted in moderate to low departure, and overall, a trend that is likely to remain static or slowly move toward desired conditions.

Continuing to implement direction in the 1987 plan (alternative A) for treatments, including riparian treatments and road removal and upland watershed treatments, would continue to occur on an opportunity basis and improve riparian function or promote riparian habitat connectivity and/or reduce riparian fragmentation commensurate with funding and workforce associated with the opportunity. Because of these opportunities to treat riparian areas and to naturalize or decommission roads, riparian vegetation would improve locally along stream banks, aiding in the ability to filter sediments; capture bedload and aid floodplain development; improve flood-water retention and groundwater recharge; develop root masses that stabilize streambanks against cutting action; and dissipate stream energy associated with high water flow, thereby reducing erosion and improving water quality. This would be sufficient to allow a slow trend toward desired conditions at the landscape scale.

In addition, fire exclusion in PNVTs that adjoin these riparian forest types has facilitated conifer encroachment (in Mixed Broadleaf and Montane Willow Riparian Forests), which is shading out riparian deciduous trees and shrubs, and thereby increasing the risk for uncharacteristic fire in these PNVTs. Uncharacteristic wildfire would kill riparian vegetation, facilitate establishment of invasive exotic plants, and dry riparian areas. Continuing implementation of alternative A would slowly move a small percentage of riparian areas to the desired condition of properly functioning, resilient riparian areas, but it would not be sufficient to address threats that affect the PNVT on a landscape scale.

Riparian condition and nutrient cycling function are expected to improve with the forestwide allowable use guidelines for livestock grazing. These guidelines are intended to be used when site-specific information is not available and provide guidance, so there is sufficient vegetative ground cover to maintain soil productivity. Projected future litter and vegetation conditions (nutrient cycling function) should improve and approach historic levels under the 1987 plan grazing guidelines as long as allowable use levels in the plan are met.

In riparian PNVTs, Riparian and Open Waters Management Area (MA 12) provides the primary direction for managing and protecting riparian features and functions. While most of the direction in this section supports properly functioning riparian forests, riparian improvement is hindered by standards and guidelines in MA 12 that prohibit precommercial thinning in riparian areas, or areas with riparian characteristics. Precommercial thinning is a tool used to remove young conifers, whose encroachment increases the risk of uncharacteristic fire in these PNVTs and moves understory conditions away from desired conditions.

The Sedona-Oak Creek area (Amendment 12 of the 1987 plan, or MAs 21 to 29) contains riparian forest direction as well. While management areas such as Oak Creek (MA 14) and Lower Oak Creek (MA 23) address threats to these PNVTs and have some direction to restrict activities that negatively impact water resources, others such as Savannah (MA 27) do not provide any direction for riparian resources. Management areas outside of the Sedona-Oak Creek area have direction that could hinder progress toward desired conditions for this PNVT, because it would prevent successful active restoration. Given this plan direction, current conditions would likely persist, resulting in natural succession patterns, barring major droughts or uncharacteristic fire.

Under alternative A, plan direction includes fire suppression objectives and language that makes it difficult to implement the reintroduction of fire as a natural disturbance across a large part of the forest. As a result, the increase in risk of uncharacteristic fire to adjacent riparian vegetation types would correspondingly increase.

For Mixed Broadleaf Deciduous Riparian Forest, the majority of this PNVT is found in Wilderness (MA1) and within the Amendment 12 area. These management areas protect this resource because they minimize or address the major threats to the vegetation type, except for those segments of the vegetation type that are found in uplands of the associated watershed or outside of Forest Service control. This means that while direct impacts to the vegetation type would be minimized, there would be little direction to manage indirect effects from activities in the surrounding watershed that could be sources of sedimentation.

Alternatives B, C, and D

Alternatives B, C, and D would move the condition of riparian areas faster toward the desired condition of properly functioning, resilient riparian areas than alternative A because plan objectives are more realistic. There are no measurable differences in plan objectives for riparian improvement among alternatives B, C, and D. As a result, alternatives B and D would move riparian condition and function toward desired conditions at about the same rate.

The primary differences between plan direction in alternative A versus alternatives B, C, and D are the updated and more accurately defined desired conditions to include managing for fire, vegetative diversity, and riparian function and a guideline for more flexible width of the streamside management zone depending on site-specific conditions protecting water quality and the functioning of riparian forests. Compared to alternative A, implementation of alternatives B, C, and D plan direction and objectives could lead to more stream and upland soil and watershed improvement projects that would result in improved riparian functional condition and more road naturalization and decommissioning. Desired conditions promote reducing riparian fragmentation and improve habitat connectivity.

Reductions in the modification of riparian areas, erosion, and sediment delivery into streams would collectively decrease. Road systems can degrade riparian function when located in riparian streamside management zones. Implementing the plan direction in alternatives B, C, and D would naturalize or decommission some roads located in riparian areas and, consequently, it would improve riparian area function that would not occur under alternative A direction. As a result of plan language in alternatives B, C, and D, riparian function would be improved.

Alternatives B, C, and D have objectives to directly treat riparian areas, as well as to remove roads and improve upland watershed condition. Therefore, some positive trend is expected along with reducing riparian fragmentation and the threat of excessive sedimentation. Implementing plan direction for soil and water resource improvement projects prescribed in alternatives B, C, and D would result in improved soil condition and reduce the threat of high-severity fires that might threaten riparian function and water quality. This clearer direction on how to actively restore functioning-at-risk and nonfunctional riparian types is more likely to result in restoring more of these areas to properly functioning condition than would occur under alternative A.

Currently, the forest does not permit livestock grazing along the Verde River. This restriction has resulted in improved riparian conditions along the river during the last 10 years, and this is common to all alternatives. Many other allotments have also reduced occurrence of livestock grazing in perennial streams to hardened areas or to times when grazing pressure does not adversely affect riparian area condition. To meet desired conditions in alternatives B, C, and D, it is expected that these restrictions would continue, or if drought conditions or other threats cumulatively impact the riparian conditions, the restrictions could be expanded.

For stream systems, alternatives B, C, and D could structurally treat between 200 and 500 acres every 10 years. The midpoint acreage is 350, which is similar to alternative A and would restore about 10 percent of departed riparian forest PNVTs. If the upper estimate of the objective is realized, then alternatives B, C, and D would improve overall function and resiliency through riparian treatment more than alternative A. Riparian vegetation would improve along streambanks aiding in the ability to filter sediments; capture bedload and aid flood plain development; improve floodwater retention and groundwater recharge; develop root masses that stabilize streambanks against cutting action; and dissipate stream energy associated with high waterflow, thereby reducing erosion and improving water quality. The concept of filter strips in Alternative A is replaced with the newer concept of streamside management zones in Alternatives B, C, and D.

Alternative C restricts grazing in research natural areas. However, this restriction does little to change the effects to riparian areas within current and proposed research natural areas among alternatives because little to no grazing occurs in these areas under current management.

Alternative C also recommends that portions of the forest are not suitable for recreational shooting. This change in suitability would not impact riparian function.

Desired conditions for all riparian forests states, “flooding is a primary disturbance, not fire. Fire is a disturbance from incursions originating in adjacent systems and may creep into riparian corridors. Fire in riparian areas is influenced by the fire regime condition class in adjacent vegetation types…). Under alternatives B, C, and D, Ponderosa Pine, Mixed Conifer with Frequent Fire, Mixed Conifer with Aspen, and those PNVTs adjacent to riparian forests (and more likely to introduce fire to riparian forest PNVTs), would move toward desired conditions and closer to their natural fire regimes as a result of plan objectives and the removal of other

restrictions to fire management that would be present under alternative A. As a result, the landscape-scale risk of uncharacteristic fire to riparian forest PNVTs would be less under these alternatives than under alternative A.

For Cottonwood Willow, desired conditions for alternatives B, C, and D for this PNVT state:

> *"Associated higher stream terraces support a mix of riparian and upland vegetation, including mesquite and desert willow…Flood plains tend to have higher surface litter and diversity of species, more protective ground cover, and greater vegetation productivity (i.e., biomass) than terraces. Consequently, flood plains have greater ability to resist erosion and recycle nutrients."*

If management activities under these alternatives were to occur at current levels, it would then be expected that the departure would remain moderate and the trend would be slowly toward desired conditions. Management activities that would occur in this PNVT beyond levels assumed for this analysis, however, would help make additional progress toward stated desired conditions.

Mixed Broadleaf Deciduous Riparian Forest is currently at a low level of vegetative departure with a trend toward reference conditions. Desired conditions under alternative B for this PNVT include the following language:

> *Generally, both terraces and flood plains have high amounts of protective litter and plant cover and are not compacted. Consequently, terraces and flood plains are able to resist erosion and recycle nutrients."*

Under alternatives B, C, and D, the departure would be expected to remain low and have a trend that would be slowly toward desired conditions. Management activities that would occur in this PNVT beyond levels assumed for this analysis, however, would help make additional progress toward stated desired conditions.

Montane Willow Riparian Forest is currently at a low level of vegetative departure with a trend of static to slowly toward desired conditions. Desired conditions include that, "soils have high amounts of litter and plant cover, and a spongy, moist surface in terraces and wet meadows. Such desired conditions would support the maintenance and improvement of this PNVT.

With respect to livestock grazing, alternatives B, C, and D provide desired conditions that riparian areas are rarely impacted negatively by livestock, and supporting guidelines focus on management of livestock grazing that provides for retention of desired plan species and ensures plant recovery. Guidelines also direct that salt and other supplements, as well as range improvements be placed in locations where riparian areas and other sensitive locations would not be affected by trampling. These alternatives also call for functioning watersheds, with quantities of water in amounts and during times necessary to support vegetation, wildlife, and communities that depend on these resources. Desired conditions and guidelines also direct that new and existing instream water rights are maintained or procured to ensure that enough water is guaranteed to provide for habitat needs, as well as other needs on the forest over the long term.

Alternative B

Recommended wilderness in alternative B would have minor and localized impacts on riparian PNVTs. The 1,179-acre Davey's recommended wilderness includes 30 acres (1.1 percent of

Cottonwood Willow Riparian Forest). Wildfires in this recommended wilderness would likely be managed for resource objectives. Cottonwood Willow Riparian Forest would be protected through guidance in the proposed revised plan to maintain a streamside management zone, and few direct impacts would be anticipated. Some fire creep into the riparian area could occur; however, it is expected to be minor in extent. Since riparian PNVTs are not fire adapted, riparian structure and function could be reduced in areas where fire creep occurs. Overall, wildfires managed to meet resource objectives in Davey's recommended wilderness would reduce the departure of fire-adapted PNVTs and lower the risk of uncharacteristic fire. It would also increase the likelihood of restoring the natural fire return interval in this localized area. This would indirectly lower the risk of sediment delivery into connected waters associated with this riparian PNVT. Only 1.1 percent of Cottonwood Willow Riparian Forest would be located in recommended wilderness areas where wildfires with resource objectives would be used. This could have localized effects; however, it would not affect the sustainability of this PNVT at the forest level.

There would be a moderate to high likelihood that wildfires would be suppressed in the Walker Mountain recommended wilderness, which contains 26 acres of riparian habitat (19 acres in Mixed Broadleaf Deciduous Forest and 7 acres in Cottonwood Willow Riparian Forest). Wildfires would burn until they are suppressed. Where uncharacteristic fuel loads occur and burn, portions of upland and riparian PNVTs would likely burn under conditions associated with uncharacteristic fire, and riparian structure and function would be reduced. Where effectively suppressed, the moderate to high PNVT departures in the recommended wilderness would be maintained; and the risk of uncharacteristic fire would increase. Suppressing fires would likely not result in 100 percent suppression of all acres in wilderness, leading to a portion that would likely burn under conditions of uncharacteristic fire or high severity. Portions where fire suppression would not occur could burn under conditions of high severity and indirectly increase the risk of sediment delivery into the connected waters. A much higher risk and magnitude of short-term exceedances of water quality would be expected in those areas. However, because only 0.2 percent of riparian forest PNVTs would be located in recommended wilderness areas where wildfires have a moderate to high likelihood of being suppressed, the sustainability of riparian PNVTs would not be affected even though there could be localized effects.

Alternative C

Recommended wilderness in alternative C would have localized impacts on riparian forest PNVTs but would not affect the sustainability of the PNVTs at the forest level. There are 948 acres of riparian habitat (9.5 percent of riparian forest PNVTs) associated with recommended wilderness areas in which wildfires have a low likelihood of being suppressed. Six recommended wilderness areas (Barbershop, East Clear Creek, Railroad Draw, Davey's, Cimarron-Boulder, and Hackberry) include Cottonwood Willow Riparian Forest (15.4 percent of PNVT acres), Mixed Broadleaf Deciduous Forest (3.6 percent of PNVT acres), and Montane Willow Riparian Forest (11.3 percent of PNVT acres). Wildfires in these recommended wilderness areas would likely be managed to meet resource objectives if possible. Riparian PNVTs would be protected through guidance in the proposed revised plan to maintain a streamside management zone, and few direct impacts would be anticipated. Some fire creep into the riparian area would likely occur; however, it is expected to be minor in extent. Since riparian PNVTs are not fire adapted, riparian structure and function could be reduced in areas where fire creep occurs. Overall, wildfires managed to meet resource objectives in fire adapted PNVTs in these wilderness areas would reduce PNVT departures and lower the risk of uncharacteristic fire. This would indirectly lower the risk of

sediment delivery into connected waters associated with these riparian PNVTs. Only 9.5 percent of forest riparian PNVTs would be located in recommended wilderness areas where wildfires would be managed to be meet resource objectives. This could have localized effects yet would not affect the sustainability of riparian PNVTs at the forest level.

There would be a moderate to high likelihood that wildfires would be suppressed in the Black Mountain, Cedar Bench, Walker Mountain, and Deadwood Draw recommended wilderness areas. These recommended wilderness areas collectively contain 232 acres of riparian habitat. There are 199 acres (5.5 percent) in Mixed Broadleaf Deciduous Forest, 24 acres (1 percent) in Cottonwood Willow Riparian Forest, and 9 acres (0.9 percent) in Montane Willow Riparian Forest. Wildfires would burn until they are suppressed. Where uncharacteristic fuel loads occur and burn, portions of upland and riparian PNVTs would likely burn under conditions associated with uncharacteristic fire, and riparian structure and function would be reduced. Where effectively suppressed, the moderate to high PNVT departure in the recommended wilderness would be maintained; and the risk of uncharacteristic fire would increase. Suppressing fires, however, would likely not result in 100 percent suppression of all acres in wilderness, leading to a portion that would likely burn under conditions of uncharacteristic fire or high severity. Portions where fire suppression would not occur could burn under conditions of high severity and indirectly increase the risk of sediment delivery into the connected waters. A much higher risk and magnitude of short-term exceedances of water quality would be expected in those areas. However because only 2.3 percent of riparian forest PNVTs would be located in recommended wilderness areas where unplanned natural ignitions have a moderate to high likelihood of being suppressed, the sustainability of riparian PNVTs as a whole would not be affected even though there could be localized effects.

Alternative C restricts grazing in research natural areas. However, this restriction does little to change the effects to current and proposed research natural areas among alternatives because little to no grazing occurs in these areas under current management.

Alternative C also recommends that portions of the forest are not suitable for recreational shooting. Shooting is not a ground-disturbing activity and would not impact riparian function.

Alternative D

In contrast to the other alternatives, mechanized recreation on designated trails in botanical and geological areas is allowed (i.e., is considered suitable) under alternative D as long as the use does not conflict with the purpose of the area. It would also be possible to develop future trails, where appropriate. Mechanized recreation on designated trails would not affect riparian condition at the landscape level, because there are few acres of riparian PNVTs within these areas. There could be localized effects which could include soil compaction, accelerated erosion, and vegetation loss. Additionally, it is unlikely trails would be designated within streamside management zones, and best management practices would be followed under all alternatives. Therefore, it is unlikely that allowing mechanized recreation on designated trails in botanical and geological areas would result in different effects to riparian resources at the landscape level as compared to alternatives B and C. Alternative D could result in more localized effects than alternatives B and D (which do not allow mechanized uses in these areas) and fewer localized effects than alternative A (which could allow mechanized use anywhere in a botanical and geological area as long as the use does not conflict with the purpose of the area)

Environmental Consequences – Wetland/Cienega

Management of wetlands would continue in accordance with direction in the 1987 Forest Plan (as amended). Wetland direction is nonexistent or vague and does not provide clear direction to maintain or restore wetlands toward desired condition of properly functioning, resilient riparian areas. Over the last 10 years, only a few wetlands have been restored and most due to settlements stemming from range Allotment planning NEPA.

The primary differences between plan direction in alternative A versus alternatives B, C, and D are plan components that prescribe realistic objectives for restoration of Wetland/Cienegas and springs as well as updated desired conditions. There are no measurable differences in plan component objectives for riparian improvement among alternatives B, C, and D. For Wetland/Cienega and spring riparian areas, continuing implementation of alternative A results in opportunistic and slower improvements compared to alternatives B, C, and D. Alternatives B, C, and D could result in more rapid achievement of riparian areas to the desired condition of properly functioning, resilient riparian areas. Table 10 summarizes the differences in impacts from plan components, including objectives, among the alternatives.

Table 10. Summary of riparian departure values and trend by alternative for wetlands/springs

PNVT	Amount on Forest	% of Forest	Existing Riparian Departure (%)/Trend	Alt. A. Riparian Departure (%)/Trend	Alts. B, C, & D Riparian Departure (%)/Trend
Wetland	78 wetlands, 9,859 acres		By number: Moderate (41%)/Toward; By acres: Low (9%)/Toward	By number: Moderate (41%)/Slowly Toward; By acres: Low/Slowly Toward	By number: Low (19%)/Toward; By acres: Low/Toward
Cienega	20 acres		High	Static About 3% would move toward	Toward
Springs	340 known springs	Unknown	High for accessible unfenced springs. Low for fenced springs, or those with poor access. Toward for about 25 (10%) springs	Static 0% or by opportunity would move toward	Toward About 25 springs or 10% toward

Springs: Management of springs would continue in accordance with direction in the 1986 Forest Plan (as amended). Spring management and restoration direction is nonexistent or vague and does not provide clear direction to maintain or restore toward desired condition of properly functioning, resilient riparian areas. Over the last 10 years, only a few springs have been restored.

Continuing implementation of Alternative A would probably not move many springs to the desired condition of properly functioning, resilient riparian areas as quickly as Alternatives B, C, and D because they are not listed as objectives and are only management goals or emphasis that are not required.

Under current plan guidance riparian vegetation and root masses would probably not improve nor stabilize soil against cutting action or dissipate energy to reduce erosion, sedimentation and water quality or improve flood water retention and ground water recharge.

Alternative A

Management of Wetland/Cienega would continue in accordance with direction in the 1987 plan (as amended). Wetland/Cienega direction is nonexistent or vague and does not provide clear direction to maintain or restore wetlands toward desired condition of properly functioning, resilient riparian areas.

Alternative A has opportunity based objectives to construct 10 miles of fences per decade for the first two decades where necessary to protect key wet meadows, wetlands, and riparian regeneration from grazing; construct 150 waterfowl islands per decade in Decades 2 and 3; create potholes in wetland areas to provide nesting habitat; and prioritize road closures where roads within stream courses or wetlands (permanently or intermittently wet) are reducing hydrologic function. Language from existing plan would protect wetlands, locate roads and skid trails out of wetlands; Following Executive Order would further protect wetlands, wildlife habitat, fish habitat, visual quality and watershed condition. Wetlands with emergent vegetation would be managed to provide nesting habitat and to maintain 80% emergent vegetation during nesting season.

Continuing implementation of alternative A would probably not move a large number of wetlands or large number of wetland acres, cienegas, and springs to the desired condition of properly functioning resilient riparian areas as quickly as alternatives B, C, and D because it lacks objectives specific to Wetland/Cienega PNVT and springs. In addition, alternatives B, C, and D include direction on improvement to Non-Functional and Functional-At- Risk wetlands whereas alternative A lacks this direction. Wetland/Cienega PNVT and springs are expected to remain static, under alternative A. Under this alternative, treatments, including riparian treatments and road removal and upland watershed treatments would occur only on an opportunity basis.

Because of the lack of objectives, wetland riparian vegetation and root masses would probably not improve nor stabilize shoreline features against cutting action; dissipate energy to reduce erosion and sedimentation, and improve water quality; or improve flood water retention and groundwater recharge. There is a lack of plan direction to provide for these functional aspects of wetlands and to provide for PFC, and so projects do not have to be designed to mitigate effects to these wetland characteristics. As a result, Wetland/Cienega function is expected to be static and not improve under alternative A.

Management of springs would continue in accordance with direction in the 1987 plan (as amended). Spring management and restoration direction is nonexistent or vague and does not provide clear direction to maintain or restore toward desired condition of properly functioning, resilient spring riparian areas. A small proportion of springs have been restored or protected since the 1987 plan was approved. Alternative A treatments that would benefit springs would occur only on an opportunity basis. Continuing implementation of alternative A would likely result in a

static trend because of a lack of emphasis on spring restoration and little to no improvement of riparian function of springs and would probably not move many springs to the desired condition of properly functioning, resilient riparian areas as quickly as alternatives B, C, and D.

Because of the similarities in threats and sensitivity of springs relative to other riparian resources, alternative A 's approach for addressing threats to Wetland/ Cienega would be similar to that of riparian forest PNVTs.

Alternative B, C, D

Desired condition descriptions in the Revised Plan would provide the following:

- Description of desired conditions (required outcomes). Overall, riparian areas are resilient to natural disturbances and changing climate conditions and are functioning across the landscape. Wetlands are maintained or trending towards properly functioning condition. . Implementation of desired condition statements in Alternatives B, C, and D are required and should indirectly result in improved riparian condition and function
- Alternatives B, C and D have desired conditions, guidelines, objectives and management approaches that focus on maintaining or improving soil, riparian condition, water quantity, resiliency and physical and biological components necessary to provide habitat for those species that rely on it for their survival whereas Alt. A does not.
- Alternatives B, C, D better detail and include desired conditions managing the natural role of fire, the threat of uncharacteristic fire, and the interactive role with native species and invasive exotic plant species (especially non-native annual grasses).
- Alternatives B, C, and D have desired conditions, guidelines and objectives that should better achieve protection of these areas because the desired conditions are required to implement, more explicit in detail, and guidelines are more flexible to on-site conditions and objectives can realistically achieve riparian area protection and improvement.
- Alternatives B, C, and D have strategic desired conditions that are required and achievable, realistic objectives that could restore more springs, wetlands and riparian areas than A.
- An objective that addresses implementation of riparian improvement projects on 200 to 500 acres per plan life specifically for the purpose of improving riparian function.
- An objective that addresses implementation of wetland restoration projects on 5-10 wetlands during plan life.
- An objective that addresses implementation of spring restoration projects on at least 25 springs during plan life.
- An objective for naturalizing or decommissioning roads both in uplands and riparian areas on 200-800 miles per life of plan.
- An objective that addresses implementation of upland watershed/soil improvement projects on 100,000 to 350,000 acres per year specifically for the purpose of maintaining or improving soil and watershed condition.

The Wetland /Cienega PNVT is currently at a moderate level of vegetative departure with a static trend toward desired conditions. Herbivory in unprotected areas could lead to a shift toward earlier successional species and shorter vegetative structure. The plan objective under alternative

B is to restore 5 to 10 wetlands per decade to a properly functioning condition. With continued protection and at that objective level, this PNVT would be expected to move toward desired conditions over time. Any additional management activities that occur in this PNVT would help make progress toward stated desired conditions.

Alternatives B, C, and D include plan components that would move wetlands and cienegas toward identified desired conditions and reduce the departure of this PNVT. Desired conditions specify that: (1) wetlands, reservoirs, and lakes provide healthy soil and water resources to support diverse vegetation for native and desirable non-native riparian and aquatic species habitat; (2) wetland vegetation has diverse age class, a diverse composition of native species, and includes species that indicate maintenance of riparian soil moisture characteristics; and (3) wetlands are maintaining or trending toward Proper Functioning Condition, and soil condition and riparian function are in satisfactory condition on most acres. As a result, maintenance of soil cover, reduced sheet erosion, and improved nutrient cycling and soil productivity would occur.

Implementation of the objective to restore between 5 to 10 wetlands every 10 years currently not in PFC would result in wetland restoration between 15 to 30 percent of the total number of wetlands not in PFC. As a result, wetland riparian vegetation and root masses would improve or stabilize shoreline features against cutting action; dissipate energy to reduce erosion and sedimentation and improve water quality; or improve flood water retention and groundwater recharge. In contrast, alternative A lacks objectives for Wetland/Cienega restoration.

For springs, alternatives B, C, and D have an objective to restore riparian function to at least 25 springs not in properly functioning condition within 10 years to provide water quantity and aquatic habitat for the recovery of plant and animal species. There are approximately 340 known springs on the forest, but functional condition assessment information for them is variable. Restoring 25 springs would equate to at least 10 percent of known springs, which would be significant progress toward achieving desired conditions for springs. In contrast, alternative A lacks plan components including objectives for spring restoration.

Because of the similarities in threats and sensitivity of springs relative to other riparian resources, the approach for addressing threats to Wetland/Cienega under alternatives B, C, and D would be similar to that of riparian forests PNVTs.

Table 11 displays riparian and wetland forest plan direction by alternative.

Table 11. Riparian and Wetland FP Direction and Objectives by Alternative

	Alternative A	Alternative B	Alternative C	Alternative D
Riparian Treatment Objectives across all riparian vegetation types	80% of riparian areas are recovered by 2030 Actual acres implemented is about 300 acres or 3% of total but probably 10% of non PFC acres	200 – 500 Acres Would treat about twice as many acres as Alternative A or 10% of total	Same as B	Same as B
Road Removal Objectives including from riparian areas	Opportunity Basis	200-800 road miles naturalized or decommissioned	Same as B	Same as B
Wetland/Cienega Objective	Opportunity Basis	Restore 5 to 10 wetlands in planning period or 15-30% of total	Same as B	Same as B
Spring Restoration	No specific desired conditions, management emphasis or objectives listed. direction Opportunity Basis	Restore at least 25 springs or 10% of total	Same as B	Same as B
Benefit from upland soil and water resource improvement projects including hazardous fuel reduction	Limited	Yes	Yes	Yes
Overall Riparian Vegetation Treatment Emphasis	Yes but implementation unattainable	Yes	Yes	Yes

Roads

The road system that is analyzed is the same for all alternatives and off-road vehicle use is generally not allowed. The road system results in a net loss of riparian area extent and function where located in riparian streamside management zones. Implementing the plan direction in Alternatives B, C, and D would naturalize or remove some roads located in riparian areas and improve riparian area extent and function.

Upland Soil Restoration

Implementing plan direction for soil and water resource improvement projects prescribed in Alternatives B, C, and D would result in improved soil condition and reduce the threat of high severity fires that might threaten riparian function and water quality.

Cumulative Effects for All Alternatives

The cumulative effects analysis for this plan revision is being assessed at the 4th field HUC or subbasin scale and are temporally bounded by the next 10 to 15 years. Disturbances that impact riparian vegetation or compact or detach soil can reduce riparian function and condition and are considered and assessed at the 4th code watershed scale with some further detail at the 5th code watershed scale

It is impractical to complete a quantitative cumulative watershed effects analysis at this scale of strategic planning. Detailed quantitative cumulative watershed effects analyses will be completed at the project level.

Table 12 displays the 4th field HUC intersecting the forest. Influences come from within and outside of the forest boundary and cumulatively impact soil and water resources.

Past, present and reasonably foreseeable planning actions that are relevant to soil and water resources make up the cumulative effects analysis. This cumulative effects analysis does not attempt to quantify the effects of past human actions by adding up all prior planning actions on an action-by-action basis. In order to understand the contribution of past planning actions to the cumulative effects of the proposed action and alternatives, this analysis relies on current environmental conditions as a proxy for the impacts of past planning actions. This is because existing conditions reflect the aggregate impact of all prior human actions and natural events that are difficult to quantify that have affected the environment and might contribute to cumulative effects. Furthermore, existing conditions are a result of past and present impacts to soil and water resources. Past planning actions make up part of existing conditions and are already described in the affected environment section of this report and Alternative A (current plan).

Table 12. Sub basins and Percent Ownership

4th Code Watershed	Percent watershed on the Forest	Percent watershed off Forest
Havasu Creek	0.16%	99
Middle Little Colorado River	15%	85
Canyon Diablo	57%	43
Lower Little Colorado River	15%	85
Tonto Creek	0.2%	99
Upper Verde River	40%	60
Lower Verde River	24%	76
Forest Totals at 4th Code Scale	**19.7%**	**80.3**

Nearly all of the management activities conducted by the forest have potential to affect soil and water resources and overall watershed condition. Their cumulative impact to a watershed depends upon the effects of past, present, reasonably foreseeable actions, and the watershed's sensitivity to disturbance.

Cumulative effects include activities on the forest as well as other public and privates lands including the following.

- All of the watersheds associated with the forests have private inholdings and appreciable areas outside of the forest boundary (ranges from 43-99%). Many of the impacts occur on lands of other ownership, adjacent to or within riparian areas such as unpaved roads, grazing, that may result in reduced riparian function and conditions. Dozens of wells located on non forest lands are withdrawing groundwater at a rate faster than can be naturally recharged (Steinke 2011a) and can impact ground water dependent resources, streamflow, and reduce water available for riparian vegetation growth and therefore reduce riparian function.
- In addition to the above potential impacts, activities that have a high risk of adverse watershed and riparian impacts include water diversions and extractions, irrigation, loss of groundcover, increased trail density and use, and trampling of riparian areas. The cumulative effects of management activities and the expansion of urban populations in vicinity of the forest trend toward increased pressure to develop more groundwater resources. The results are increased risks of damage to groundwater quality, lowered groundwater tables; reduced base flows, loss of groundwater dependent springs and seeps, and shifts in riparian species.

- Entities like the Nature Conservancy and the Verde Valley Land Preservation Institute can assist in acquisition of key parcels, particularly related to riparian and the Verde River that would help retain water resources and habitat for desired conditions for fish and other wildlife species. The Nature Conservancy's interest in acquisition of Verde River properties and water rights may result in continued land acquisition cases depending on available funding. The interest in protecting the Verde River may become higher as Northern Arizona University works on their Verde Valley Initiatives. Support for land acquisition or other forms of protection of the Verde River and its tributaries may result in protection of soil, riparian and water resources and overall riparian function and condition.
- Implementation of the preferred alternative of Travel Management Rule Final Environ Wetland functional condition is displayed in table 7 below The Cienega portion of this PNVT is assumed to be highly departed. riparian condition will improve with the closure of many roads and dispersed campsites both within and outside riparian areas and springs. The Prescott, Kaibab, and Apache-Sitgreaves National Forest are conducting similar travel management analysis and are expected to restrict motorized cross-country travel and limit and close many high risk roads that may pose a risk to soil, riparian area and water quality. These actions should cumulatively reduce on-site erosion and sediment delivery to connected stream courses resulting in improved water quality in perennial streams, and overall improved riparian condition located in the aforementioned 4th Hydrologic Unit Code watersheds.
- Neighboring forests with similar forest plan efforts underway include, the Tonto, Kaibab and Apache –Sitgreaves National Forests. The Coconino National Forest shared portions of 4th HUC watersheds with these forests. Therefore, planning efforts directing soil and water resource management would indirectly impact all forests. The aforementioned forests have developed plan guidance and desired conditions that address riparian function.. Their revised plans are expected to move soil and water resources towards identified desired conditions resulting in maintenance or improvement riparian function.

Summary

Overall, implementation of plan direction in Alternatives B, C, and D would indirectly result in improved riparian conditions Forest-wide, compared to Alternative A.

Implementation of Alternative A (continuation of current management) in combination with past, present and reasonably foreseeable actions would indirectly pose additional but largely unquantified risk to riparian function and condition as described under Alternative A compared to Alternatives B, C and D..

Disturbances that impact riparian vegetation or compact or detach soil can reduce riparian function and condition and are considered and assessed at the 4th-code watershed scale with some further detail at the 5th-code watershed scale.

Influences come from within and outside of the forest boundary, and cumulatively, they impact soil and water resources. The size of the sub-basins and the area administered by the Coconino National Forest are displayed and relevant to the potential cumulative effects Forest activities may contribute to the sub-basins. The percent of lands managed within the sub-basins by the Forest ranges from less than 1 percent to 57 percent. Where multiple land ownership exists, it is important that the Forest work with the appropriate organizations and individuals.

While the Forest contains riparian acres of three out of seven watersheds: Middle Little Colorado River (48 percent of the riparian acres in the watershed are on the Forest), Upper Verde River (36 percent) and Lower Verde River (21 percent), the majority of riparian acres in these watersheds, however, still lie on other land ownerships. Therefore, cumulative effects include activities on the forest as well as other public and privates lands.

All alternatives would maintain or improve riparian conditions on the forest. There are activities outside forest control and on lands of other ownership, however, that impact riparian and water resources.

There are several threats to the Cottonwood Willow Riparian Forest PNVT that are mostly outside the control of Forest Service management. Water diversions and increasing human development in the watersheds in lands adjacent to the forest have affected water quantity and seasonality of historical flood regimes as well as groundwater availability to these systems. Consequently, portions of Cottonwood Willow Riparian Forest are now perched above the water table and its long-term sustainability may be in jeopardy.

Water quality in Oak Creek within the Upper Verde 4th-code watershed is also affected by *E. coli* from septic systems associated with private development, wildlife, and swimming. Only swimming on forest lands is in Forest Service control.

The middle stream reaches of Fossil Creek (part of the Lower Verde 4th-code watershed) and Oak Creek are impacted by activities on non-Forest Service lands and improperly located roads. The portions of streams that are of most concern are the middle reach of Fossil Creek due to recreation impacts and Oak Creek because of recreation impacts, improperly located roads, and septic systems associated with private development.

Drought is another influence that is outside of forest control.

While all alternatives would maintain or improve riparian and water resources on the forest, activities outside of forest control limit the ability of riparian and water resources to improve at a watershed scale.

Climate Change

Proposed treatments for each Alternative were evaluated for probable effects to water resources assuming these hotter, drier environmental conditions:

- Temperatures are expected to increase 0.5 degrees F per decade or 3 degrees by 2050 and precipitation during spring and summer critical periods of vegetative growth USDA Forest Service 2013
- There will be more hot days with summer heat waves lasting 2 weeks or longer
- Precipitation may decrease
- Winters will be warmer with reduced snow pack and monsoon rains may start later.
- Extreme events, such as floods, may become more common.

Consequences Common to All Alternatives:

Qualitatively, climate change may result in:

- Reduced snowpack in higher elevations.

- Less water available for groundwater recharge.
- Reduced baseflows.
- Increased area where precipitation does not exceed evapotransipiration.
- Changes to stream channel morphology.
- Possible shift in stream types and flow. Intermittent streams may flow less and become ephemeral and only respond to storm events and not flow seasonally. Some perennial streams may have reduced flow.
- Riparian areas may shrink in size reducing riparian vegetation and habitat for those species that rely on it for their survival.

Hotter, drier environments are likely to enhance the size and severity of wildfires, and fire disturbance would increase. Larger, more frequent, high intensity fires would likely result in increased soil erosion, increased runoff, faster response to the hydrograph with higher peak flows, increased sedimentation, increased turbidity, and pulses of increased pH from ash. Severe fires can often cause changes in successional rates, alter above- and belowground species composition, generate volatilization of nutrients and ash entrainment in smoke columns, produce rapid or decreased mineralization rates, alter C : N ratios, and result in subsequent nutrient losses through accelerated erosion, leaching or denitrification. In addition, changes in soil hydrologic functioning, degradation of soil physical properties, decreases in micro- and macro-fauna, and alterations in microbial populations and associated processes can occur (Neary, 1999). Soil formation and vegetation recovery is relatively slow in arid environments. The extent of loss to soil productivity would correlate to hydrologic effects. Changes to channels would likely include less vigorous riparian vegetation, reduced streambank stability, channel braiding and or downcutting, greater turbidty, and increased stream temperatures. Baseflows could be reduced in both volume and temporally.

Management approaches that enhance ecosystem resiliency and ability to adapt during climate change include:

- Reducing anthropogenic stresses.
- Reducing uncharacteristic disturbances.
- Allowing disturbances that promote adaptation and biodiversity.

Modifying vegetation structure and composition to more open conditions allows individual plants to better compete for limited water and nutrients, and facilitates ecosystem transition from current to new conditions, such as those that result from changing natural and human disturbance regimes (Millar and others 2007).

Landscape-scale application of wildland fire not only mitigates fire risk, it allows fire to continue to enhance resistance to loss, and to facilitate natural (evolutionary) adaptation, and migration as climate changes (Fulé 2008, Hurteau and Brooks 2011).

In the long term, vegetation and fire treatment activities would be beneficial in building ecosystem resiliency and capacity for plant communities to accommodate expected changes imposed by future climate trends.

Alternatives B, C, and D

Alternatives B, C, and D provides the most protection to soil and water resources for expected changes imposed by predicted climate changes. This conclusion is reached based on the assessment of which alternative provides the most improvement in desired conditions Alternative A provides the least amount of ecosystem resilience and capacity for plant communities to adapt to changing climate.

Short-term Uses and Long-term Productivity

The NEPA requires that decision makers examine the potential consequences of proposed actions as they affect "the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" (40 CFR 1502.16). In Section 101 of the NEPA, Congress explained that this includes using all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans.

Implementation of Forest management in accordance with the direction provided by any of the alternatives evaluated in this EIS would not result in adverse impacts to the long-term productivity of the affected environment because of the short-term uses of natural and human resources on the Forest. This is because the direction in the Plan was carefully developed to guide the use of these resources in a manner that achieves short-term conservation objectives and long-term sustainability.

As an example, the achievement of the desired condition of vegetation, and riparian communities, as envisioned in the Draft Revised Plan, would require a dramatic increase in treatments, such as mechanical thinning or prescribed fire. Treatments also benefit other Forest resources (e.g., soils, wildlife, and water) that depend on healthy and sustainable vegetation communities. Wide-scale disturbance on the Forest to move rapidly toward desired conditions would have adverse effects on these other resources in the short term. Over the long term, these same resources would benefit from more sustainable and productive ecosystems that are at a reduced risk to loss to catastrophic wildland fire or insect and disease outbreaks.

Unavoidable Adverse Impacts

The land management plan provides a programmatic framework that guides site-specific actions but does not authorize, fund, or carryout any project or activity. Before any ground-disturbing actions take place, they must be authorized in a subsequent environmental analysis. Therefore, none of the alternatives cause unavoidable adverse impacts. Mechanisms are in place to monitor and use adaptive management principles in order to help alleviate any unanticipated impacts that need to be addressed singularly or cumulatively.

Irreversible and Irretrievable Commitment of Resources

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 ground disturbing actions, none of the alternatives cause an irreversible or irretrievable commitment of resources

Adaptive Management

All alternatives assume the use of adaptive management principles. Forest Service decisions are made as part of an ongoing process. The land management plan identifies a monitoring program. Monitoring the results of actions will provide a flow of information that may indicate the needs to change a course of action or the land management plan. Scientific findings and the needs of society may also indicate the need to adapt resource management to new information.

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