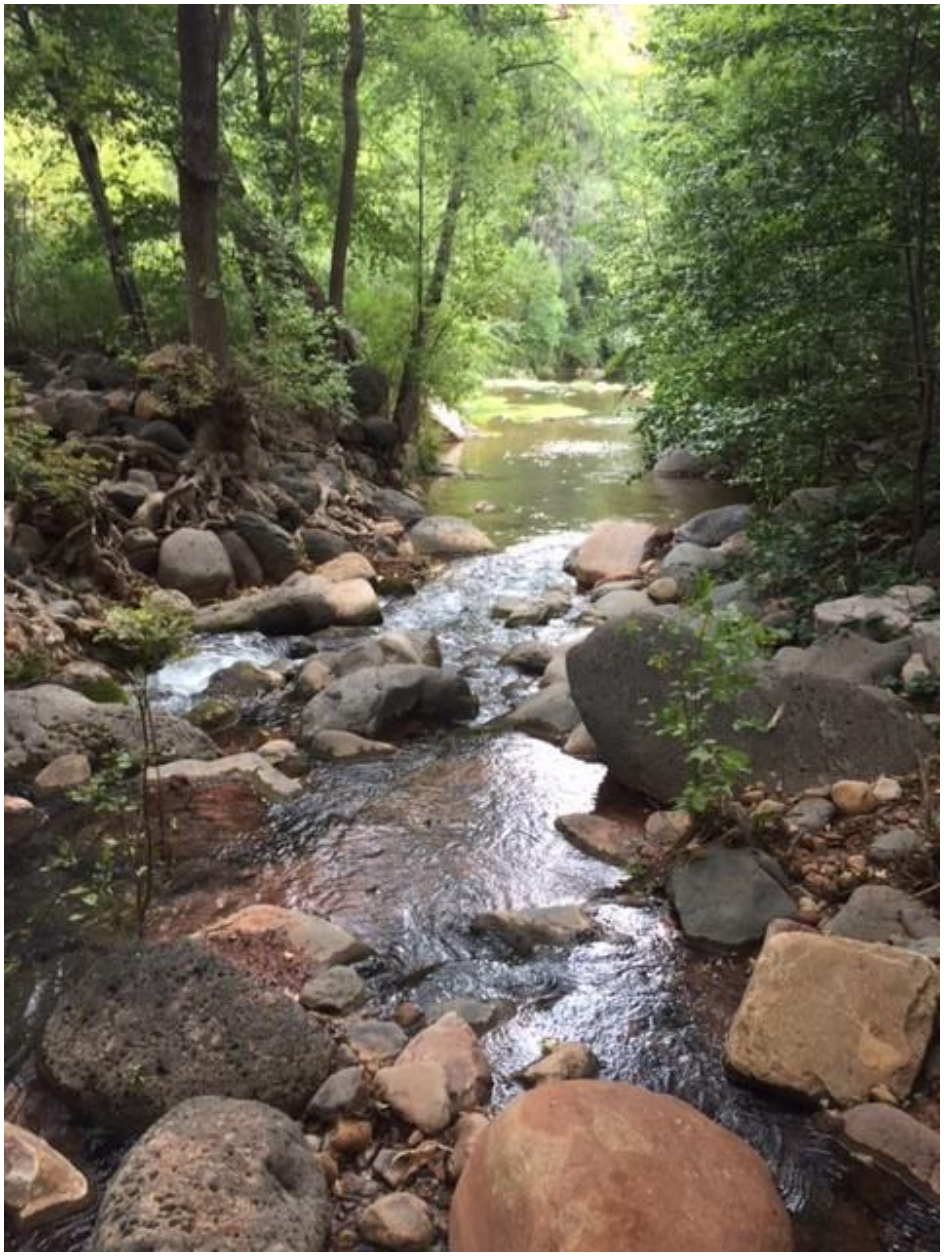
USDA Forest Service
Southwestern Region

Riparian and Aquatic Ecosystem Strategy



Fossil Creek, Coconino National Forest, Arizona

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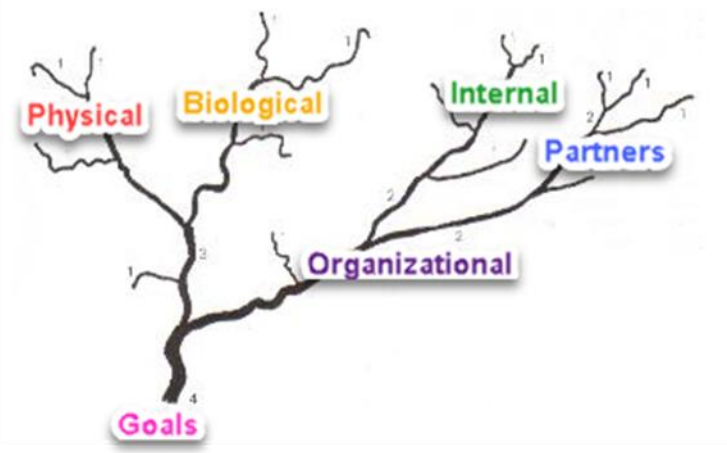
I. Executive Summary

Rivers and streambeds are conduits for life. In no other ecosystem can we as an agency have a greater impact in "*Caring for the land and serving people*." Protection and enhancement of riparian and aquatic areas is paramount in providing habitat and sustainable water for dependent fish, wildlife, plant species, and human communities alike.



INTRODUCTION

The eleven National Forests (NF) and four National Grasslands (NG) in the Southwestern Region (Region) of the USDA Forest Service (Forest Service) occupy 20.6 million acres that range in elevation from 1,600 feet to more than 13,000 feet above sea level. Riparian areas currently occupy approximately 431,000 of these acres which represents only two percent of National Forest System (NFS) lands in the Region.

Riparian and aquatic zones are among the most heterogeneous landscapes with habitats harboring the highest plant, bird, insect, reptile-amphibian, fish, and mammal biodiversity of most ecosystems. These zones are associated with a range of ecosystem services that are valued by humans (National Research Council 2002 and 2004; Covich et al. 2004; Giller et al. 2004). In the arid southwest, riparian areas offer a multitude of benefits that are disproportionate relative to the small area they occupy on the landscape (Naiman and Décamps 1997).

Riparian areas have been impacted by numerous stressors, including dams, diversions, groundwater pumping, non-native species, channelization, conversion to agricultural uses, urbanization, grazing, roads, recreational uses, fires, mining, fuel wooding, logging, and invasive species. Many of these stressors result in altered flow regimes that disrupt the connection between the stream and its floodplain. The percent of riparian areas degraded by human impacts is estimated to be as high as 90 percent (Zames et al. 2007). Between 30 and 50 percent of Southwest wetlands have been lost outright (Mitch and Gosselink 1993).

These factors have resulted in species declines and increased federal listings under the Endangered Species Act (ESA). Continued population growth, associated recreational use, and climate change put additional disturbance pressure on already impacted areas. As much as eighty percent of wildlife species use riparian areas during part or all of their life cycle (Zames et al, 2007). Of the 59 species in Region 3 currently listed as Threatened, Endangered, Proposed, or Candidate species, 33 are riparian or aquatic obligates with another five species significantly benefitting from these habitats (ECOS, 2016).

The overarching goal of this strategy is to ensure that the ecological integrity of riparian and aquatic habitats is maintained and/or restored. The intent is to build a program for managing these ecosystems collaboratively with our interdisciplinary staffs and partnership workforce (local, state, and federal agencies; tribes; universities; and, supporting non-governmental organizations and stakeholders). Our objectives are to improve the structure, function, composition, and connectivity of riparian, aquatic, and terrestrial habitats. We intend to tie these values back to the communities we serve through enhanced water supply and quality, recreation, economics, and cultural amenities. The purpose of this document is to provide a comprehensive strategy for riparian and aquatic ecosystems within the Region.

Forest Service policies related to riparian and aquatic ecosystems are directed by several foundational laws. The Organic Act of the Forest Service states that "*no national forest may be established except to improve and protect the forest, or to secure favorable conditions of water flows, and to furnish a continuous supply of timber*." The National Forest Management Act requires the Forest Service to provide for diversity of plant and animal communities based on the suitability and capability of the land area in keeping with multiple-use objectives. The ESA requires protection of federally listed species and their habitat, many of which are dependent on riparian or aquatic areas. See Appendix 1 for a complete list of other statutes and regulations related to riparian and aquatic ecosystem management.

CHALLENGES & OPPORTUNITIES

By and large, Southwestern National Forests comprise the headwaters that provide water to ever-expanding urban centers as well as rural communities. Stewarding these lands requires our best efforts and those of our supporting partners. Our assessment of current conditions begins by identifying challenges to, and opportunities for more effective stewardship.

We have identified significant challenges as internal weaknesses within our organization as well as external threats from outside forces. Internal challenges such as an absence of workforce capacity dedicated to riparian and aquatic ecosystems is compounded with a lack of training or knowledge of what training opportunities exist. Although a wealth of data exists, there is a lack of organization of the data as well as guidance in how to access and use the data. Additionally, gaps are evident in the data, especially for aquatic systems. Finally, the capacity for integration and communication amongst program areas is not focused to enhance management of these ecosystems.

In addition to internal challenges, there are many external challenges to managing riparian and aquatic ecosystems as well. These include direct physical impacts such as water developments, impoundments, diversions, withdrawals, water rights claims including groundwater pumping, and absence of regulation. The connection between surface water and ground water is not always agreed upon, and as a result, is not cohesively managed. The above issues are complicated by the effects of population growth and increased urbanization, resulting in increasing recreational use of the NFs and NGs and increased demand for water, both of which could threaten riparian areas.

Overarching external forces, some of which can be managed and some of which cannot, are predicted. Climate change is anticipated to result in warmer and drier conditions, and less water to support riparian and aquatic ecosystems. Invasive species, both nonnative aquatic species and nonnative plants, often have devastating effects to riparian and aquatic ecosystems including predation on native species, and competition for water, nutrients and sunlight.

Although the challenges are many, opportunities are also present. These, too, are characterized by internal and external elements. Within the Forest Service, there exists a wide range of expert knowledge, including long-term local knowledge about riparian and aquatic ecosystems and the unique values and service these areas provide. Externally, diverse entities are already working together with the Forest Service toward the goal of functioning riparian and aquatic ecosystems. This shared sense of responsibility connects communities enhancing education, conservation, and motivation to work with the Forest Service to responsibly manage riparian and aquatic ecosystems. Existing authorities can be used to leverage partnerships for this effort, for example the Good Neighbor and Secure Rural Schools authorities. These authorities support a high potential for partnerships and joint funding for projects that will restore, improve or sustain riparian and aquatic ecosystems in the Southwest.

OVERVIEW OF STRATEGY AND HIGH-PRIORITY ACTIONS

This strategy contains seven goals:

1. Ensure quality information exists including inventory, monitoring, and assessments to support project work.
2. Prioritize work in riparian and aquatic ecosystems.
3. Set performance expectations.
4. Provide training.
5. Integrate work across disciplines at multiple levels.
6. Work with partners within and across Forest Service boundaries.
7. Communicate the value and benefits of riparian and aquatic ecosystems.

Each goal contains multiple objectives, providing a long-term foundation to address current and future challenges. The goals and objectives contained in this strategy will better enable the Forest Service to accomplish work in riparian and aquatic ecosystems in a coordinated and effective way, and take advantage of new opportunities such as emerging technologies and innovative partnerships.

Four specific priorities are highlighted with associated near-term actions to strategically focus implementation of the strategy with current resources. The Forest Service will work in cooperation with states, other federal agencies, and tribal governments and in partnership with nongovernmental organizations, private landowners and water users, the private sector, and others to implement these near-term priorities. Progress toward realizing these actions will be shared with Forest Service leadership, cooperators, and partners through an annual report.

Core Action Plan:

Build Shared Expectations with Regional Leadership and Our Partners

- Actions:
    - Set clear expectations and accountability for management of these riparian and aquatic systems.
    - Work with regional leadership and our partners to communicate how riparian and aquatic stewardship integrates within the regional priorities.
    - Make available specific resources in support of achieving priority riparian and aquatic work.

Enhance Public and Partnership Support

- Actions:
    - Build lines of communication with a wide array of partner groups and strengthen partnership connections utilizing established and new methods.
    - Collaborate with partners to share information and address mutual concerns and restoration opportunities.
    - Increase the capacity and efficiency for NFs and NGs to participate in or manage collaborative projects.
    - Enlist the Region's Office of Communication and Engagement expertise for sharing successes and lessons learned, and for enhancing public support and involvement.
    - Work with our partners to develop a shared education/outreach curriculum and methods of delivery regarding riparian and aquatic values, ecology, function, services, management, inventory, and monitoring.

Identify, Integrate, Implement Top Priority Needs and Opportunities

- Actions:
    - Involve relevant subject matter experts within the Forest Service and partner organizations with local expertise to focus limited resources on priority riparian and aquatic habitat management and restoration needs.
    - Use existing tools and information from subject matter experts as well as other emerging technology to work in an integrated fashion within the NFs & NGs and with partners to identify priority projects in most need of riparian and aquatic stewardship to restore or maintain habitat.
    - Direct resources (e.g., budget, workforce, training) to support high priority riparian and aquatic restoration projects identified at the regional level using objective criteria such as:
        - Degree of involvement of partners in identifying projects and leveraging funds

        - Emphasis on maintaining systems that are functioning well and meeting desired conditions
        - Restoration of imperiled sites considering local capacity and expected outcomes
        - Overlap of Watershed Condition Framework (WCF) priority watersheds and location of Watershed Restoration Action Plan (WRAP) projects
        - Occurrence of riparian and aquatic species listed under ESA, occurrence of species of conservation concern, and occurrence of other priority species identified by partners (such as state listed species)
        - Improving watersheds critical for supplying drinking water
        - Improving watersheds with heavy recreational use
        - Identify riparian areas with potential wildlife and grazing encounters
    - Foster a shared commitment to sound riparian and aquatic habitat management, including areas not prioritized for immediate restoration treatments.

Monitor, Improve Data Quality, and Inform Ongoing Work

- Actions:
    - Establish *desired conditions* for riparian and aquatic systems, founded on site potential (geomorphology, hydrologic regime, soil characteristics, vegetation types, etc.) and based on best available science to better inform management of riparian and aquatic systems.
    - Improve Regional expertise in the management and restoration of riparian and aquatic systems. Including providing training, sharing information from various sources, building Regional teams, and working with partners or contractors to monitor and learn from success or failure of completed and ongoing projects.
    - Make a concerted effort across all levels to collect and disseminate meaningful data and best available science before, during, and after project implementation to improve management in these systems over time. Current projects that assist in this effort include:
        - Update of the National Hydrography Database (NHD)
        - Collection and verification of information to update the Water Rights and Uses (WRU) database
        - Focus Terrestrial Ecological Unit Inventory (TEUI) on riparian systems
        - Riparian Existing Vegetation mapping (REV) and Aquatic Riparian Inventory (ARI) with Geospatial Technology and Applications Center (GTAC)
        - Continue development of RAES Priority Projects Arc-GIS product
    - Establish clear, concrete goals for a monitoring plan associated with each project that includes monitoring and reporting for Best Management Practices (BMPs) and the Infrastructure (INFRA), Watershed Improvement Tracking (WIT), and Watershed Classification and Assessment Tracking Tool (WCATT) databases.
    - Provide guidance for the best management of streams and riparian and aquatic areas in preparation for drought and future climate.
    - Investigate evolving technologies relevant to riparian and aquatic management and monitoring.

II. Strategic Framework

First and foremost, the purpose of this strategy is: To conserve and improve riparian and aquatic ecosystems by implementing actions that will result in achieving desired conditions. The strategy is built on a framework for managing riparian and aquatic ecosystems collaboratively with interdisciplinary Forest Service staffs and with external partners (local, state and federal agencies, non-governmental organizations, tribes, universities, etc.). An integrated, coordinated approach will provide for effective collaboration to capitalize on the diverse resources and values partners bring to the table. The freedom to work in innovative ways will lead to improved understanding of riparian and aquatic systems, increased capacity for adaptive management, and cooperative restoration beyond what can be accomplished with Forest Service resources alone.

NEED FOR A STRATEGY

A strategic approach will result in management that is cohesive, and therefore achieving the level of result necessary to preserve and improve the riparian and aquatic resources in the Region. Water is the most precious resource in the arid Southwest. Growing human demand for limited water supplies creates an urgency to protect these sparse resources on the NFs and NGs. Ensuring flows necessary to sustain riparian and aquatic areas is becoming more difficult in the face of increasing demands to develop water resources for other uses.

In addition to inherent stressors (dams, channelization, conversion, grazing, roads, recreational uses, etc.), the Region is facing a number of other issues that accentuate the need to focus on management, protection, and restoration of riparian and aquatic ecosystems. These include:

- **Climate change and drought:** Streams, springs, ponds, wetlands, and riparian areas are being stressed by warmer temperatures and continued drought.
- **Undesirable non-native species:** Non-native fish, aquatic invasive species, and invasive plants are major threats to the ecological processes and native species composition of riparian and aquatic ecosystems.
- **Groundwater stewardship:** There is increasing demand for groundwater that is essential in maintaining base flows in streams, discharge from springs and seeps, and water table elevations in wetlands and riparian areas.
- **Integration and coordination:** Responsibilities for managing specific aspects of riparian and aquatic ecosystems are distributed among distinct functional areas in regional office and NF staffs, which necessitates a comprehensive and integrated riparian area management strategy.
- **Partnerships:** Many current or potential partners are interested in riparian area management. The Region must improve our capacity to capitalize on these partnerships.
- **Communication and Education:** There is a need to improve communication and education about the functions and values of riparian and aquatic areas, and the benefits, impacts, and consequences of various activities on these functions and values.

MISSION

Mission for Agency and Partner Organizations

- The agency and partners are knowledgeable regarding the extent, condition, impacts and dynamics of riparian and aquatic ecosystems throughout the Region. Our mission is to use this knowledge to continually adapt management of riparian and aquatic ecosystems to realize the visions outlined herein.

VISION

Vision for Riparian Areas

- Riparian areas exhibit a high degree of connectivity along streams, laterally across the floodplains and valley bottoms, and vertically between surface and subsurface flows.
- Stream channels, aquatic habitat, and floodplains are dynamic and resilient to disturbances and climate fluctuations.
- Periodic flooding and scouring are the primary natural disturbances and promote a diverse plant structure consisting of herbaceous, shrub, and tree species of all ages and size classes necessary for the recruitment and succession of riparian dependent species. Uncharacteristic fire is infrequent.
- Riparian systems provide the composition and structure to filter sediments, build and stabilize banks, reduce the damaging/negative effects of flooding, store and release water, and recharge aquifers.
- Instream flows provide for channel and floodplain maintenance, recharge of aquifers, aquatic and riparian vegetation, water quality and quantity, and maintenance of aquatic and riparian habitat.
- Riparian areas buffer waterways against excessive runoff from upland activities, whether natural or human induced, which can degrade water quality.

Vision for Aquatic Habitats

- Habitat conditions contribute to the survival and recovery of listed species, allow for repatriation of extirpated species, contribute to the delisting of species under the Endangered Species Act, preclude the need for listing new species, improve conditions for the Region sensitive species, and keep common native species common.
- Aquatic areas provide a diversity of interconnected habitats that support aquatic species life history and the population level resiliency and redundancy necessary to maintain species diversity and meta-populations.
- Woody and herbaceous vegetation and overhanging banks provide fish habitat, regulate stream temperatures, and maintain soil moisture in the aquatic management zone.
- Water quality and quantity (magnitude, duration, and timing) are sustained at levels that retain the biological, physical, and chemical integrity of associated systems and benefit survival, growth, reproduction, and migration of native aquatic species.

- Stream substrates provide clean gravels for fish spawning, woody debris for hiding cover, and sites for germination and establishment of riparian vegetation.
- Streams, springs, and wetlands with the potential to support native fish and/or other aquatic species provide habitats that are resilient or adaptive to projected warmer and drier climatic conditions.
- Aquatic habitats are free of negative impacts from invasive plant and animal species. Recreational fishing opportunities are balanced with the needs of native species.

Vision for Water Quality and Quantity

- Water quality meets or exceeds relevant State (Arizona, New Mexico, Texas, and Oklahoma) Environmental Protection Agency standards for designated uses.
- Water quality and quantity are improved through an integrated approach to managing riparian areas and associated upland areas.

Vision for Groundwater Dependent Ecosystems

- Springs, seeps, wetlands, ponds, and other groundwater dependent ecosystems have the necessary soil, water, and vegetation attributes to be healthy and functioning.
- Water levels, flow patterns, groundwater recharge and discharge rates, temperatures, and geochemistry are within the natural range of variability.

Vision for Wetlands

- Wetlands provide viable habitats for native plant and animal species, with existing populations within the natural constraints of the particular wetland community.
- Native macroinvertebrates are abundant and diverse. Wetlands are free of nonnative species.
- Wetlands control flooding, improve water quality, and serve as areas of groundwater recharge.

Vision for Ecosystem Services

- Riparian ecosystems are capable of filtering sediment, capturing bedload, aiding floodplain development, improving floodwater retention, improving groundwater recharge, improving or maintaining water quality, providing habitat for aquatic and riparian species, maintaining instream flows for recreational uses, and providing water for wildlife and grazing for on and off-National Forest use.

GOALS

Short (1-5 years) and Long (>5 years) Term

Goal: Ensure quality information exists including inventory, monitoring, and assessments to support project work.

- Short-Term Objectives:
    - Work with other agencies and partners to standardize types of data collected and data collection methods. This will reduce duplication of collected data and increase the amount of unique data which can be shared by all.
    - Compile RAES Priority Projects to complete Arc-GIS product for identifying targeted locations for allocating workforce, partner, and funding resources.
    - Complete National Hydrography Database (NHD) update for the Region by funding forests and contractors.
    - Compile a GIS dataset with all federally-listed plant and animal species and designated critical habitats. Also include any other species with special status (e.g., positive 90-d findings, Regional Forester's Sensitive Species List, Species of Conservation Concern, etc.), where data exists.
    - Complete collection and verification of information to update Water Rights and Uses (WRU) database.
    - Continue Terrestrial Ecological Unit Inventory (TEUI) implementation through technology transfer, site reviews, and project specific consultation.
    - Continue Riparian Existing Vegetation mapping (REV) effort with Geospatial Technology Application Center (GTAC) until the entire Region is covered.
    - Continue innovative use of remote sensing and other technology such as the Earth Sense Technology employed for vegetation trend analysis in New Mexico meadow jumping mouse (NMMJM) critical habitat.
- Long-Term Objectives:
    - Implement standard protocols for identifying trends in the condition of riparian areas.
    - Complete five-year assessments to quantify the flows necessary to apply for instream flow rights in Arizona.
    - Complete an inventory of water source data needed for water right adjudications and to identify springs and wetlands that support aquatic habitat and riparian vegetation.
    - Compile, review, and report on data relating to water diversions, pumping, and impoundments, and prepare a GIS layer or geodatabase illustrating each with metadata describing spatial and temporal information to aid understanding of riparian and aquatic habitat conditions and help focus protection and restoration efforts.
    - Identify fish distributions and characterize aquatic habitat and stream morphology within the Region to inform priority project work.
    - Prepare conservation assessments/strategies for a variety of riparian/aquatic wildlife/fish/plants that are currently vulnerable from FS actions.

    - Identify reference areas throughout the Region that can be used for informing desired conditions and as a baseline for project effectiveness monitoring.

Goal: Prioritize work in riparian and aquatic ecosystems

- Short-Term Objectives:
    - Elevate the emphasis on selecting proposals for competitive funding when they include objectives that clearly and directly relate to stewardship of riparian and aquatic systems.
    - Identify the most pressing aquatic and riparian restoration needs on each district through interdisciplinary teams and with involvement of local partners and stakeholders.
    - Cross-reference Watershed Condition Framework and other assessments of condition with areas that have listed riparian and aquatic obligate species and critical habitat. Prioritize work in watersheds with WRAPs to leverage restoration and ESA goals for these species and habitats.
    - Evaluate Forest Five-Year Restoration Plans and prioritize riparian projects.
- Long-Term Objectives:
    - Identify a subset of riparian and aquatic systems within the Region that are most in need of restoration to focus efforts.
    - Identify streams in Arizona that would benefit from instream flow water right protection.
    - Identify opportunities in New Mexico where potential for conservation agreements exist.

Goal: Set performance expectations

- Short-Term Objectives:
    - Include performance expectations in budget direction.
    - Identify and assign appropriate accomplishment measures for riparian and aquatic systems.
        - Acres/miles of riparian areas affected by improvement projects
        - Acres/miles/percent of riparian and aquatic ecosystems moving toward desired conditions
        - Acres treated for invasive vegetation
        - Meters/feet of stream channel improvement
        - Number of springs improved
        - Number of water sources inventoried
        - Number of water sources protected
        - Number of instream flow water right application processes initiated
        - Number of conservation agreements completed
        - Structure: percent improvement for ecosystem departure (seral state proportion)
        - Composition: percent improvement for departure from site potential/functional group diversity

- Long-Term Objectives:
    - Assess the short term objectives every 5-10 years by Forest and recognize those that have positive outcomes. Those that do not are refined or removed.
    - Measure how Forests are performing in meeting riparian and aquatic forest plan components, goals, and objectives.

Goal: Provide Training

- Short-Term Objective:
    - Build local capacity in restoration using internal and external expertise.
        - Offer training on restoration and capture lessons learned, host experts such as The National Stream and Aquatic Ecology Center (NSAEC).
        - Continue to provide training opportunities related to riparian and aquatic subjects such as Aquatic Organism Passage (AOP) and database training for AqS, BMPs, WIT, WCATT, and WRU.
        - Include training opportunities in scheduled internal programmatic workshops.
        - Take opportunities to work with external partners to build training curriculum for specific audiences.
- Long-Term Objectives:
    - Emphasize field trainings (e.g. assessments for Properly Functioning Condition).
    - Establish formal mentoring program with on-the-job training.
    - Improve access to Web-based training opportunities.

Goal: Integrate work across disciplines at multiple levels

- Short-Term Objectives:
    - Provide coordination with WO to advance national initiatives.
    - Engage with Rangeland Management and Vegetation Ecology staff regarding Riparian National Inventory (RNI).
    - Work with the Wildlife, Fish, Water, and Air Resources Program (WFWARP) to implement essential projects within the WCF priority watersheds for restoration of riparian areas.
    - Garner support from WFWARP for quantification studies pertinent to instream flow water rights for Wild and Scenic Rivers.
    - Coordinate with the WFWARP new Stream and Riparian Restoration Network https://ems-team.usda.gov/sites/fs-wfwarp-streamsyst/SitePages/Home.aspx
    - Coordinate training for new national Riparian Vegetation Monitoring Protocols.
    - Continue coordination of monitoring and reporting for BMPs, INFRA, WIT, and WCATT.
    - Region provides functional assistance to Forests.
    - Integrate RAES in Regional Range, Wildlife, Forest Health, Fire, Recreation, Engineering, Watershed meetings.
    - Integrate with Regional Recreation staff in “Working with Partners” initiative.
    - Integrate with recreation staff in project work.

- Long-Term Objectives:
    - Structure the work force to more effectively manage riparian and aquatic ecosystems. For example, a program leader position could be created at the Regional Office whose primary mission is leadership of the program and implementation of the Riparian Strategy.

Goal: Work with Partners Within and Across Forest Service Boundaries

- Short-Term Objectives:
    - Regional Forester encourages partners to work with Forest Service in the RAES.
    - Build and maintain partner database on Web site(s). This partner database should house information on all partnerships (not just those related to restoration).
    - Develop Partnership Agreements and Indefinite Delivery Indefinite Quantity (IDIQ) Contracts for Riparian and Aquatic Ecosystem Restoration.
    - Ensure environmental compliance is done in an efficient and effective manner for timely implementation of restoration projects that entice partners to invest on NFS lands.
    - Collaborate with partners to share information and address mutual restoration opportunities.
        - Enhance partnership connections through outreach and networking (e.g. Rio Grande Water Fund, Cross-Watershed Network).
        - Meet with partners to assess how we can best work together to benefit riparian and aquatic systems.
        - Embrace partnerships and funding opportunities that are focused in riparian and aquatic systems.
        - Honor our commitments to partners that provide funding or other support by completing mutually agreed to projects.
        - Use the Sustainable Recreation "Taking Partnership to the Next Level" Action Plan a source of ideas to build partnerships in riparian and aquatic ecosystem restoration.
- Long-Term Objectives:
    - Maintain, integrate, and communicate the partnership database.
    - Augment the communication with Regional partnership coordinators and State liaisons to continue building a culture of collaboration and to increase potential partnerships.

Goal: Communication the Value and Benefits of Riparian and Aquatic Ecosystems

- Short-Term Objectives:
    - Communicate success stories and lessons learned internally and externally.
    - In cooperation with partners, prepare guidance document on how to best manage riparian areas to prepare them for resiliency to climate change.
    - Utilize Office of Communication and Engagement for sharing successes and lessons learned internally and externally.

    - Coordinate communication of success stories with the Sustainable Recreation Strategy.
    - Explore Global Rangelands network for increasing knowledge about riparian ecosystems and successful riparian management.
- Long-Term Objectives:
    - Develop an education/outreach curriculum regarding riparian values, ecology, function, ecological services, management, inventory, and monitoring.

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APPENDICES

Appendix I.

UNDERSTANDING OUR RIPARIAN AND AQUATIC ENVIRONMENTS

Physical and Biological Properties of Riparian Areas

Riparian areas are topographically delineated areas, with distinctive resource values and characteristics. They consist of both aquatic and riparian ecosystems. They include the stream channel, the frequently flooded area (the floodplain) from the edges of streams, springs and seeps, playas, wetlands, fens, and areas adjacent to ponds and lakes. The terrestrial component of riparian ecosystems is a transition between the aquatic ecosystem and the adjacent upland terrestrial ecosystem. It is distinctly different from the surrounding lands because of unique soil, vegetation, and hydrologic characteristics that are strongly influenced by frequent flooding and free or unbound water in the soil (shallow groundwater).

Healthy riparian areas provide a number of ecosystem services. Their root systems stabilize stream channels, they provide water quality benefits by filtering and storing sediments, nutrients and pollutants, they regulate water temperature through shading, reduce flood peaks by slowing and spreading flood waters, serve as key recharge areas for renewing groundwater supplies, provide groundwater discharge to maintain base flows in perennial streams during dry seasons, maintain biodiversity, provide shade, shelter and food for fish and other aquatic organisms, provide wildlife habitat. In addition, they provide domestic, commercial and agricultural water supplies, recreational opportunities, and sequester carbon.

Riparian areas and the adjacent uplands have similar physical and biological processes, but differ due to differences in soil characteristics, water sources, and disturbance regimes. Soil differences are due to depositional and erosional processes stemming from frequent flood events. Riparian soils have higher spatial diversity, are typically younger, and lack well-developed soil horizons relative to their terrestrial upland counterparts.

Riparian areas have higher vegetation densities and different species compared to the adjacent terrestrial uplands due primarily to their sources of water. Precipitation is the principal water source for upland vegetation. Riparian areas, in contrast, receive water from upland sources in the form of overland flow, shallow subsurface flow, and ground water recharge, and from aquatic systems, in the form of out-of-bank flows, infiltration into stream banks (bank storage), and hyporheic (the area below the stream bed) flow from upstream. Riparian areas consequently have access to a greater volume of water compared to adjacent uplands.

Riparian areas are also adapted to frequent disturbance regimes, primarily flooding, that upland areas are not exposed to. Channel characteristics of streams and rivers (their dimensions, patterns, and profiles) are shaped by the range of water flows and sediment loads produced by the contributing watershed. Relatively frequent floods (approximately a 1.5 year return interval) are the dominant channel forming flows. These flows do the most work over time at moving

water and sediment and shaping the channel system (Dunne and Leopold, 1978). Stream channel characteristics can be affected by management activities (e.g. runoff from roads, bridges, domestic animal crossings, etc.) that disrupt the sediment balance, flow regime, groundwater levels, or the riparian vegetation.

Riparian areas are highly valued habitat for many types of species. For example, in the southwest it has been estimated that up to 60% of threatened and endangered vertebrate species are riparian obligates (species that require riparian habitat to complete some portion of their life cycle) (Johnson 1989). Riparian areas also have higher species richness and density (plants and animals) than the surrounding uplands (Jobin et al. 2004; Lyon and Gross 2005). Due to the linear nature of riparian areas, they also serve as corridors that provide dispersal routes for many species, and act as filters, sinks, and sources of biological and non-biological materials (Malanson 1993; Forman 1995).

Physical and Biological Properties of Aquatic Habitats

There are approximately 88,000 miles of mapped stream channels on NFS lands within the Region.[1] The majority of these channels are ephemeral channels that flow only in response to snowmelt or during periods of storm water runoff. Approximately 5,380 miles (7%) are considered perennial streams that flow year round. The percent of perennial streams on individual forests range from as little as one percent of all streams on the Coronado and Kaibab NFs to as much as seventeen and eighteen percent on the Santa Fe and Carson NFs.

There are many diverse types of aquatic habitats that are present within a given reach of stream depending on stream type. Typically, streambeds undulate in elevation in a regular repeating pattern. Shallow, higher velocity areas (riffles and runs) alternate with deeper, lower velocity areas (pools). Diversity of instream habitat features within a reach is crucial for the various life stages of fish and other aquatic species. Low velocity areas are especially important for larval fish development. Adult fish can occupy many different types of habitats depending on the species and their life history. Many larger bodied fish such as trout, chubs, and suckers use riffles and runs for feeding and pools for resting. Some of the smaller bodied species such as loach minnow, spend most of their life within high velocity riffle sections, hiding under large cobbles, which create small areas of low velocity water. Loose substrate is critical for creating these microhabitats. The quantity of instream habitat types that is present at a given time varies depending on flow and substrate condition. At higher flows, the diversity of instream habitat features often become less evident (Dunne and Leopold 1978). Substrates embedded with fine sediments can decrease habitat diversity for smaller fish and aquatic invertebrates

[1] [1]*Estimates of stream miles are based on outdated Cartographic Feature File (CFF) and National Hydrography Database (NHD) data. The NHD database is currently being updated and when completed will result in more accurate identification of miles of ephemeral, intermittent, and perennial streams in the Region. Completion of the update varies by forest but all forests should have updated data by late 2018.*

Water temperature is an important driver for the type and abundance of aquatic organisms found within a given aquatic system, particularly cold water areas that contain salmonid fish. Water temperatures in many smaller stream reaches are significantly influenced by shade from overhanging vegetation near the channel and can be influenced by groundwater discharge to the channel as well (Brown 1969; Hauer et al. 2000; Naiman et al. 2000 in Zaimes 2007). Channel shape also influences water temperature, narrow deep channels generally maintain cooler water than wide shallow systems. Shade and groundwater input may be key factors in maintaining resilient streams in the face of climate change (Ziegler et al. 2013).

The banks of a channel form a critical interface between terrestrial and aquatic ecosystems. Many species, particularly aquatic invertebrates, depend on habitat at the stream bank as a site to emerge and pupate into adult forms (Benke and Wallace 1990). By providing plant materials (litter) to the aquatic system, the habitat at the channel edge plays a critical role in carbon dynamics of the instream community, especially in small first and second order streams (Vannote et al. 1980; Giller and Malmqvist 1998; Wipfli 2005).

The inner riparian area, found between the channel banks and outer riparian habitat supports riparian tree species that may enter the stream system and become part of the coarse woody debris load (woody material greater than 3 in. in diameter (Platts et al. 1987)). Coarse woody debris represents an important habitat in smaller rivers and streams and can have significant effects on channel geometry, creating a diversity of habitat elements such as hiding cover and thermal refugia (Beschta 1979; Hamon et al. 1989; Maser and Sedell 1994). Coarse woody debris in the inner riparian area also provides important habitat for a wide range of reptiles (Warren and Schwalbe 1985; Szaro and Belfit 1986).

Disturbance Regimes and Temporal Diversity

Riparian habitats often experience significant changes over time resulting in habitat patches of differing ages in a small spatial area. The main drivers of habitat variation over time are flooding, deposition and scour of sediments, recruitment and redistribution of large wood, regeneration of vegetation, channel avulsion, and drought (Stanford et al. 2005). Floods are an important regenerative mechanism for many types of riparian habitat (Miller et al. 1995; King et al. 1998; Fierke and Kauffman 2005). Floods can remove herbaceous and woody species and accumulated woody debris, they can scour substrates, deposit sediments and create new sites for germination and establishment of plant species. They connect the stream to its floodplain and allow for exchange of energy and nutrients. Many riparian woody species such as cottonwood and willow require the open mineral seedbed created by scouring for successful germination. Slowly receding water table elevations following flood events are important to enable root growth of newly recruited riparian vegetation to keep pace with the declining water table.

Flood pulses are critical for the life history of some types of fish. These pulses may cue spawning events, loosen and clean the substrate, and create habitat diversity. Many populations of native fish species in the Southwest respond positively to flood events, while areas that have modified flows are dominated by non-native fish. Non-native species are often much more dominant in areas with an altered flow regime. Altered flows can be caused by dams, diversions, and groundwater pumping. (Olden and Poff 2005; Propst et al. 2008)

Altered hydrology as a result of water diversion can cause encroachment of vegetation into stream channels and mortality in the outer riparian area (Harris 1986; Martin and Johnson 1987; Sedgwick and Knopf 1989; Webb and Leake 2005). Reducing the amount of water passing through these areas can decrease the width of the riparian zone due to mortality of species, especially in the outer riparian zone and change the stream morphology. Other actions that confine stream channels (such as roads) or cause incision result in a narrowing of the riparian zone. (*Much of the preceding several paragraphs comes from Zaimes et al. 2007. References included in the paragraphs are found in Zaimes*)

Engineering of Aquatic and Riparian Ecosystems by Beaver

The distribution and abundance of beaver in North America have been dramatically reduced since the arrival of Europeans to the continent. A large and growing body of science indicates that dam-building beavers play an integral role in aquatic and riparian ecosystems by enhancing water storage, raising water tables, prolonging periods of water delivery, and by providing diverse and complex habitat types for aquatic and riparian obligate species. These effects collectively enhance the functionality of riparian and aquatic ecosystems while also increasing their resilience to climate change. The loss and persistent absence of beavers from aquatic and riparian ecosystems has been driven by direct (i.e., trapping for fur markets, hunting for food, killing nuisance individuals, etc.) and indirect effects (i.e., loss of woody vegetation that provides food and dam-building materials from riparian vegetation communities due to preferential browsing by domestic and wild ungulates). Restoring suitable riparian habitat (including the crucial woody component) that can support robust beaver populations in historically occupied range has the potential to be a valuable element of effective restoration in these systems. (Macfarlane et al. 2014; McColley et al. 2011; McKinstry 2009; Wheaton 2013)

Groundwater Dependent Ecosystems

Groundwater dependent ecosystems, including springs, seeps, wetlands, and fens are important types of riparian areas. Springs and seeps are typically present where the water table intersects the land surface. They can be important sources of water to streams and other surface water features by maintaining or prolonging baseflows. The constant source of water at springs and seeps leads to the abundant growth of plants and many times to unique habitats for endemic species like spring snails (Glasser et al. 2007). Wetlands occur in widely diverse settings ranging from coastal margins, to floodplains, to mountain valleys. Wetlands can receive inflow from groundwater, recharge groundwater, or both. Fens are peat-forming wetlands that receive recharge and nutrients almost exclusively from groundwater (Chaddle et al. 1998). These systems tend to function as carbon sinks and can store large amounts of carbon for thousands of years, providing an important ecosystem service (Chimner and Cooper 2003; Charman 2002). Fens are less acidic and have higher nutrient levels than other types of peatlands and are able to support a much more diverse plant and animal community. Wetlands and fens provide many of the same benefits provided by stream riparian areas. They also provide habitat for unique plant and animal communities.

Appendix II.

CURRENT REGIONWIDE DATA COLLECTION AND MONITORING

Terrestrial Ecological Unit Inventory (TEUI) of Riparian and Aquatic Ecosystems

The Terrestrial Ecological Unit Inventory endeavors to systematically classify and map ecosystems based on integrating biotic and abiotic factors that comprise the physical and biological environments. The primary purpose of TEUI is to describe and classify ecological types and map ecological land units with similar capabilities and potential for management. The TEUI process is foundational for the development of monitoring objectives and sampling designs.

When classifying and mapping riparian and aquatic ecosystems a unique set of soil, vegetation, landform, and site characteristics are considered. This is largely due to their location on the landscape and the influence of water as it flows across and through landforms; the amount of water which is held within the soil over space and time; and the resulting vegetation that grows upon the wet or moist soil. Geology and geomorphic process that create specific landforms on which riparian and aquatic ecosystems occur strongly influence the stability and morphometry of the channel; soil productivity; vegetation composition, density and cover and aquatic habitat.

Regional Riparian Mapping Project – RMAP

RMAP is a 1:12,000 scale potential vegetation map product that captures the extent of riparian across the Regions NFs and NGs. RMAP represents a framework of broad riparian types to underpin and organize the subsequent analysis, inventory, and monitoring of aquatic and riparian resources. This mapping has been integrated with regional analysis methods, TEUI, NHD, ERU mapping, and the Aquatic-Riparian Inventory. RMAP was developed with several key data sources including TEUI, RSAC valley bottom models, infrared aerial photography, and other ancillary information and remote sensing technology. This work encompasses the full extent of those 5th-level HUCs intersecting NFS lands in the Region, with over 819,000 acres of mapping including 266,000 acres adopted and normalized from previous mapping, particularly TEUI. TEUI vegetation classification provided a base for map unit themes, leading to a legend of 24 map units and four subclasses. RMAP has been integrated with upland mapping of Ecological Response Units to form one regional dataset of ecosystem types downloadable from the Regional GIS library: http://www.fs.usda.gov/detail/r3/landmanagement/gis

Riparian Existing Vegetation Mapping

Existing vegetation mapping is being developed for all the Regions NFs and NGs to represent current vegetation conditions of structure and composition. Mapping is completed for the Gila, Coconino, Kaibab, and Tonto National Forests. Existing vegetation mapping is an important component in an inventory, monitoring, and analysis framework by providing site condition information on current vegetation characteristics such as the extent of riparian vegetation, seral

state diversity, and the recruitment of woody vegetation. This mapping occurs within all RMAP extents, and includes feature class information on life form and plant composition, tree and shrub height, and tree and shrub density. At 1:6,000 scale, this mapping has sufficient spatial detail for habitat assessment, planning for restoration and rangeland management, and other R3 needs requiring information on current condition for compliance, environmental assessment, effects analysis, and decision making. The mapping can be intersected with RMAP and other ancillary information to support the monitoring and analysis of several key indicators such a seral state diversity. http://www.fs.usda.gov/detail/r3/landmanagement/gis

Aquatic-Riparian Inventory

The Aquatic-Riparian Inventory (ARI) represents an efficient mid-level approach to the systematic and quantitative inventory and monitoring of riparian and stream resources in R3. ARI has been integrated with RMAP as part of an inventory, monitoring, and assessment framework to provide site condition information on current riparian and aquatic characteristics such as stream cover of vegetation, stream bank features, incision, and sinuosity. A recent pilot for ARI on the Prescott and Cibola NFs was conducted as a proof-of-concept, as an inexpensive remote sensing-based inventory method. Using high resolution photography and computer workstations, heads-up interpretation and 3D stereo viewing were used to collect information on each sample site (1ha). Field validation and accuracy assessment were performed on a portion of the samples. The method follows a statistical sample design and includes data collection of sufficient detail to help determine function and sustainability based on several indicators. ARI includes an inventory of 1) cover features, such as the type and size of vegetation, 2) bank features, such as armoring and overhanging vegetation, and 3) stream features, such as sinuosity and gradient. Partners for the this work include the Prescott and Cibola NFs, Regional Office GIS unit, Photo Science Inc., RO EAP/WSA, RO Wildlife, and Natural Heritage New Mexico/UNM. Based on successes of the Prescott-Cibola pilot, ARI has been extended to an additional 550 samples on four Forests in FY17 and FY18.

R3 Climate Change Vulnerability Assessment (CCVA)

The CCVA is an all-lands assessment for major upland systems of AZ and NM, representing the potential vulnerability of Southwest ecosystems to the projected climate of late 21st-century. Recently a watershed vulnerability layer was derived from CCVA, providing an inference of climate vulnerability on watershed resources within each 6th-level HUC. Vulnerability was based on the amount of departure of climate predicted for the year 2090 from the pre-1990 climate measured for the Southwest for several key temperature and precipitation variables. Pre-1990 climate envelopes were built for each major ecosystem type of the Region. CCVA represents the anticipated effects of climate change to site potential, and the probability of climate as a future stressor and change agent for vegetation structure, composition, and function. Vulnerability ratings (low, moderate, high, very high) are on par with risk and the probability of ecosystem stress. In more specific terms, vulnerability may be considered as the relative probability of type conversion. CCVA vulnerability ratings were based on the projected climate departure from the historic climate envelope for a given ERU and location. While designed to evaluate upland systems, the CCVA watershed ratings may have some value in assessing aquatic

and riparian resources. https://ems-team.usda.gov/sites/fs-r03-fp/Pages/CCVA-and-SEVA-Assessments.aspx

Watershed Condition Framework

The Watershed Condition Framework established a nationally consistent reconnaissance-level approach for classifying watershed condition, using a comprehensive set of 12 indicators that are surrogate variables representing the underlying ecological, hydrological, and geomorphic functions and processes that affect watershed condition. Primary emphasis is on aquatic and terrestrial processes and conditions that FS management activities can influence. The 12 indicators evaluated in the assessment include:

1. Water Quality
2. Water Quantity
3. Aquatic Habitat
4. Aquatic Biota
5. Riparian/Wetland Vegetation
6. Roads and Trails
7. Soils
8. Fire Regime or Wildfire
9. Forest Cover
10. Rangeland Vegetation
11. Terrestrial Invasive Species
12. Forest Health

All NFs and NGs in the Region completed the first round of watershed condition assessments in 2010 for their 6th code watersheds. Updated condition assessments for selected watersheds were completed in 2015. Updating of the watershed condition ratings in an on-going process as forests determine a need to do so. Changed conditions that would trigger a reassessment of the rating of a watershed include completion of identified essential projects needed to move the watershed to an improved condition class, a severe wildfire burn over most of a watershed, or removal of overstory vegetation.

NHD Spatial Data Update Project

The USFS, Southwestern Regional Office (R3), GIS/Photogrammetry Staff and the Ecosystem, Planning & Analysis/ Watershed, Soil & Air (EAP/WSA) Staff are working with the Center for Geographical Studies at California State University Northridge (CSUN) to update the existing National Hydrography Dataset (NHD) for the Southwestern Region.

The National Hydrography Dataset (NHD) is the water dataset used in US Forest Service (USFS) applications including: Aquatic Surveys, Best Management Practices (BMP) monitoring, Fire Retardant Avoidance Maps, Water Improvement Tracking (WIT), Watershed Condition Framework (WCF), Watershed Classification and Assessment Tracking Tool (WCATT), Water Rights and Uses (WRU) on which all spatial planning and reporting of accomplishments are documented. It is also used for Forest/Project planning, in NEPA assessments, and the Draft

Southwest Region Riparian and Aquatic Ecosystem Strategy. It is essential to the success of these projects and programs to use an accurate NHD. NHD is also the core water dataset used by other federal agencies and all of our state partners. Having a consistent dataset enhances collaboration and our abilities to work together.

The United States Geological Survey (USGS), the authoritative agency and data stewards of NHD, is currently correcting stream attributes of NHD watersheds in the arid regions of the United States. Corrections include improved location of stream lines, correct identification of stream types (perennial, intermittent, and ephemeral), corrections to stream names and connectivity.

CSUN is working with the USGS and other organizations (The Desert LCC, US National Park Service, etc.) to complete a comprehensive spatial data update to the NHD watersheds in the Southwestern Region. These comprehensive updates are occurring adjacent to National Forest land, and therefore partnering with CSUN to complete spatial data updates on USFS land is in line with the priority NHD updates required for R3 as noted in the NHD Assessment Report completed by Region 3 in 2015, with FY15 RLT Commitment funding.

CSUN is currently updating the existing NHD for the Coronado, Tonto, Coconino, Carson, and Kaibab National Forests through a cost-reimbursement agreement managed by the R3 RO/GIS Staff, with FY16 RLT Commitment funding. Funding provided by an FY17 RLT Commitment will be used to support forest staffs mentioned above during the review process of the NHD updates made by CSUN before the edits are submitted to the USGS, and to begin updating the existing NHD for the remaining forests and grasslands in the Region.

Water Rights and Uses Database

The Water Rights and Uses (WRU) database is the mandatory repository for data associated with water rights and uses on National Forests and Grasslands, as noted in the letter from FS Deputy Chief Leslie Weldon, dated April 23, 2014. The WRU database is an important national tool for property management and reporting. This database houses spatial and tabular data associated with water rights obtained under Federal or State law, as well as water use inventories. The database facilitates the agency with keeping its water rights property inventory up-to-date.

A key advantage of the database is that documents and records can be attached thus reducing the need to maintain voluminous paper files. It also makes records universally available across staff areas and to those teleworking. It is designed to comply with litigation holds that are regularly requested by the Office of the General Counsel or the U.S. Department of Justice when water rights matters enter into adjudication or litigation.

The R3 Regional Leadership Team, acknowledging the importance of having an up-to-date WRU database in place has provided off the top funding for forests to expedite collection, input and verification of the data in WRU.

Appendix III.

STRENGTHS, WEAKNESSES, OPPORTUNITIES, THREATS

An analysis of strengths, weaknesses, opportunities and threats for aquatic and riparian resources in the Southwestern Region revealed areas for improving management of riparian and aquatic ecosystems, as well as areas where things are working well and can be built upon.

Strengths (Positive, Internal Factors)

- The timing of this strategy is good, it coincides with New Mexico Forest Plan revisions and resonates with Regional priorities (Relationships, Recreation, and Restoration).
- There is a wide range of expert knowledge among staff.
- The Region has proven to be a leader in collaboration.
- There is a wealth of existing data to inform the strategy.
- Existing laws, rules and policies in place help support riparian management. (See Appendix III)

Weaknesses (Negative, Internal Factors)

- There is no clearly articulated strategy to achieve desired conditions in riparian and aquatic ecosystems.
- There is a lack of workforce capacity, not enough staff dedicated to riparian and aquatic ecosystems.
- There are problems with corporate databases and a lack of knowledge and skills to work with them, leading to underuse of valuable information and analytical tools.
- There is a real or perceived lack of administration of existing policies to protect riparian and aquatic ecosystems.
- There is a lack of opportunities to attend training, or lack of knowledge thereof.
- There is a lack of, or inefficient coordination or integration of FS program areas.
- There are gaps in the data that exists to guide management, especially in regards to aquatic ecosystems.
- Communication, both internal and external, is not as effective as it needs to be. Effective communication will be key to building a shared understanding of why and how to restore, sustain and improve our riparian and aquatic ecosystems.

Opportunities (Positive, External Factors)

- There is a high level of understanding of values of riparian areas, especially in the Southwest, and there are opportunities to communicate the importance of this strategy.

- There are numerous and diverse entities working with us toward the goal of functioning riparian and aquatic ecosystems.
- There is shared responsibility for many of the riparian and aquatic ecosystems in the Southwest
- We can use the rivers and streams that connect us to educate, conserve, and motivate the public to work with us to conserve riparian and aquatic ecosystems.
- There is a wide range of expert knowledge, including long-term local knowledge about riparian and aquatic ecosystems.
- There is a high potential for partnerships and joint funding for projects that will restore, improve or sustain riparian and aquatic ecosystems in the Southwest.
- There are existing authorities that can be used to leverage partnerships for this effort, for example the Farm Bill, Good Neighbor, and the Secure Rural Schools authorities.
- There are a number of good examples of where working with partners has resulted in improved ecosystem services, i.e. the Flagstaff Watershed Protection Project, the Santa Fe Fireshed project, and the Comanche Creek project.
- Existing efforts can be built upon, such as the Opportunity Map (as being completed by NM Forests with partners) to focus attention / resources on riparian / aquatic systems.
- Existing public messages, such as the Forests to Faucets or NFF & Brewing Companies ("Tap to Top" video https://www.nationalforests.org/get-involved/tap-to-the-top) can be expanded.

Threats (Negative, External Factors)

- Direct physical impacts, such as water developments, impoundments, diversions, withdrawals, water rights claims.
- Groundwater pumping, absence of regulation, lack of understanding or acknowledgement of groundwater-surface water connection.
- Effects of population growth and increased urbanization, resulting in increasing recreational use of the NFs and NGs and increased demand for water, both of which could threaten riparian areas.
- Climate change is anticipated to result in warmer and drier conditions, and less water to support riparian and aquatic ecosystems.
- Socio-political barriers such as desires for state ownership of Federal land, and the perception that management of riparian may infringe on water rights of others.
- Invasive species, both nonnative aquatic species and nonnative plants, often have devastating effects to riparian and aquatic ecosystems including predation on native species, and competition for water, nutrients and sunlight.

Appendix IV.

DEFINITIONS

The interaction of climate with the earth's surface has created a variety of landscapes drained by networks of streams, rivers, lakes, wetlands, and other types of aquatic systems. The main feature of an aquatic system is the presence of reliable water, whether perennial or seasonal. The water may be surface water or near surface groundwater. Riparian vegetation areas are found adjacent to essentially all of these waterbodies (National Research Council, 2002).

Riparian Areas

What follows is a broad description and definition of riparian within the context of the R3 Riparian Strategy that follows direction from the Forest Service Manual (FSM 2526), R3 Riparian Area Handbook (FSH 2509.23), and the National Riparian Protocols, including the definition of riparian. It excludes stringers of robust upland vegetation that are taller or denser than surrounding upland vegetation; and it is consistent with RMAP, which provides a base for riparian location and themes. Embedded within RMAP are all TEUI riparian map features and vegetation subseries.

Riparian areas represented by the R3 Riparian and Aquatic Ecosystem Strategy tier from the Forest Service Manual definition (FSM 2526.05):

- Riparian Areas: Geographically delineable areas with distinctive resource values and characteristics that are comprised of the aquatic and riparian ecosystems.
- Riparian Ecosystems: A transition area between the aquatic ecosystem and the adjacent terrestrial ecosystem; identified by soil characteristics or distinctive vegetation communities that require free or unbound water.

"Free or unbound" water is physically and chemically available to support the development of riparian vegetation. Riparian ecosystems are distinguished by the presence of free water within the rooting depth of native perennial plants at least seasonally (10 percent of the time or more) (FSH 2509.23). Plants that require at least seasonally free water for all or part of their life cycle indicate a riparian ecosystem. Exhibit 1 of the R3 Riparian Area Handbook contains a partial list of plant species associated with free water including where upland species may dominate (free-water associates) (FSH 2509.23).

The RMAP dataset and operational definition are consistent with the agency definition, R3 Riparian Area Handbook, and the description here. As stated above, riparian ecosystems with robust upland vegetation and ephemeral settings lacking riparian plant indicators were deferred from RMAP, but could be accommodated by this or other strategies in the future. Also deferred, in the absence of riparian vegetation, were these additional areas stipulated by the Riparian Area Handbook (FSH 2509.23): 1) all-100 year recurrence interval floodplains and 2) all other lands within at least 100 horizontal feet of the annual high-water edge of perennial or interrupted water bodies.

Aquatic Ecosystems

Aquatic ecosystems are driven by the interaction of water, physical, chemical, and biological components of the site as well as upland conditions (Sullivan et al. 1987). The physical components which influence the aquatic system are numerous and include: elevation, gradient, soil and substrate types, climate, and shape of the drainage area (valley bottom) all of which influence the presence, quality, and quantity of water. Chemical components that influence aquatic systems include dissolved oxygen, nutrient concentrations, alkalinity and acidity, and organic and inorganic materials washed into aquatic ecosystems. The biological community includes woody and herbaceous riparian and aquatic vegetation, fish, wildlife, and invertebrates both within the riparian area as well as in upland communities within the watershed. The Southwestern Region contains diverse types of aquatic ecosystems including streams, springs, lakes, cienegas, playas, and other wetland features. These systems each have unique processes that are essential in maintaining their form and function.

Appendix V.

STATUTES AND REGULATIONS RELATED TO RIPARIAN AND AQUATIC ECOSYSTEMS

Statutes and regulations that provide authority to manage riparian and aquatic ecosystems can be found in Title 36 Chapter 2 Parts 200-299 of the Code of Federal Regulations (CFRs), in Executive Orders, in the Forest Service Manual, in the Forest Service Handbook, and in the Standards and Guidelines sections of Forest Plans. Applicable sections of these authorities are presented here.

Regulations:

36 CFR 219.8 Sustainability

(a) Ecological Sustainability.

(3) Riparian Areas

(i) The plan must include plan components, including standards or guidelines, to maintain or restore the ecological integrity of riparian areas in the planning area, including plan components to maintain or restore structure, function, composition, and connectivity, taking into account:

(A) Water temperature and chemical composition;

(B) Blockages (uncharacteristic and characteristic) of watercourses;

(C) Deposits of sediment;

(D) Aquatic and terrestrial habitats;

(E) Ecological connectivity;

(F) Restoration needs; and

(G) Floodplain values and risk of flood loss.

(ii) Plans must establish width(s) for riparian management zones around all lakes, perennial and intermittent streams, and open water wetlands, within which the plan components required by paragraph (a)(3)(i) of this section will apply, giving special attention to land and vegetation for approximately 100 feet from the edges of all perennial streams and lakes.

(A) Riparian management zone width(s) may vary based on ecological or geomorphic factors or type of water body; and will apply unless replaced by a site-specific delineation of the riparian area.

(B) Plan components must ensure that no management practices causing detrimental changes in water temperature or chemical composition, blockages of water courses, or deposits of sediment that seriously and adversely affect water conditions or fish habitat shall be permitted within the riparian management zones or the site-specific delineated riparian area.

(4) Best Management Practices for Water Quality. The Chief shall establish requirements for national best management practices for water quality in the Forest Service Directive System. Plan components must ensure implementation of these practices.

36 CFR 251.54 Special Use Permits

(e) Pre-application Actions

(1)Upon receipt of a request for any proposed use other than for non-commercial group use, the authorized officer shall screen the proposal to ensure that the use meets the following minimum requirements applicable to all special uses:

(ii) The proposed use is consistent or can be made consistent with standards and guidelines in the applicable forest land and resource management plan prepared under the National Forest Management Act and 36 CFR 219.

36 CFR 251.56 Terms and Conditions

(a) *General.* (1) Each special use authorization must contain:

(i) Terms and conditions which will:

B. Minimize damage to scenic and esthetic values and fish and wildlife habitat and otherwise protect the environment

1996 Record of Decision for the Amendment of Forest Plans

Mexican Spotted Owl

Guidelines

Riparian Areas: Emphasize maintenance and restoration of healthy riparian ecosystems through conformance with forest plan riparian standards and guidelines. Management strategies should move degraded riparian vegetation toward good condition as soon as possible. Damage to riparian vegetation, stream banks, and channels should be prevented.

Executive Order 11988-Floodplain Management

Executive Order 11990 – Protection of Wetlands

See FSM 2527 for direction regarding management of Floodplains and Wetlands based on these executive orders.

Forest Service Manual (FSM)

FSM 2020 – Ecosystem Restoration

2020.2—Objective

Ecosystems ecologically or functionally restored, so that over the long term they are resilient and can be managed for multiple use and provide ecosystem services, including but not limited to carbon storage and sequestration.

2020.3—Policy

1. The Forest Service will emphasize ecosystem restoration across the National Forest System and within its multiple use mandate.

2. The Forest Service land and resource management plans, project plans, and other Forest Service activities may include goals or objectives for restoration. The goals or objectives for ecosystem restoration must be consistent to all applicable laws and regulations. In development of restoration goals or objectives, the Forest Service should consider:

a. Factors such as the following:

(1) Public values and desires;

(2) The natural range of variation (NRV);

(3) Ecological integrity;

(4) Current and likely future ecological capabilities;

(5) A range of climate and other environmental change projections;

(6) The best available scientific information; and,

(7) Detrimental human uses.

b. technical and economic feasibility

to achieve desired future conditions.

c. ecological, social, and economic sustainability.

d. the recovery, maintenance, and enhancement of carbon stocks.

e. opporunities to incorporate restoration objectives into resource management projects to achieve complementary or synergistic results.

f. the concept that an ecological system is dynamic and follows an ecological trajectory

g. the social, economic and ecological influences of restoration activities at multiple scales.

3. The Forest Service may reestablish, maintain, or modify the composition, structure, function, and connectivity of aquatic and terrestrial ecosystems in order to sustain their resilience and adaptive capacity.

4. Activities with localized, short-term adverse effects may be acceptable in order to achieve long-term restoration objectives.

5. The definitions for following terms in this policy are identical to the definitions for the same terms in the National Forest System, Land Management Planning Directive: adaptation, adaptive capacity, adaptive management, disturbance, disturbance regime, ecological integrity, ecosystem, ecosystem services, landscape, natural range of variation (NRV), resilience, restoration– ecological, restoration– functional, stressors, and sustainability.
(FSH 1909.12, zero code, section 05).

6. When ecosystems have been altered to such an extent that reestablishing key ecosystem characteristics within the NRV may not be ecologically or economically possible, the restoration focus should be to create functioning ecosystems.

7. Resource managers should consider ecological conditions across ownerships and jurisdictions to develop and achieve landscape restoration objectives by engaging the public, State and local governments, and consultation with Indian Tribes.

8. Not all natural resource management activities are required to include restoration, and not all National Forest System lands require restoration.

FSM 2300 – RECREATION, WILDERNESS, AND RELATED RESOURCE MANAGEMENT
2354.76 - Evaluation Procedures

4. Describe How the Proposed Activity Will Directly Alter Riparian and/or Floodplain Conditions. Address the magnitude and spatial extent of the effects the proposed activity will have on riparian/floodplain attributes. Give special attention to changes in features that would affect the outstandingly remarkable and other significant resource values.

Describe:

a. The position of the proposed activity relative to the riparian area and floodplain.

b. Any likely resulting changes in:

(1) Vegetation composition, age structure, quantity, or vigor.

(2) Relevant soil properties such as compaction or percent bare ground.

(3) Relevant floodplain properties such as width, roughness, bank stability, or susceptibility to erosion.

6. Evaluate and Describe How Changes in On-Site Conditions Can/Will Alter Existing Hydrologic or Biologic Processes. Evaluate potential changes in hydrologic and biological processes by quantifying, qualifying, and/or modeling the likely effects of the proposed activity on:

a. The ability of the channel to change course, re-occupy former segments, or inundate its floodplain;

b. Streambank erosion potential, sediment routing and deposition, or debris loading;

c. The amount or timing of flow in the channel;

d. Existing flow patterns;

e. Surface and subsurface flow characteristics;

f. Flood storage (detention storage);

g. Aggradation/degradation of the channel; and,

h. Biological processes such as:

(1) Reproduction, vigor, growth and/or succession of streamside vegetation;

(2) Nutrient cycling;

(3) Fish spawning and/or rearing success;

(4) Riparian dependent avian species needs; and,

(5) Amphibian/mollusk needs.

9. Compare Project Analyses to Management Goals. Based on the analysis of steps 3-8, identify and document project effects on achievement, or timing of achievement, of management goals and objectives relative to free-flow, water quality, riparian area and floodplain conditions, and the outstandingly remarkable and other significant resource values.

FSM 2526 - RIPARIAN AREA MANAGEMENT

Riparian areas consist of riparian ecosystems, aquatic ecosystems, and wetlands.

2526.02 - Objectives

1. To protect, manage, and improve riparian areas while implementing land and resource management activities.
2. To manage riparian areas in the context of the environment in which they are located, recognizing their unique values.

2526.03 - Policy

1. Manage riparian areas in relation to various legal mandates, including, but not limited to, those associated with floodplains, wetlands, water quality, dredged and fill material, endangered species, wild and scenic rivers, and cultural resources.
2. Manage riparian areas under the principles of multiple-use and sustained-yield, while emphasizing protection and improvement of soil, water, and vegetation, particularly because of their effects upon aquatic and wildlife resources. Give preferential consideration to riparian-dependent resources when conflicts among land use activities occur.

3. Delineate and evaluate riparian areas prior to implementing any project activity. Determine geographic boundaries of riparian areas by onsite characteristics of water, soil, and vegetation.
4. Give attention to land along all stream channels capable of supporting riparian vegetation (36 CFR 219.27e).
5. Give special attention to land and vegetation for approximately 100 feet from the edges of all perennial streams, lakes, and other bodies of water. This distance shall correspond to at least the recognizable area dominated by the riparian vegetation (36 CFR 219.27e). Give special attention to adjacent terrestrial areas to ensure adequate protection for the riparian-dependent resources.

2526.04 – Responsibility

2526.04a - Associate Deputy Chief for Resources, National Forest System

The Associate Deputy Chief for Resources, National Forest System, has the responsibility to:

1. Provide national policy, objectives, guidelines, and minimum standards for protection and improvement of riparian areas on National Forest System lands.
2. Coordinate Forest Service research programs with riparian area management needs.
3. Coordinate riparian area management direction with that of other Federal agencies at the national level.

2526.04b - Regional Foresters

Regional Foresters have the responsibility to:

1. Ensure that riparian area management is included in the land management planning process.

2. Provide technical standards, guidance, training, and quality control for the management of riparian areas.

3. Provide criteria for monitoring effectiveness of measures implemented for the protection and improvement of riparian areas.

4. Develop more specific criteria as needed to define riparian areas in terms of soil, vegetation, and landforms.

2526.04c - Forest Supervisors

Forest Supervisors have the responsibility to:

1. Inventory riparian areas in the Forest land management planning process.

2. Develop and implement measures to manage and protect riparian areas according to national objectives and Regional standards.

3. Monitor the implementation and effectiveness of management and protection of riparian areas (FSM 1922.6).

2526.05 – Definitions

Aquatic Ecosystems. The stream channel, lake or estuary bed, water, and biotic communities and the habitat features that occur therein.
Perennial Streams. Permanently present surface water. Flows occur throughout the year except possibly during extreme drought or during extreme cold when ice forms.
Riparian Areas. Geographically delineable areas with distinctive resource values and characteristics that are comprised of the aquatic and riparian ecosystems.
Riparian-Dependent Resources. Resources that owe their existence to the riparian area.
Riparian Ecosystems. A transition area between the aquatic ecosystem and the adjacent terrestrial ecosystem; identified by soil characteristics or distinctive vegetation communities that require free or unbound water.

2526.1 - Inventory and Analysis

Provide the following information as needed for land and resource management planning:

1. Riparian-dependent resources.
2. Streamside vegetation and its value as fish and wildlife habitat and its relation to the control of sediment originating on upland areas, to the maintenance of stream temperatures, and to the stability of streambanks and channels.
3. Ground water recharge areas, factors, and conditions.
4. Possibility of reducing or otherwise modifying the risk of flooding.
5. Water quality and the deposition or buffering of potential water pollutants.
6. Fluctuations in water levels, quantities, and timing of flow in relation to habitat of fish, waterfowl, mammals, and aquatic organisms, and to maintenance of phreatophytes and other riparian vegetation.
7. Cumulative effects of management activities.
8. Stream channel conditions.

2526.2 - Monitoring

Apply a monitoring system consistent with the sensitivity of the riparian area and capable of measuring attainment of Forest plan objectives for dependent resources.

FSM 2527 – FLOODPLAIN MANAGEMENT AND WETLAND PROTECTION

2527.01 - Authority

Executive Orders 11514, 11988, and 11990, and the general authorities cited in FSM 2501 apply to floodplain management and wetland protection.

FSM 2527.02 – Objectives

1. To reduce risk of flood loss.

2. To minimize impacts of floods on human safety, health, and welfare.

3. To minimize destruction, loss, and degradation of wetlands.

4. To preserve and restore the natural and beneficial values of floodplains and wetlands.

FSM 2527.03 – Policy

1. Recognize floodplains and wetlands as specific areas.

2. Provide opportunity for early public review of plans or proposals for actions in floodplains.

3. Avoid adverse impacts that may be associated with the occupancy and modification of floodplains and with the destruction, loss, or degradation of wetlands. Avoid filling of land within floodplains and wetlands wherever practicable.

4. Do not permit floodplain development and new construction in wetlands wherever there is a practicable alternative.

5. Promote nonstructural flood protection methods to reduce flood hazard and flood loss.

6. Preserve and, where needed and feasible both economically and technically, enhance the natural and beneficial function and values of wetlands.

7. Provide technical assistance to Federal and State forestry programs.

FSM 2636.4 RIPARIAN HABITATS

Use the direction in FSM 2526 to manage riparian habitats while recognizing their critical ecosystem function in maintaining dependent fish and wildlife resources.

1. Develop and implement management strategies (objectives, management prescriptions, and monitoring) to meet riparian habitat goals for dependent fish and wildlife species.

2. During project environmental analysis, describe the desired riparian habitat condition at some future time in terms of specific objectives for stream surface shaded, streambank

stability, streambed sedimentation, grass-forb cover, shrub-cover, and tree cover needed to meet planned objectives.

Forest Service Handbook 1909.12, Chapter 20

23.11d – Ecosystem Diversity

The Planning Rule requirements for ecosystem diversity from 36 CFR 219.9(a)(2) are:

The plan must include plan components, including standards or guidelines, to maintain or restore the diversity of ecosystems and habitat types throughout the plan area. In doing so, the plan must include plan components to maintain or restore:

(i) Key characteristics associated with terrestrial and aquatic ecosystem types;
(ii) Rare aquatic and terrestrial plant and animal communities; and
(iii) The diversity of native tree species similar to that existing in the plan area.

To develop the land management plan consistent with maintaining ecosystem diversity, the plan must include plan components, including standards or guidelines, designed to maintain, restore, or promote ecosystem diversity and habitat types.

The diversity of terrestrial, riparian, and aquatic ecosystems and habitats is fundamental to providing ecological conditions that support the abundance, distribution, and long-term persistence of native species and diversity of plant and animal communities. In addition, diversity of ecosystems and habitat types within the unit is an important aspect of the coarse-filter approach. The terms ecosystem diversity and habitat type are defined in FSH 1909.12, zero code, section 05. Terrestrial, riparian, and aquatic ecosystems to be addressed in the planning process are identified in the need to change the plan based on the assessment phase or identified based on information brought forward during the public and governmental participation process. See sections 23.1–23.12c of this Handbook for direction about plan components related to maintaining or restoring terrestrial, riparian, and aquatic ecosystems.

When developing plan components for maintaining and restoring the diversity of ecosystems and habitat types, the Interdisciplinary Team should consider the following:

1. The spatial extent and distribution of ecosystems and habitat types and spatial relationships to the natural range of variation (or other reference conditions if the use of natural range of variation is inappropriate).

2. The importance of ecosystems and habitats type to providing ecological conditions that contribute to the recovery of threatened and endangered species, conserve proposed and candidate species, and maintain viable populations of species of conservation concern (sec. 23.13 of this Handbook).

3. How plan components under consideration for large-scale ecosystems (like longleaf pine forests) would maintain or restore rare or unique embedded communities (like hillside bogs and longleaf savannahs) (FSH 1909.12, ch. 10, sec. 12.14c).

4. How plan components under consideration for ecosystems would contribute to maintaining the persistence of native tree species within the plan area.

5. How plan components for key characteristics of the ecosystem and habitat types contribute to the broader biodiversity of ecosystems across the plan area.

23.11e – Riparian Areas

The rule requirements for riparian areas from 36 CFR 219.8(a)(3) are:

> (i) The plan must include plan components, including standards or guidelines, to maintain or restore the ecological integrity of riparian areas in the plan area, including plan components to maintain or restore structure, function, composition, and connectivity, taking into account:
>
> > (A) Water temperature and chemical composition;
> > (B) Blockages (uncharacteristic and characteristic) of water courses;
> > (C) Deposits of sediment;
> > (D) Aquatic and terrestrial habitats;
> > (E) Ecological connectivity;
> > (F) Restoration needs; and
> > (G) Floodplain values and risk of flood loss.
>
> (ii) Plans must establish width(s) for riparian management zones around all lakes, perennial and intermittent streams, and open water wetlands, within which the plan components required by paragraph (a)(3)(i) of this section will apply, giving special attention to land and vegetation for approximately 100 feet from the edges of all perennial streams and lakes.
>
> > (A) Riparian management zone width(s) may vary based on ecological or geomorphic factors or type of water body; and will apply unless replaced by a site-specific delineation of the riparian area.
> >
> > (B) Plan components must ensure that no management practices causing detrimental changes in water temperature or chemical composition, blockages of water courses, or deposits of sediment that seriously and adversely affect water conditions or fish habitat shall be permitted within the riparian management zones or the site-specific delineated riparian areas.

To maintain the ecological integrity of riparian areas, the plan must include plan components, including standards or guidelines, designed to maintain, restore, or promote riparian areas. This provision does not prohibit projects that may have short-term adverse effects to water conditions and fish habitat, but that will maintain or restore structure, function, composition, and connectivity of riparian areas over the long term.

Riparian areas are important elements of watersheds that provide critical transition zones linking terrestrial and aquatic ecosystems. Restoration of riparian areas may be accomplished through passive management or may require active management particularly in areas where natural disturbances such as fire or flooding have been prevented from occurring.

The terms ephemeral stream, intermittent stream, perennial stream, riparian area, and riparian management zone as defined in FSH 1909.12, zero code, section 05 are:

- Ephemeral stream. A stream that flows only in direct response to precipitation in the immediate locality (watershed or catchment basin), and whose channel is at all other times above the zone of saturation.

- Intermittent stream. A stream or reach of stream channel that flows, in its natural condition, only during certain times of the year or in several years, and is characterized by interspersed, permanent surface water areas containing aquatic flora and fauna adapted to the relatively harsh environmental conditions found in these types of environments. Intermittent streams are identified as dashed blue lines on USGS 7 1/2-inch quadrangle maps.

- Perennial stream. A stream or reach of a channel that flows continuously or nearly so throughout the year and whose upper surface is generally lower than the top of the zone of saturation in areas adjacent to the stream. These streams are identified as solid blue on the USGS 7 1/2-inch quadrangle maps.

- Riparian Areas. Three-dimensional ecotones [the transition zone between two adjoining communities] of interaction that include terrestrial and aquatic ecosystems that extend down into the groundwater, up above the canopy, outward across the floodplain, up the near-slopes that drain to the water, laterally into the terrestrial ecosystem, and along the water course at variable widths (36 CFR 219.19).

- Riparian management zone. Portions of a watershed where riparian-dependent resources receive primary emphasis, and for which plans include plan components to maintain or restore riparian functions and ecological functions (36 CFR 219.19).

The National Core Best Management Practices (BMP) Technical Guide (USDA Forest Service 2012a) refers to riparian management zones as aquatic management zones. The technical guide discusses designation of the riparian management zone under the national core best management practice "Plan-3 Aquatic Management Zone Planning." The Agency uses the technical guide to carry out the requirements for the national best management practices for water quality (FSM 2526). As discussed in section 23.12c of this Handbook, plan components must ensure implementation of the best management practices.

Sections 23.1–23.12c of this Handbook give direction on plan components related to maintaining or restoring the ecological integrity of all ecosystems including riparian ecosystems (riparian areas).

The plan must establish widths for riparian management zones for all lakes, perennial and intermittent streams, and open water wetlands (36 CFR 219.8(a)(3)(ii)) so employees know where the plan components for ecological integrity of riparian areas apply.

Riparian management zones must include the riparian area.

1. When establishing riparian management zones, the Interdisciplinary Team should consider:

a. Available information on the location and extent of surface waterbodies, springs, wetlands, vegetation, soils, geomorphology, topography, and other relevant information.
b. Soil and vegetation indicators of riparian areas that include regionally distinctive riparian soils and vegetation, or the soil potential to support regionally distinctive vegetation.
c. Fluvial geomorphic indicators of riparian areas such as break in slope or evidence of fluvial deposition.
d. The 100-year recurrence interval flood stage. The water surface elevation corresponding to the 100-year recurrence interval flood may be preferable to some standard distance from the stream channel (for example, a 100-foot buffer) because a set distance may overestimate actual riparian widths along small streams and underestimate the extent of riparian vegetation along larger rivers.
e. Existing site-specific riparian area delineations, if available (FSH 1909.12, ch. 10, section 12.14d).
f. The effects of climate change on stream flows that may affect the size of riparian management zones.

2. When establishing widths for riparian management zones as require by the Rule, and in areas where available information on the distribution of riparian dependent resources within the plan area is too limited to determine appropriate riparian management zone dimensions, the Interdisciplinary Team should consider the following when establishing widths:

a. Establishing a default distance from the edge of all lakes, perennial streams, intermittent streams, and open water wetlands, such as the ordinary high water mark or bankfull flow, for the riparian management zone.
b. Giving special attention to the first 100 feet from the edges of all perennial streams, lakes, and other bodies of permanent surface water containing aquatic flora and fauna or supporting substantial riparian vegetation. In other words, plan components for riparian management zones should be developed to maintain, improve, or restore the condition of the land around and next to waterbodies in the context of the environment in which they are located, recognizing their unique values and importance to watersheds while providing for multiple uses on National Forest System lands.

c. Giving attention to dry washes or channels with minimal or no riparian vegetation that support riparian vegetation downstream due to subsurface flow through the stream channel or adjacent alluvial sediments.

3. When developing plan components for ecological integrity of riparian areas, the Interdisciplinary Team should:

a. Design plan components that constrain projects and activities to comply with requirements of the Planning Rule not to cause detrimental changes to water resources that "seriously and adversely affect water conditions or fish habitat" (36 CFR 219.8(a)(3)(ii)(B)). This provision does not prohibit projects that may have short-term adverse effects to water conditions and fish habitat, but that will maintain or restore structure, function, composition, and connectivity of riparian areas over the long term.

b. Consider designing plan components for restoring processes that support desirable riparian integrity including allowing roots of plants access to groundwater.

c. Consider designing plan components that provide for passive management or active management. An example of passive management is restoring elements of flow regimes, such as environmental flows and levels, by restricting a destructive activity. Examples of active management include recontouring roads or mechanically removing structures or vegetation. Active management may be appropriate in areas if past management has prevented natural disturbances (such as fire or flooding), or if past projects and activities have altered riparian functions (such as where roads are located within riparian areas).

For guidance on delineating site-specific riparian areas associated with streams and rivers, see the guidelines in the National Riparian Vegetation Monitoring Technical Guide (Forest Service 2012b) or other Agency supported guidance. For guidance on delineating site-specific riparian areas for non-fluvial or palustrine areas (associated with wetlands, lakes and other standing bodies of water), see the U.S. Army Corps of Engineers wetland delineation manuals for the region of interest, available at http://el.erdc.usace.army.mil/wetlands/wlpubs.html.

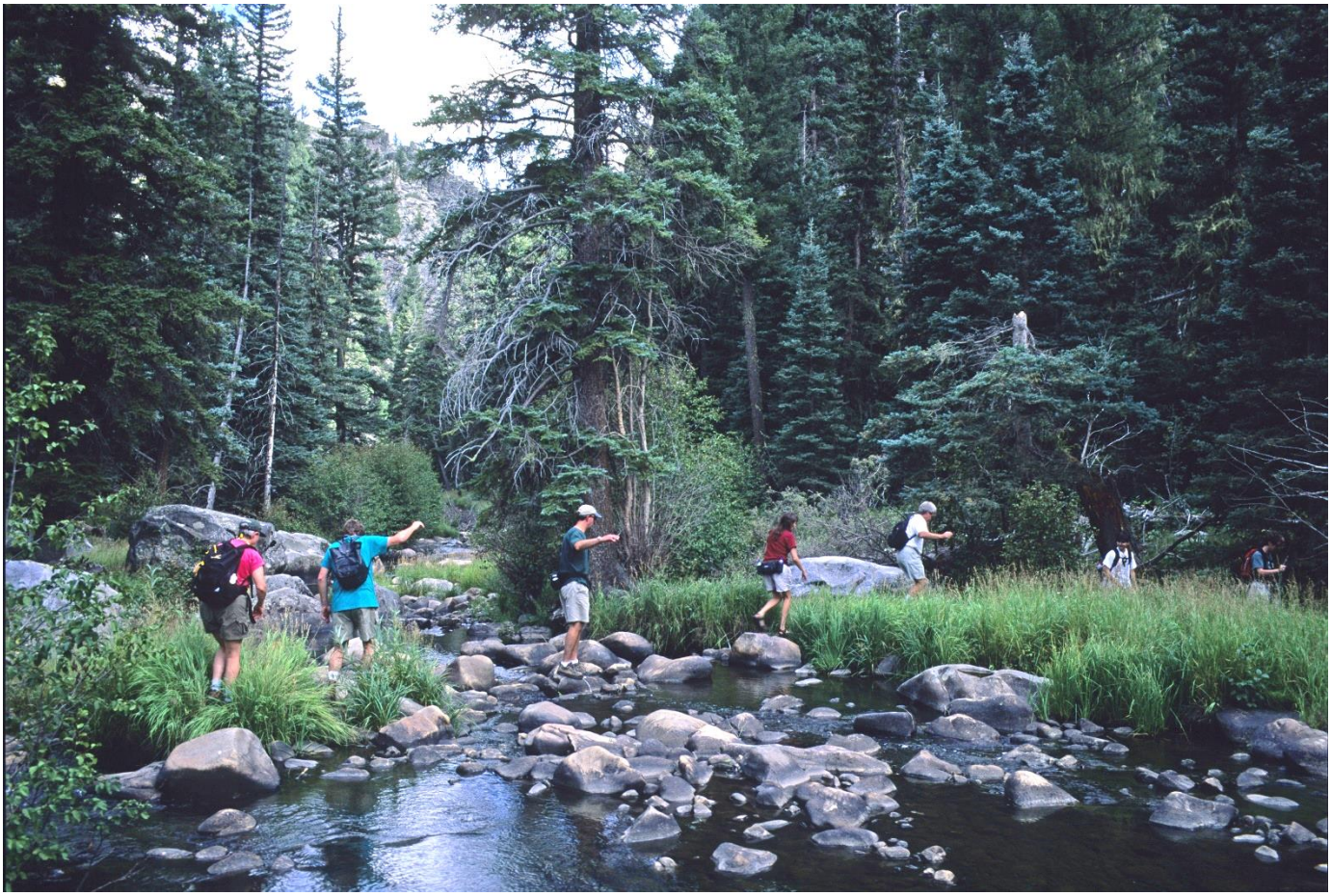
Forest Plan Standards and Guides

See individual Forest Plans for Standards and Guides

The Revised plans for the five Arizona 1982 rule revisions, all of which contain plan components related to water and soils can be found at the locations listed below:

- Kaibab Final Revised Plan: http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd517406.pdf
- Prescott Final Revised Plan: http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd517447.pdf
- A-S Final Revised Plan: https://fs.usda.gov/Internet/FSE_DOCUMENTS/stelprd3851851.pdf

- Coronado Draft Revised Plan: http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5439740.pdf
- Coconino Proposed Revised Final Plan: http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd501594.pdf
- Forest Plan revisions are underway for the remaining forests in the region. Standards and Guides will be developed through the planning processes on these forests.



Rio Vallecitos, Carson National Forest, New Mexico