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Riparian and Aquatic Ecosystem Strategy

Southwestern Region of the Forest Service

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Cover Photo – West Fork of Oak Creek Canyon, Coconino National Forest, Arizona. Photo by: Brady Smith (USFS)

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ACRONYMS

AqS	Aquatic Surveys
ARI	Aquatic Riparian Inventory
BMPs	Best Management Practices
CCVA	Climate Change Vulnerability Assessment
CFR	Code of Federal Regulations
CSUN	California State University Northridge
ERU	Ecological Response Units
ESA	Endangered Species Act
FSH	Forest Service Handbook
FSM	Forest Service Manual
GIS	Geographic Information System
HU	Hydrologic Unit
HUC	Hydrologic Unit Code
INFRA	Infrastructure database
NEPA	National Environmental Policy Act
NFS	National Forest System
NHD	National Hydrography Database
OCE	Regional Office of Communication and Engagement
R3	Region 3 of the USDA Forest Service, the Southwestern Region
RAES	Riparian and Aquatic Ecosystem Strategy
REV	Riparian Existing Vegetation
RLT	Regional Leadership Team
RMAP	Regional Riparian Mapping Project
RO	Regional Office
RSAC	Remote Sensing Applications Center
TEUI	Terrestrial Ecological Unit Inventory
USDA	United States Department of Agriculture
USGS	United States Geological Survey
WCATT	Watershed Classification and Assessment Tracking Tool
WCC	Watershed Condition Classification
WCF	Watershed Condition Framework
WFWARP	Wildlife, Fish, Water, and Air Resources Program
WIT	Watershed Improvement Tracking database
WO	Washington Office
WRAP	Watershed Restoration Action Plans
WRU	Water Rights and Uses

INTRODUCTION

The eleven National Forests and four National Grasslands in the Southwestern Region of the USDA 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 acres, or about two percent of National Forest System (NFS) lands in the Southwestern Region. These riparian and aquatic zones (see Appendix A) are among the most diverse of our landscapes, harboring higher plant, bird, insect, reptile-amphibian, fish, and mammal biodiversity than most ecosystems. In the arid Southwest, riparian areas offer a multitude of benefits and ecosystem services that are disproportionate relative to the small area they occupy (Covish et al. 2004; Giller et al. 2004; Naiman and Décamps 1997; NRC 2002, 2004).

The ecological integrity of riparian areas has been affected by numerous stressors, with the percent of riparian areas in the United States degraded by human impacts estimated to be as high as 90 percent (Zaimes et al. 2007). Between 30 and 50 percent of Southwestern wetlands have been lost outright (Mitch and Gosselink 1993). Stressors to riparian and aquatic systems include dams, diversions, groundwater pumping, non-native and invasive species, channelization, ditches, dikes, conversion to agricultural uses, urbanization, grazing, roads, fires, post-fire flooding, mining, fuel wood gathering, and logging. Continued population growth, associated recreational use, and climate change put additional disturbance pressure on already impacted areas. Many of these stressors result in altered flow regimes that disrupt the connection between the stream and its floodplain (USDA Forest Service 2020). These factors have resulted in plant and animal species declines and increased federal listings under the Endangered Species Act (ESA). Of the 55 threatened, endangered, proposed, or candidate species in the Southwestern Region, 29 are riparian or aquatic obligates with an additional five species significantly benefiting from these habitats (ECOS 2016).

As stewards of headwater systems, the Southwestern Region has developed this comprehensive strategy for management of riparian and aquatic ecosystems on NFS lands. The fundamental purpose of the Riparian and Aquatic Ecosystem Strategy (RAES) is to ensure the ecological integrity of riparian and aquatic ecosystems is maintained or restored by implementing actions to achieve desired conditions (USDA Forest Service 2020) Conservation of riparian and aquatic natural resources ensures continued physical, cultural, social, and economic benefits, as well as resilient ecosystems for future generations. In no other ecosystem can we as an agency have a greater impact in "*Caring for the land and serving people.*"

For more information on the Southwestern Region's Riparian and Aquatic Ecosystem Strategy, including access to the full document and appendices, please visit https://www.fs.usda.gov/detail/r3/landmanagement/resourcemanagement/?cid=fseprd601133.

Forest Service policies (see Appendix B) related to riparian and aquatic ecosystems are directed by several foundational laws:

The Organic Administration Act of 1897 under which most national forests were established, states: "No national forest shall be established, except to improve and protect the forest within the boundaries, or for the purpose of **securing favorable conditions of water flows**, and to furnish a continuous supply of timber for the use and necessities of citizens of the United States…"

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 Endangered Species Act requires protection of federally-listed species and their habitat, many of which are dependent on riparian or aquatic areas.

Challenges

NFS lands in the Southwestern Region comprise the majority of headwaters that provide water to ever-expanding urban centers as well as rural communities in Arizona and New Mexico. 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 of this region's high-value riparian and aquatic ecosystems (See Appendix C).

Challenges internal to our organization include the amount of workforce resources dedicated to riparian and aquatic ecosystems. Despite a wealth of data (see Appendix D), there are evident gaps in information, especially for aquatic systems. Integration and communication among program areas is not specifically focused on the enhancement and management of these ecosystem types.

There are also many external challenges to managing riparian and aquatic ecosystems. These include direct physical impacts such as water developments, impoundments, diversions, withdrawals, water rights claims (including groundwater pumping) and absence of regulation. As there are differing views on the connection between surface water and ground water, it is not cohesively addressed. The above issues are complicated by the effects of population growth and increased urbanization, resulting in increased recreational use of NFS lands and increased demand for water, both of which could threaten riparian areas.

Some effects from external forces can be managed and some cannot. Climate change is anticipated to result in warmer and drier conditions with less water to support riparian and aquatic ecosystems (Gutzler 2013). Invasive species (both non-native aquatic species and non-native plants) often have devastating effects on riparian and aquatic ecosystems. These negative impacts can include predation on native species or competition for water, nutrients, and sunlight.

Opportunities

Although the challenges are many, internal and external opportunities are also present. A wide range of expert knowledge exists within the Forest Service, 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 maintaining and restoring functioning riparian and aquatic ecosystems.

A shared sense of responsibility connects communities and enhances education, conservation, and motivation to work with the Forest Service to responsibly manage riparian and aquatic ecosystems. Existing authorities including the Good Neighbor and Secure Rural Schools authorities can be used to leverage partnerships for this effort. These authorities support partnerships and joint funding for projects that will restore, improve, or sustain riparian and aquatic ecosystems in the Southwest.

The recently implemented Forest Service "Shared Stewardship" initiative provides a framework for cross-boundary prioritization of investments to manage riparian and aquatic ecosystems. This framework provides a platform for collaboration among public and private land management entities. While the focus of this initiative was initially on wildland fire management, the scope has since expanded to include aquatic and riparian restoration, particularly in the Southwestern Region. Riparian systems span land ownerships and land tenures, and their conditions in any particular stream reach are highly dependent on natural and management disturbances upstream.

Need for a Strategy

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 NFS lands. 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. A strategic approach seeks to yield management that is cohesive and produces the level of work necessary to preserve and improve the riparian and aquatic resources in the region.

In addition to inherent stressors (dams, channelization, conversion, grazing, roads, upland fires, post-fire and other periodic floods, recreational uses, climate change, drought, undesirable non-native species, etc.), the region is facing a number of other issues that emphasize the need to focus on management, protection, and restoration of riparian and aquatic ecosystems. Other factors to consider include:

- Groundwater stewardship: There is increasing demand for groundwater, which 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: A comprehensive and integrated riparian area management strategy is needed as responsibilities for managing specific aspects of riparian and aquatic ecosystems are distributed among distinct functional areas in the Regional Office (RO) and regional forest staffs.

- Partnerships: Many current or potential partners are interested in riparian area management. The Southwestern 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.

STRATEGIC FRAMEWORK

The RAES is built on a framework for managing riparian and aquatic ecosystems collaboratively with interdisciplinary Forest Service staff and external partners (local, state and federal agencies, non-governmental organizations, tribes, universities, etc.). An integrated, coordinated approach will provide for effective collaboration and capitalize on diverse resources and values contributed by partners. Freedom to work in innovative ways will lead to improved understanding of riparian and aquatic ecosystems, increased capacity for adaptive management, and cooperative restoration beyond what can be accomplished by the Forest Service alone.

The strategy contains seven goals and seven objectives. Goals are vision statements that inform objectives. Each objective contains multiple actions, providing a long-term framework to address current and future challenges. A core action plan identifies a subset of actions to guide the current program of work and is updated as goals are accomplished. The goals, objectives, and actions contained in this strategy will better enable the Forest Service to complete 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.

Goals

Agency

- Forest Service staff is informed of and able to communicate the extent, condition, impacts, and dynamics of riparian and aquatic ecosystems existing throughout the Southwestern Region. Forest Service staff employ knowledge to continually adapt management of riparian and aquatic ecosystems to realize the goals and objectives of this strategy.

Aquatic and Riparian Ecosystem Services

- Dynamic ecosystems are capable of filtering sediment, capturing bedload, aiding floodplain development, improving floodwater retention, improving groundwater recharge, and improving or maintaining water quality.
- Protected water quantity and instream flows provide for recreational uses, water for wildlife and domestic livestock on and off NFS lands, and for downstream uses such as agriculture and municipal use.
- Protected water quantity and instream flows provide habitat for diverse populations of aquatic and riparian species.

Riparian Areas

- Areas exhibit a high degree of connectivity along streams, laterally across 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.
- Riparian systems provide the composition and structure to filter sediments, build and stabilize banks, balance the potential negative influence of flooding, store and safely release water, and recharge aquifers.
- Riparian areas buffer waterways against excessive runoff from upland activities, whether natural or human induced, which can degrade water quality.
- High severity fire in riparian and wetland areas is infrequent and patchy. Riparian corridors are resilient and able to recover following fire.

Aquatic Habitats

- Habitat conditions contribute to survival and recovery of riparian and aquatic species, allow for repatriation of extirpated species, contribute to the delisting of listed species, preclude the need for listing new species, and maintain native species.
- Aquatic areas provide a diversity of interconnected habitats that support life phases of aquatic species and 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, drier, and more variable 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.

Water Quality and Quantity

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

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.

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 non-native species.
- Wetlands control flooding, improve water quality, and serve as areas of groundwater recharge.

Objectives

Collect and utilize quality information to support project work, including inventory, monitoring, and assessments

Short-Term Actions:

- 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.
- Compile a geographic information system (GIS) and tabular dataset with all federally listed plant and animal species and designated critical habitats. Where data exists, include any other species with special status (e.g., positive 90-d findings, Regional Forester's Sensitive Species List, Species of Conservation Concern, etc.).
- Complete collection and verification of information to update Water Rights and Uses (WRU) database for the Southwestern Region.
- 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 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 critical habitat.

Long-Term Actions:

- 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, withdrawals, pumping, and impoundments. Prepare a geodatabase 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.
- Identify reference areas throughout the region that can be used for informing desired conditions and as a baseline for project effectiveness monitoring.

Prioritize work in riparian and aquatic ecosystems that reflect the greatest need for restoration

Short-Term Actions:

- Elevate the selection criteria for funding proposals to those that 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 ranger district through interdisciplinary teams and with involvement of local partners and stakeholders.
- Cross-reference Watershed Condition Framework (WCF) and other assessments of condition with areas that have listed riparian and aquatic obligate species and critical habitat. Prioritize work in watersheds with Watershed Restoration Action Plans (WRAP) to leverage restoration and ESA goals for these species and habitats.
- Evaluate Forest Five-Year Restoration Plans and prioritize riparian projects.

Long-Term Actions:

- Identify a subset of riparian and aquatic systems within the region that are most in need of restoration.
- Identify streams in Arizona that would benefit from instream flow water right protection.
- Identify opportunities in New Mexico where potential for conservation agreements exist.

Set performance and accountability expectations

Short-Term Actions:

- 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 Actions:

- Assess the short-term objectives by forest every 5-10 years 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.

Provide training to staff and partners across disciplines

Short-Term Actions:

- Build local capacity in restoration using internal and external expertise.
    - Offer training on restoration and capture lessons learned. Host experts such as the Washington Office (WO) and National Stream and Aquatic Ecology Center.
    - Continue to provide training opportunities related to riparian and aquatic subjects such as Aquatic Organism Passage and database training for applications such as Aquatic Surveys (AqS), Best Management Practices (BMPs), Watershed Improvement Tracking database (WIT), Watershed Classification and Assessment Tracking Tool (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.
    - Provide incentives and funding for employees to take training above what is typically provided at the forest level.

Long-Term Actions:

- 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.

Integrate work across disciplines at multiple levels

Short-Term Actions:

- Coordinate with WO to advance national initiatives.
- Engage with Rangeland Management and Vegetation Ecology staff regarding Riparian National Inventory.
- 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, Infrastructure database (INFRA), WIT, and WCATT.
- Region provides functional assistance to Forests.
- Integrate RAES in Regional Range, Wildlife, Forest Health, Fire, Recreation, Engineering, Watershed meetings.
- Continue to integrate and coordinate project work with recreation staff.

Long-Term Actions:

- Structure the workforce to more effectively manage riparian and aquatic ecosystems. For example, a program leader position could be created at the Regional Office (RO) whose primary mission is leadership of the program and implementation of the RAES.

Work with partners within and across Forest Service boundaries

Short-Term Actions:

- Regional Forester encourages partners to work with Forest Service through the RAES.
- Actively engage and continue to inform the Regional Partnership Database project, ensuring that the database reflects all RAES partners, not only those related to restoration.
- Develop Partnership Agreements and Indefinite Delivery Indefinite Quantity 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 as a source of ideas to build partnerships in riparian and aquatic ecosystem restoration.

Long-Term Actions:

- Maintain, integrate, and communicate the partnership database.
- Participate with regional partnerships team and Government Liaison to increase potential partnerships.

Communicate the value and benefits of riparian and aquatic ecosystems

Short-Term Actions:

- 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 (OCE) to share 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 Actions:

- Develop an education/outreach curriculum regarding riparian values, ecology, function, ecological services, management, inventory, and monitoring.

IMPLEMENTING THE STRATEGY

We have described the need and framework for the Riparian and Aquatic Ecosystem Strategy. Now we will describe the most important part; implementation of the strategy to realize positive results and improve riparian and aquatic ecosystems across the Southwestern Region. As we implement the strategy, it is useful and informative to frame the work in the context of Forest Service values of safety, diversity, interdependency, service and conservation.

Safety: Healthy riparian and aquatic systems create safe environments and promote long-term resilience for people, plants, animals and fish.

Diversity: We listen and adapt to the ever-changing communities we serve. We recognize that you never step in the same stream twice (Heraclitus).

Interdependency: Nothing exists in isolation; we are all neighbors. Our actions (or inactions) have impacts.

Service: We strive for beneficial solutions, produce scientific information, and convene and facilitate collaborations to get the right work done in riparian and aquatic ecosystems.

Conservation: We are the stewards of headwaters, natural water systems and dependent riparian and aquatic ecosystems, as well as traditional and new ways of life.

The goals and objectives outlined in this strategy provide a well-informed basis for taking action and for enrolling others in shared management. Because successful strategies are dynamic, periodic review to identify accomplishments and recognize changing priorities will be critical. What follows is an Action Plan that the Region started implementing in 2016.

Action Plan

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, tribal governments, other federal agencies, nongovernmental organizations, private landowners, water users, the private sector, and others to implement these highest priority actions. Progress toward realizing these actions will be shared with Forest Service leadership, cooperators, and partners. As actions are realized and capacity is available, the objectives will be reviewed, and new actions will be prioritized.

Build Shared Expectations with Regional Leadership and Our Partners

Actions:

- Set clear expectations and accountability for management of these riparian and aquatic systems (USDA Forest Service 2020).
- 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.
- Build a framework for collaborative restoration opportunities in prioritization as part of shared stewardship.

Identify, Integrate, and Implement 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 as well as other emerging technology to work in an integrated fashion within NFS lands and with partners to identify priority projects most need of riparian and aquatic stewardship to restore or maintain habitat.
- Direct resources (budget, workforce, training, etc.) to support high priority riparian and aquatic restoration projects identified at the regional level using objective criteria.
- Foster a shared commitment to sound riparian and aquatic habitat management, including areas not prioritized for immediate restoration treatments.
- Use new tools for scenario planning to prioritize riparian restoration activities both within national forests and upstream land ownerships.

Monitor Riparian and Aquatic Systems and Improve Data Quality to Inform our Work

Actions:

- Implement actions that will result in "desired conditions" for riparian and aquatic systems, founded on site potential (geomorphology, hydrologic regime, soil characteristics, vegetation types, etc.) and based on the best available science to better inform management of riparian and aquatic systems (USDA Forest Service 2020).
- Maintain and enhance Forest Service staff knowledge and expertise in the management and restoration of riparian and aquatic systems. This includes providing training, sharing information, 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 of these systems over time.
- Establish clear, concrete goals for a monitoring plan associated with each project that includes monitoring and reporting for BMPs, INFRA, WIT, and WCATT databases.
- Provide guidance for the best management of streams and riparian and aquatic areas in preparation for drought and future climate (USDA Forest Service 2020).
- Investigate evolving technologies relevant to riparian and aquatic management and monitoring.

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 lands to participate in or manage collaborative projects.
- Enlist OCE 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.
- Work with the WO of the Forest Service to build the shared stewardship component to riparian restoration.

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Photos: Volunteers on the Rio Cebolla: Beaver Dam Analog (BDA) installation, Santa Fe National Forest.

Photo: Youth on the Rio Vallecitos, Carson National Forest, New Mexico

APPENDICES

Appendix A. 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 (NRC 2002).

Riparian Areas

What follows is a broad description and definition of riparian within the context of the Southwestern Region RAES that follows direction from the Forest Service Manual (FSM 2526), Southwestern Region Riparian Area Handbook (FSH 2509.23), and the National Riparian Protocols. It excludes stringers of robust upland vegetation that are taller or denser than surrounding upland vegetation; and it is consistent with the regional Riparian Mapping Project (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 Southwestern Region RAES 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 Southwestern Region 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, Southwestern Region 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 B. 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), Executive Orders, the Forest Service Manual (FSM), the Forest Service Handbook (FSH), and 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) BMPs for Water Quality. The Chief shall establish requirements for national BMPs 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 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 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) opportunities 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.

    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.

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

4. 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, NRV, resilience, restoration–ecological, restoration– functional, stressors, and sustainability. (FSH 1909.12, zero code, section 05).

5. 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.

6. 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.

7. Not all natural resource management activities are required to include restoration, and not all NFS 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.

8. 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, NFS

The Associate Deputy Chief for Resources, NFS, has the responsibility to:

1. Provide national policy, objectives, guidelines, and minimum standards for protection and improvement of riparian areas on NFS 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, "Land Management Plan"

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 U.S. Geological Survey (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 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 BMP "Plan-3 Aquatic Management Zone Planning." The Agency uses the technical guide to carry out the requirements for the national

BMPs for water quality (FSM 2526). As discussed in section 23.12c of this Handbook, plan components must ensure implementation of the BMPs.

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 NFS 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.

Appendix C. 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 support riparian management. (See Appendix B)

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, with limited staff dedicated to riparian and aquatic ecosystems.
- There are problems with corporate databases. Valuable information and analytical tools are underused due to a lack of the knowledge and skills needed to work with these databases.
- There is a real or perceived lack of administration of existing policies to protect riparian and aquatic ecosystems.
- Opportunities to attend training are lacking or knowledge of training is missing.
- 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 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.
- Existing authorities, such as the Farm Bill, Good Neighbor, and Secure Rural Schools, can be used to leverage partnerships for this effort.
- Good examples exist of partnerships that have successfully 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 New Mexico Forests with partners) to focus attention and resources on riparian / aquatic systems.
- Existing public messages, such as the Forests to Faucets or National Forest Foundation & 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 lands 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 non-native aquatic species and non-native plants, often have devastating effects on riparian and aquatic ecosystems including predation on native species, and competition for water, nutrients and sunlight.

Appendix D. Current Regionwide Data Collection and Monitoring

Terrestrial Ecological Unit Inventory of Riparian and Aquatic Ecosystems

The TEUI 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 is 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 held within the soil over space and time and the resulting vegetation that grows upon the wet or moist soil. Geology and geomorphic processes 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 region's NFS lands. 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, National Hydrography Dataset (NHD), Ecological Response Units (ERU) mapping, and the ARI. RMAP was developed with several key data sources including TEUI, Remote Sensing Applications Center (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 ERUs 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 region's NFS lands 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 as it provides 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 information on current condition for compliance, environmental assessment, effects analysis, and decision making to address other Southwestern Region needs. 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—ARI

The ARI represents an efficient mid-level approach to the systematic and quantitative inventory and monitoring of riparian and stream resources in the region. 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 National Forests was conducted as an inexpensive proof-of-concept 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 National Forests, Regional Office GIS unit, Photo Science Inc., Regional Office Ecosystem, Planning & Analysis/ Watershed, Soil & Air Program, Regional Office Wildlife, and Natural Heritage New Mexico/University of New Mexico. Based on successes of the Prescott-Cibola pilot, ARI has been extended to an additional 550 samples on four national forests in FY17 and FY18.

Southwestern Region Climate Change Vulnerability Assessment—CCVA

The CCVA is an all-lands assessment for major upland systems of Arizona and New Mexico, representing the potential vulnerability of Southwestern 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://www.fs.usda.gov/treesearch/pubs/54501).

Watershed Condition Framework—WCF

The WCF 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 Forest Service 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 lands 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 ongoing 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 RO GIS/Photogrammetry staff and the Ecosystem, Planning & Analysis/ Watershed, Soil & Air staff recently worked with the Center for Geographical Studies at California State University Northridge (CSUN) to update the existing NHD for the national forests and grasslands in the Southwestern Region.

The NHD is the water dataset used in Forest Service applications including: AqS, BMP monitoring, Fire Retardant Avoidance Maps, WIT, WCF, WCATT, and WRU on which all spatial planning and reporting of accomplishments are documented. It is also used for forest/project planning, NEPA assessments, and the Southwestern Region RAES. 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, state agencies and other partners. Having a consistent dataset enhances collaboration and our ability to coordinate and work together. The 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, identification of stream types (perennial, intermittent, and ephemeral), corrections to stream names and connectivity.

CSUN was working with USGS and other organizations (The Desert Landscape Conservation Center, National Park Service, etc.) to complete a comprehensive spatial data update to the NHD watersheds in the Southwestern United States. These updates were occurring adjacent to NFS lands, and therefore partnering with CSUN to complete spatial data updates on NFS lands was in line with the priority NHD updates proposed for the Southwestern Region, as recommended in the NHD Assessment Report prepared by Critigen Inc. in 2015.

CSUN updated the NHD coverages for all national forests and national grasslands in the Southwestern Region except for the Gila NF. The Gila NF had previously updated the NHD for their forest using internal resources. Funding for the region-wide NHD assessment by Critigen Inc. and NHD forest updates by CSUN was provided by Regional Leadership Team (RLT) commitments. The funding supported Southwestern Region forest staffs that participated in the on-forest review process of the NHD updates made by CSUN. It also funded CSUN staff that did the final editing of the NHD coverages and submittal of the completed updates to the USGS for posting on their internet servers. NHD coverages on USGS website are publicly available.

Water Rights and Uses Database (WRU)

The WRU database is the mandatory repository for data associated with water rights and uses on NFS lands, 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 and/or state law, as well as water use inventories. The database facilitates keeping the agency 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 wherever they are located. 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 adjudication or litigation.

The RLT, acknowledging the importance of having an up-to-date WRU database, has provided off-the-top funding for forests to expedite collection, input, and verification of data in WRU. In FY19 the formation of a three-person Water Rights Team was approved by the RLT. This team will assist forests in collecting, verifying, and inputting into WRU all information found that documents the initial and continued use of waters on national forests and grasslands in the Southwestern Region.