Angeles National Forest
Copper, Ranch, and Sayre Fires Restoration Strategy

The Angeles National Forest and National Fish and Wildlife Foundation Partnership

In 2016, the National Fish and Wildlife Foundation (NFWF) undertook a cooperative partnership with the U.S. Forest Service – Region 5 and the Angeles National Forest (ANF) to address the impacts of the Copper, Ranch, and Sayre Fires in a holistic way that will lead to compounded benefits for the impacted landscapes and watersheds. For this partnership, the Forest Service dedicated approximately $17 million for planning and restoration projects in the lands burned and affected by the Copper, Ranch, and Sayre fires.

The Restoration Strategy serves as the guiding document to aid the ANF and its partners in focusing, and ultimately implementing, projects that advance post-fire restoration in an ecologically meaningful and measurable way. The Restoration Strategy outlines the goals and objectives of the ANF for the fire restoration work, and highlights potential actions toward reaching those goals. Focus areas described within this document will be targeted in the initial phases of restoration; however projects outside of these areas may be considered depending on their alignment with the strategic goals of the program. Refinements to the Conservation Strategy may be completed as additional information is gathered and project success is evaluated.

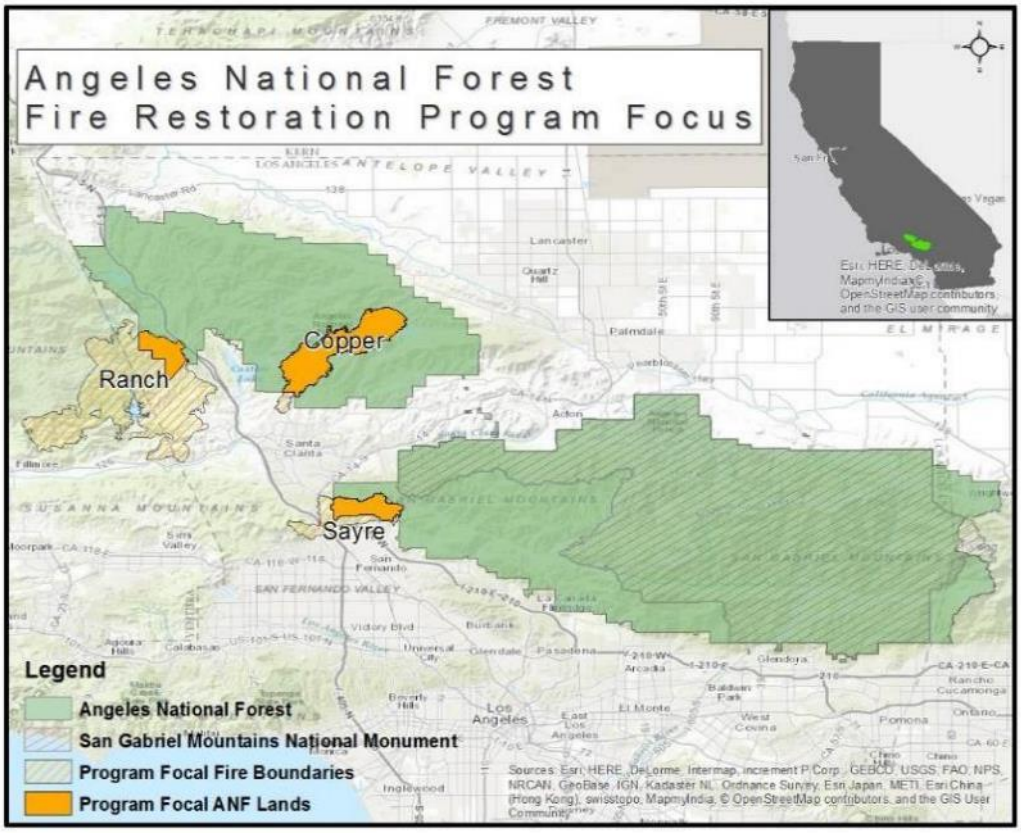

Figure 1. Angeles National Forest and the three focal fires for this program

Significance of the Angeles National Forest

The Angeles National Forest serves as the picturesque backdrop for one of the country's largest and most diverse urban centers, providing access to approximately 700,000 acres of open space in the greater Los Angeles metropolitan area. Each year, the ANF hosts over 3.5 million visitors, giving them the opportunity to explore a variety of landscapes including chaparral, oak thickets, high desert, pine woods, steep and rugged mountains, and numerous lakes, streams, and rivers. The first national forest in California, the ANF is located within one of the world's vital biodiversity hot spots, and contains many natural and cultural resources unique to Southern California. It is home to a variety of wildlife, including the California condor, spotted owl, bighorn sheep, and numerous threatened and endangered species. The watersheds of the ANF support the natural environments within the boundaries of the Forest and are also the source of one-third of Los Angeles's drinking water, and the eighteen dams and debris basins support a massive flood control system to protect and provide for the millions of people that live downstream.

Wildfire and the National Forests

Wildfire may be the biggest challenge that forest managers and the public will face over the next couple of decades (USDA 2005). The national forests of Southern California occur within a Mediterranean climate; one of the driest, most fire prone areas in the United States. Periodic wildfire is a natural and important part of the ecological processes of the region. The threat of unnatural, catastrophic wildfire, however, have been increased by decades of fire suppression activities, recent droughts and insect infestations, and the challenges from increased human ignitions associated with population growth and increasing use of the forest. Although the ecosystems of Southern California have evolved to be well adapted to fire, the stressors associated with recent increases in frequency and intensity of fires have resulted in long-term losses in habitat, ecosystem transitions, changes in hydrology and associated effects to sediment and nutrient fate and transport, and opportunities for invasive species to take hold and spread. In addition, urban communities adjacent to national forest boundaries share the risks of wildfire, and forest managers are challenged to provide safe environments for those within and adjacent to the forest. In California, 10 of the state's largest 20 wildfires have occurred within the last 10 years.

Copper Fire

In 2002, the Copper Fire, occurring predominantly within the San Francisquito watershed, burned approximately 20,000 acres of coastal sage scrub, montane chaparral, grasslands, and riparian corridor, as well as isolated big cone Douglas-fir stands. The intense nature of the fires, coupled with the steep terrain and highly erosive soils of the watershed, resulted in loss of vegetative cover and significant sediment loading to San Francisquito Creek, which in turn resulted in particularly acute impacts to two endangered aquatic species: the unarmored three-spine stickleback and the California red-legged frog. In addition, the loss of vegetation significantly exacerbated encroachment of invasive vegetation throughout the watershed, and facilitated an increase in illegal and damaging off-route OHV use. The Copper Fire also notably reduced the population of an endangered plant, the Nevin's barberry, among other rare and threatened native plant species on the Forest.

Along with the natural resources, the Copper Fire affected infrastructure important to the Los Angeles urban area, including power transmission lines for Los Angeles Department of Water and Power and

Southern California Edison, a portion of the Los Angeles aqueduct, and lands that drain to Bouquet Reservoir, a source of drinking water for Los Angeles. Many cultural and historical heritage sites were also affected, including the site of the St. Francis Dam failure, a proposed national memorial site.

The impacts from the Copper Fire continued well after the initial event, as heavy rains and flooding occurring in 2005 and 2006 were exacerbated by the loss of vegetation that resulted from the Copper Fire and led to significant erosion, sediment loading to San Francisquito Creek and critical California red-legged frog habitat, and damages to the road and road crossings that parallel San Francisquito Creek through portions of the watershed.

Ranch Fire

The Ranch Fire originated on the western portions of the Angeles National Forest in the fall of 2007. Over two weeks, it burned over 58,000 acres across two National Forests, with 13,000 acres burned on the ANF in the Piru Creek and Lake Piru watersheds. The vegetation types burned on ANF land were predominantly sagebrush, annual grassland, and chaparral, with smaller stands of oak woodlands.

Fire frequency within some areas of the Ranch fire footprint have been extremely high, with three large fires, the Wolf (2002), Piru (2003), and Day (2006) occurring within 5 years prior to the Ranch fire. The impacts from these recurring fires have resulted in a significant loss of native vegetation regrowth and soil stability, and exacerbated the encroachment and establishment of both non-native grasses and noxious weeds on the landscape and invasive species within aquatic environments such as Piru Creek. Road, trail, and communications infrastructure were also affected, which have continued to provide a source of sediment, and a conduit for the introduction and spread of non-native plants.

The watersheds impacted by the Ranch Fire are also known to provide habitat for the endangered arroyo toad, for which post-fire erosion and sediment loading has altered riparian, wetland, and in-stream habitat. Additionally, the Piru Creek watershed provides nesting and foraging habitat for the California condor, and microtrash concerns persist in these areas.

Sayre Fire

In November 2008, the Sayre Fire consumed approximately 95% of all vegetative cover across roughly 5500 acres of the ANF. The Bull Creek and Lower Pacoima watersheds were the most predominantly affected watersheds on USFS land, with some effects extending to the South Fork Santa Clara River watershed. The impacts from the Sayre Fire are consistent with the consequences of fire in the steep, chaparral covered environments of much of the ANF; the most significant are increased sediment from mass-wasting and erosion, the conversion of native vegetation communities to non-native grasses and noxious weeds, and the amplified threats of off-trail use by OHVs and other users, which further destabilized soils and provide opportunities for invasive plants to spread. Similar to other areas on the ANF, the increased frequency of overlapping or adjacent fires such as the Foothill Fire (2004) and Marek and Sesnon fires (2008) compound these effects across the landscape.

In addition, the Sayre Fire impacted miles of roads, trails, fuel breaks, and utility corridors, and burned through five hazardous waste sites, creating heightened risk for soil and water contamination. The extensive vegetative cover loss from the Sayre Fire also exposed microtrash, increasing the threat to the California condor population that frequents the western areas of the ANF.

Angeles National Forest Fire Restoration Goals and Priorities

This program aims to increase the pace and scale of conservation on the Angeles National Forest through strategic partnership opportunities that address the impacts to the watersheds and ecosystems affected by these fires, provide sustainable and lasting ecological benefits, promote ecological resilience to future wildfire events, and inform efficient post-fire restoration through innovation.

The proposed conservation outcomes of this program are informed by the USDA Forest Service Strategic Plan, which identifies two main goals: (1) restore, sustain, and enhance the nation's forests and grasslands by fostering resilient, adaptive ecosystems to mitigate climate change; through strategic land management, mitigating wildfire risk, and conserving open space, and (2) deliver and sustain the benefits of the national forests to the American public by providing abundant clean water, strengthening communities, and connecting people to the outdoors (USDA 2015). Those goals are further described and expanded upon for the ANF within the Forest Service's Land Management Plan – Part 1 Southern California National Forests Vision, Part 2 – Angeles National Forest Strategy, and Part 3 – Design Criteria for the Southern California National Forests (USDA 2005).

Angeles National Forest Restoration Priorities

The ANF and NFWF seek to implement a holistic, watershed-scale approach to fire restoration. The restoration activities to be completed through this program are primarily supported through fire cost recovery settlement funds that are designated to address the impacts and concerns related to their respective fires. In order to achieve program goals while operating within the constraints of existing funding sources, a variety of separate but complementary strategies and associated activities may be implemented. Some of the highest priority activities for recovery within the Copper, Ranch, and Sayre fires include:

- San Francisquito Creek Aquatic Organism Passage Improvements – feasibility and design planning for improving hydrologic function and connectivity, and stream and riparian habitat conditions for unarmored three-spine stickleback, California red-legged frog, and other aquatic species indigenous to San Francisquito Creek watershed. Includes completing all necessary NEPA requirements.
- Chaparral and Coastal Sage Scrub Restoration – priority planning for chaparral and coastal sage scrub restoration, with subsequent seed collection and plant propagation, and project implementation within degraded vegetation communities.
- Forest Woodland Restoration – landscape-scale evaluation and development of vegetation management and restoration priority plan for forest environments; including native woodlands, grasslands, and riparian habitat and wetland communities. Post-management plan development, conduct subsequent seed collection and plant propagation, and implementation of projects within identified priority areas. Implementation will include completing all necessary NEPA requirements. Presently, Angeles National Forest woodland restoration requests a focus toward oak communities and riparian areas.
- Non-native Invasive Vegetation Removal and Control – species of particular interest within the given fire scars:
    - Copper: arundo, tamarisk, Spanish broom, tree-of-heaven, black locust, blessed thistle, Russian thistle, pampas grass
    - Ranch: perennial pepperweed, tamarisk, yellow star-thistle, Spanish broom

    - Sayre: Spanish broom, tamarisk, Russian thistle, castor bean
- Fuel Break Evaluation – Inventory of plant communities within Copper Fire fuel break network.
- Illegal Off-Highway Vehicle (OHV) Use Management – Using completed OHV trail inventory and condition survey, develop strategies for protecting and maintaining both recreation and ecosystem values.

While the identified priorities above highlight some of the most pressing recovery needs from these fires on the forest, the following section describes a full range of strategies that may be employed through this program, with specific examples relevant to the fire scars of interest as appropriate. As more information is gathered over time, these strategies may be refined to increase success and effectiveness of the program. Strategies and highlighted recommendations are provided below:

Strategy 1. Assessment, Prioritization, and Planning

Information regarding pre- and post-fire forest conditions is incomplete or outdated across many areas of the fire scars. In order to develop strategic and effective restoration and conservation projects, relevant information must be gathered to focus opportunities to areas of greatest need, determine the best techniques to employ given site conditions and restoration goals, comply with regulatory requirements, and evaluate project effectiveness over time. Therefore, in many cases, assessment, prioritization, and planning will be a critical first step in addressing this program's goals.

The types of assessment, prioritization, and planning activities that may be conducted to address watershed needs are broadly identified in the following strategies (adapted from Roni and Beechie, 2013):

Watershed-scale Process Assessment – Assess effects of changing land cover and vegetation types on runoff and stream flows, erosion processes, nutrient supply to streams, and the implications on ecosystems and natural communities.

Reach-scale Process Assessment – Assess riparian conditions, alterations of stream flow by dams or diversions, sediment transport and storage, and floodplain habitats.

Habitat Alterations Assessment – Evaluate condition of habitat features relative to expected natural conditions or reference conditions, identify fish passage barriers, and assess water quality.

Changes to Biota – Evaluate status of priority populations or species, ecosystem assemblages, and presence, abundances, and impacts of non-native species.

Regulatory Compliance and Approval – Develop analysis and reports for compliance with regulatory policies such as the Endangered Species Act, Wilderness Act, and Wild and Scenic Rivers Act.

The Watershed Condition Classification (WCC) is a standardized method used by the US Forest Service to evaluate and rate the health and function of watersheds on a number of different attributes. Initial prioritization of watersheds and their related needs may be guided by the available WCC information for the ANF. The watersheds directly impacted by the fires addressed through this program are shown in the figure below. Watershed Condition Classification information is summarized in Appendix B.

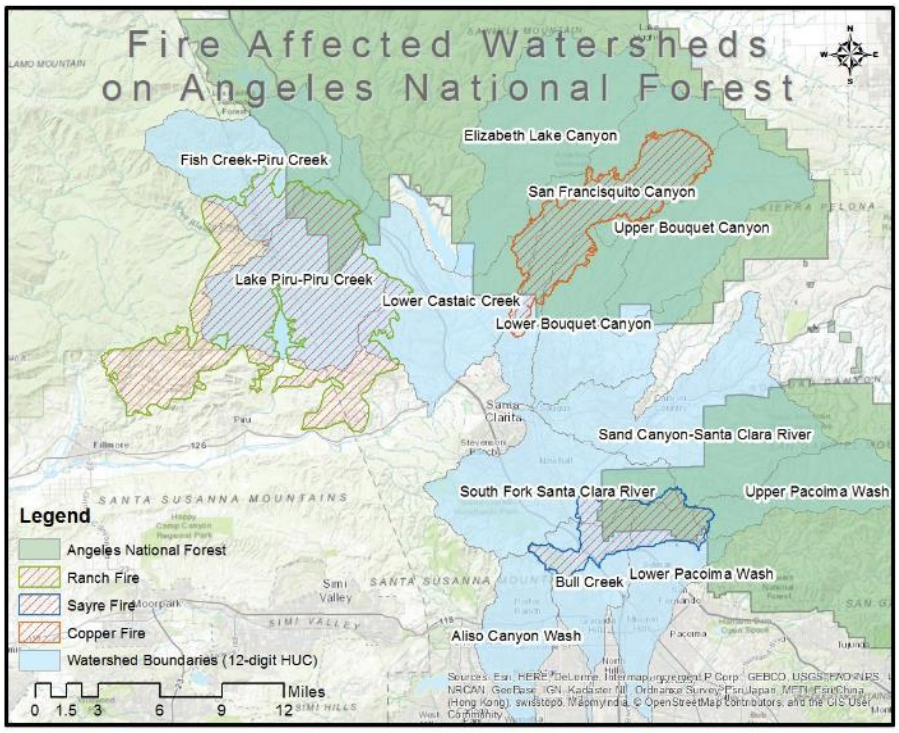

Figure 2. Fires of Interest and watersheds affected or in proximity to those fires.

Strategy 2. Forest/Upland Restoration and Management

Activities under this strategy refer largely to work designed to improve or sustain terrestrial environments. Projects may be developed at a broad scale to restore ecosystems such as grasslands, chaparral, or forest stands, but depending on the locations most impacted by the fires and identified by USFS staff or through Strategy 1 assessments, projects may be designed to directly focus on the recovery of individual species of interest to the ANF such as gray pine or live oak.

Seed Collection/Propagation - Changes in fire regime, including increased intensity or frequency, may decimate standing vegetation and the seed bank within the soil. As high intensity fires become more frequent, burned landscapes become more susceptible to converting from diverse native vegetation communities to monocultures dominated by invasive plants. Seed collection and propagation is therefore important to ensuring a source for conducting restoration. The ANF has a particular need to collect and propagate seed from native chaparral, coastal sage, live oak, gray pine, and big cone Douglas-fir.

Revegetation - In order to restore forest and upland environments, replanting native species where native vegetation communities once existed may be necessary where natural recovery processes have been delayed or altered as a result of wildfire or other stressors. Vegetation communities of particular interest to the ANF are chaparral, coastal sage, live oak, gray pine, and big cone Douglas-fir.

Prescribed Burn - Prescribed burns may help some areas replicate the natural process of wildfire, which reduces fuels, removes competitive invasive species, promotes germination of fire adapted species such as big cone Douglas-fir, and increases diversity and age structure in vegetative environments. On the ANF, prescribed burns may have particular applications in maintaining riparian corridor and oak grove regeneration.

Invasive Eradication - A number of species of invasive plants have established a presence on the Forest and pose a threat to native plant communities and the fish and wildlife species they support. These threats can be manifested in a variety of ways: changing soil fertility and stability, increasing fire return intervals, altering habitat needed by other native animal species, and decreasing water availability. Where possible, implementation of control measures to remove invasive species should be conducted. Invasive plant species of particular concern include:

- Tamarisk (*Tamarix* spp.)
- Giant reed *(Arundo donax)*
- Perennial pepperweed (*Lepidium latifolium*)
- Spanish broom (*Spartinum junceum*)
- Yellow starthistle (*Centaurea solstitialis*)
- Russian thistle (*Salsola tragus*)
- Blessed thistle (*Centaurea* benedictus)
- Castor bean (*Ricinus communis*)
- Black locust (*Robinia pseudoacacia*)
- Pampasgrass (*Cortaderia selloana*)
- Tree-of-Heaven (*Ailanthus altissima*)

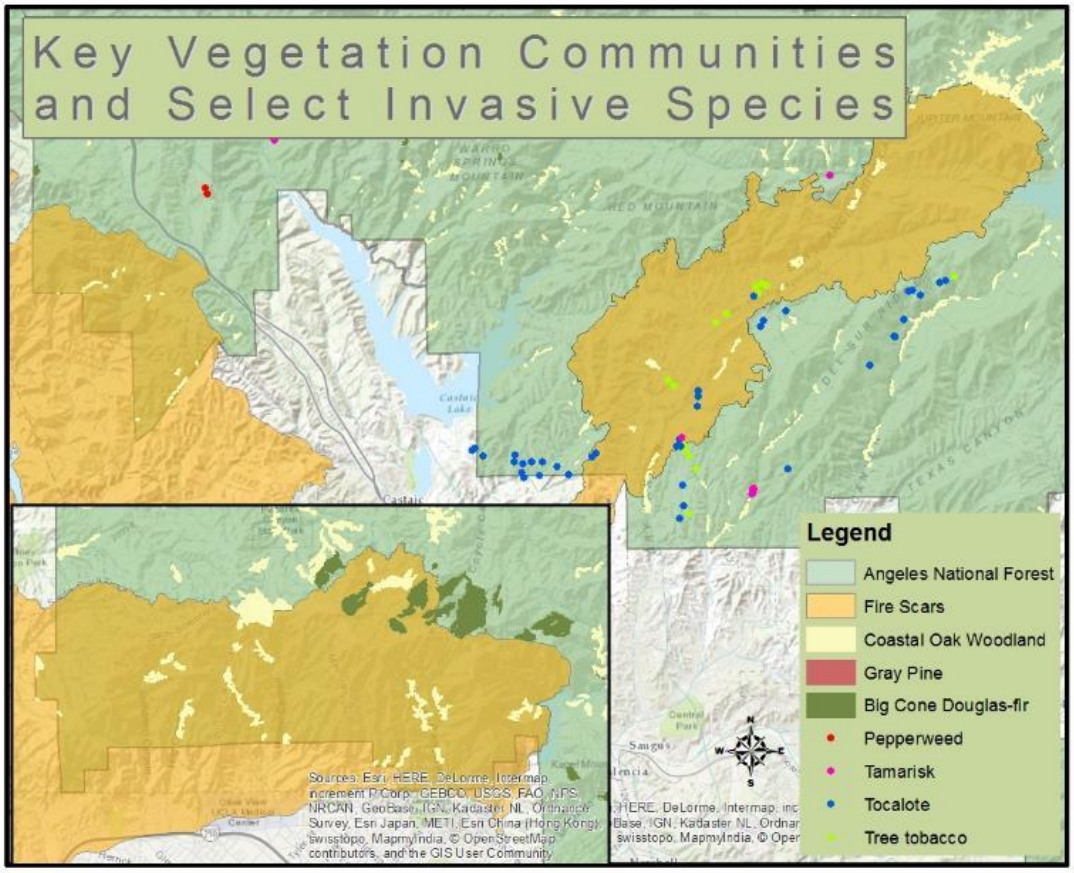

Figure 3. Select vegetation communities and invasive species on the ANF.

Strategy 3. Stream/Riparian Restoration Management

Approaches described under this strategy refer to restoration of aquatic environments and the species they support, such as unarmored three-spine stickleback and California red-legged frog. Where needed, project activities will be guided by the assessment, prioritization, and planning described in Strategy 1 to ensure program goals and priorities are appropriately incorporated.

Aquatic Organism Passage Improvements - Aquatic organism passage barriers affect some aquatic species by obstructing their distribution and range, reducing available habitat, threatening genetic diversity by isolating populations, and increasing the risks from predation, competition, and water quality and quantity impacts. These impacts can be exacerbated even further with increases in pollutant loads and altered habitat after wildfire events. Activities may include modifying road/stream crossings to allow unimpeded natural flow such as replacing culverts with a free span bridge, or installing fish ladders or other engineered solutions for fish or other aquatic species to traverse barriers. In particular, there are a number of sites appropriate for aquatic organism passage improvement projects in San Francisquito Creek. These sites will be evaluated, and solutions developed to maximize the ecological benefits to be gained at these sites.

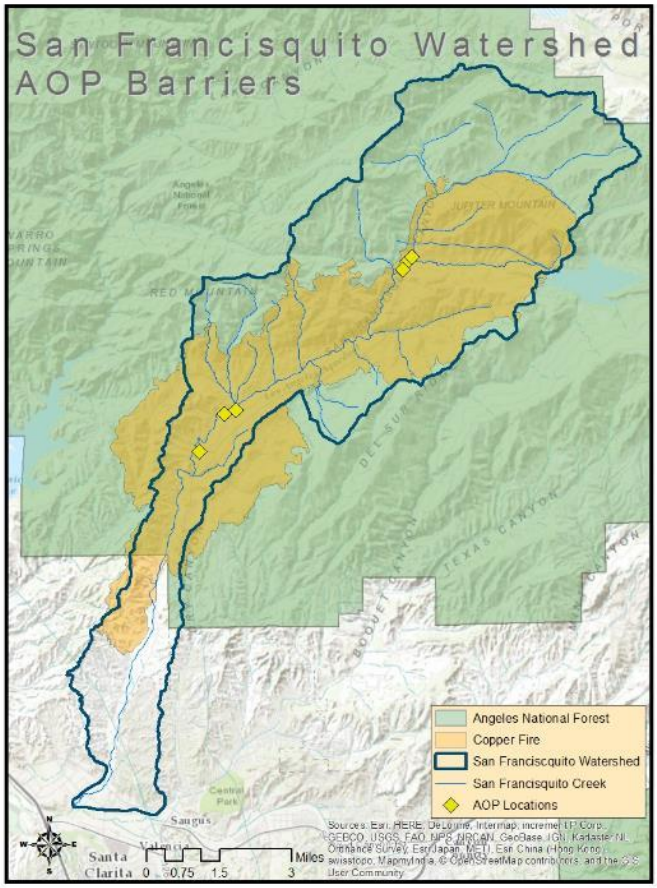

Figure 4. Locations of priority aquatic organism passage barriers in San Francisquito Creek (Copper Fire)

Invasive Eradication - As with the forest/upland environments, aquatic and riparian invasive plant and animal species that have established a presence in ANF waterways threaten the success of native populations. Invasive species such as crayfish or bullfrog may displace, outcompete, or prey on native species and disrupt the ecology of the aquatic and riparian environments. Aquatic and riparian invasive

plants such as tamarisk and arundo may affect water availability, nutrient cycling, sediment storage, and flow and flood dynamics, as well as increasing the risk of future fire events. Activities may include removing aquatic vegetation through hand-pulling and mechanical treatment, localized herbicide application, or in the case of invasive species such as crayfish, eradication may be completed through systematic surveys of the aquatic systems, followed by selective capture and eradication. In the San Francisquito Creek watershed, invasive plants and non-native aquatic fauna have been targeted and removal projects completed, but evaluation of those efforts will be necessary to continue those efforts.

Instream Habitat Restoration - The alteration of habitat after fire events is not confined to upland environments. Sediment and debris that enters stream channels and floodplains may dramatically modify the type and distribution of in-stream habitats throughout the stream network. These impacts may be magnified when anthropogenic influences such as dams, diversions, or road crossings modify the flow regime and prohibit the natural movement of sediment and other inputs through the system. Instream habitat restoration may include removing or modifying culverts or other flow obstructing features to enhance downstream sediment transport, restoring floodplain connectivity to streams to disperse sediment from channel; and re-establishing habitat types necessary for various life-cycle stages of aquatic organisms that have been eliminated or diminished as a result of the effects of the fire.

Instream Flow Restoration - Wildfire may have ramifications to local hydrology, particularly in the arid Mediterranean climate of Southern California. Changes in soil infiltration rates, evapotranspiration, and overland flows and pathways may all be impacted by post-wildfire events, which can lead to changes in the quantity and timing of in-stream flows. These changes may in turn directly affect aquatic species that are flow- and habitat-dependent to reach all life history stages. In addition, changes in hydrology have implications for the supply and management of water for human populations that rely on local sources of surface and groundwater. Where these hydrologic alterations are identified and understood, efforts should be made to recover in-stream flows to conditions supportive of aquatic and riparian species that exist in affected streams.

Riparian Corridor Restoration - Riparian corridors provide a number of ecosystem functions that support both upland and aquatic environments. Stream side vegetation buffers pollutants from waterways, contributes shade and habitat structure for both aquatic and terrestrial species, ameliorates fluctuations in water temperature, reduces instream water temperature, stabilizes stream channel form and function, and can help slow or halt advancing wildfire. However, the loss of riparian vegetation, and the conversion of riparian systems from native species to invasive dominated vegetation such as Arundo donax or tamarisk, can alter and degrade these functions in ways that have lasting impact across the landscape. Riparian corridors will be assessed and restored, where appropriate, to help maintain healthy watersheds and support species such as steelhead, arroyo toad, and southwestern willow fly-catcher.

Strategy 4. Species Specific Strategies

The ANF supports numerous federally threatened and endangered species, and Forest Service sensitive plants and animals (Appendix A). Many of the activities identified in Strategies 1, 2, and 3 indirectly influence the restoration and conservation of these species. However, where appropriate, projects designed to specifically address species of particular interest occurring within the fire scars may be addressed through this program. Some of the priority species of interest within the fire affected areas on the ANF include: unarmored three-spine stickleback, California red-legged frog, arroyo toad, southwestern willow flycatcher, and least bell's vireo. Figure 5 illustrates known ranges on the ANF for a few of those species.

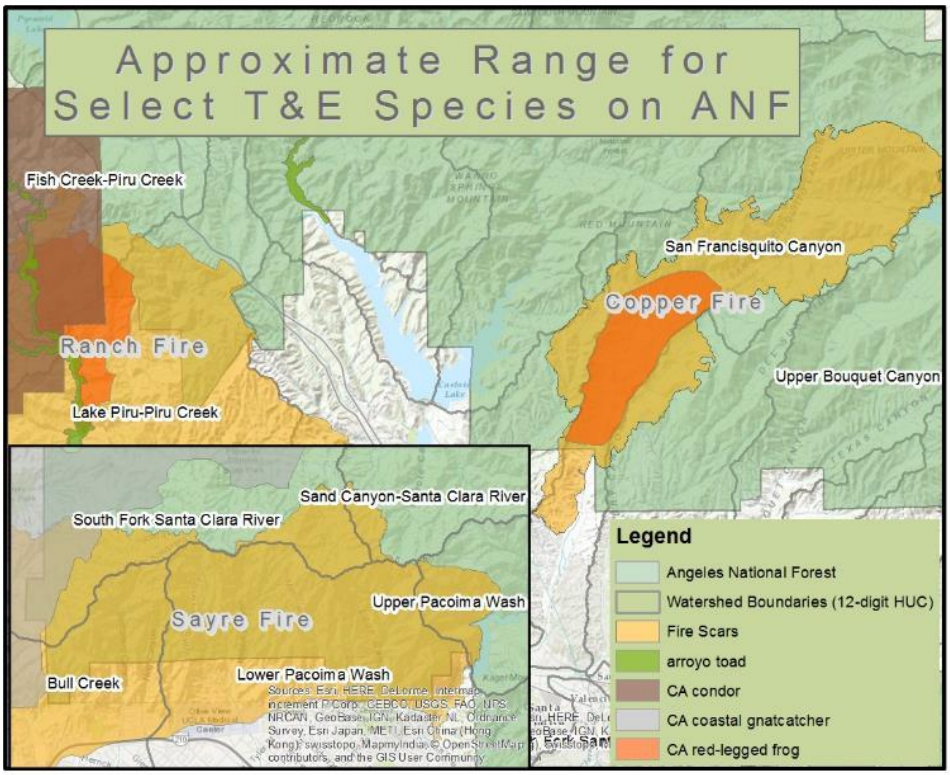

Figure 5. Select threatened and endangered species distribution on the ANF.

Strategy 5. Non-natural Features Management

The post-fire recovery of non-natural features such as trails, roads, and fuel breaks plays an important role in maintaining healthy landscapes. These features provide critical pathways that allow Forest Service personnel and other resource managers' access to the forest to work and fight fires. They also provide an opportunity to connect people with the outdoors and foster appreciation of the natural environment. However, unmaintained and damaged trails, roads, and fuel breaks may exacerbate natural resource problems by acting as conduits of sediment and other pollutants. Degraded infrastructure and burned landscapes may also lead to users creating their own unauthorized off-trail routes, which further impact the lands, increase pollutant sources, and provide new opportunity for the introduction of invasive species. Restoring these features to Forest Service standards therefore provides multiple benefits to ecosystem restoration and facilitating use and appreciation of public lands.

Field Condition Assessments – Gather information to strategically identify critical trails, road segments, or fuel breaks in need of recovery projects related to the goals of this plan. Comprehensive field condition assessments have already been completed for areas impacted by the Copper Fire.

Trail System Improvements - Maintenance, decommissioning, or improvement of Forest Service system trails impacted by the fires. Preference for restoration locations will be toward those locations that have resulted in the post-fire diminishment of forest or watershed health, forest management capabilities, or forest use.

Fuel Break System Improvements - Recovery of fuel breaks, incorporating invasive species removal and revegetation projects, and maintenance of critical fuel breaks deemed necessary for future forest health and fire management so long as they include mitigation to meet other ecological goals.

Forest Road System Improvements - Maintenance of forest roads at critical locations where repercussions from fire have led to chronic erosion and sediment loading to watersheds, habitat, or other natural features of the forest.

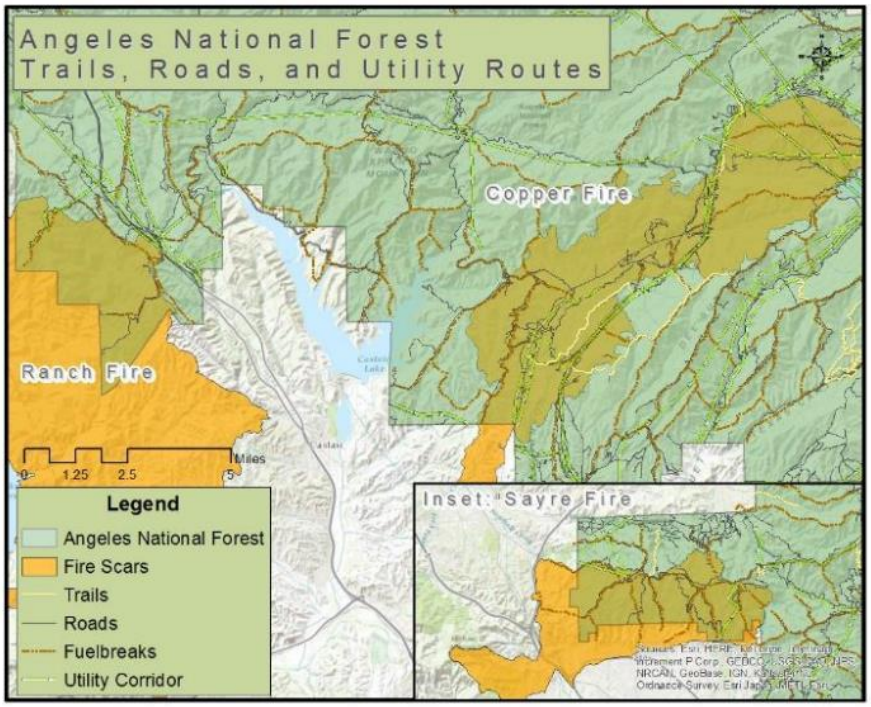

Figure 6. Major infrastructure routes on the ANF

PROGRAM EVALUATION

This document is intended to direct actions that result in measureable and beneficial improvement of the resource, and contribute to the goals of fire recovery and watershed restoration. Projects completed through this program will be required to quantify outcomes that align with the identified priorities. As part of this program, preliminary goals have been identified to assist restoration toward those outcomes. The quantifiable goals developed for ecological restoration are presented below. These measures may be expanded or improved upon as additional assessment work is completed and priorities are further evaluated.

Evaluation Goals

- 7 stream miles made accessible to aquatic species via aquatic organism passage improvement
- 20 acres of riparian habitat restored
- 10 acres of invasive species management completed
- 5 acres of chaparral revegetation completed
- 30 pounds of native seed harvested
- 13 miles of authorized Forest Service trail restored
- 30 miles of non-authorized user created trails to be evaluated

RISK AND THREATS TO SUCCESS

Risk is an uncertain event or condition which, if it occurs, could have a negative effect on an initiative's desired outcome. We reviewed several risk event categories to determine the extent to which they could impede progress towards our stated business plan strategies and goals over the course of this program.

Regulatory Risks

Actions conducted on federal lands must comply with a variety of federal regulations to ensure proper consideration and evaluation for a number of different factors. In many instances on the ANF, these processes require significant time and coordination to complete successfully. Depending on the level of complexity, these regulatory risks can significantly alter project timelines and program momentum. In particular, the National Environmental Policy Act (NEPA) requires evaluation of potential projects for the anticipated and unanticipated outcomes that might arise as a result of their implementation, which adds further complexity to project planning and evaluation tasks.

Mitigating strategies: Increase regulatory compliance capacity through the contracting of non-FS professional expert in completing regulatory compliance. Where appropriate, develop regulatory compliance documents at a programmatic level that address forest wide issues.

Financial Risks

Funding for this program comes largely through finite USFS Federal Fire Settlement Funds. Therefore, funding for maintenance and evaluation activities that may be long-term in nature, such as multiple year treatments to ensure invasive species removal, are potentially problematic. In addition, the designation of the fire settlement funds to projects directly linked to the fire scars may, in some cases, limit the forest's capacity to holistically address some issues within watersheds.

Mitigating strategies: Identify those projects that are expected to accomplish the greatest ecosystem benefit given the time and resources available based on an analysis of each watershed's condition ratings (as described in the WCC), and comparison of the restoration needs, the associated costs, and expected outcomes among the watersheds will be evaluated by ANF, NFWF, and potentially other partners or consultants to target those projects that provide the greatest ecological return on investment. Where long-term activities are required or geographic focus must be broadened outside of the fire scar or off federal lands, integrate strategies to build additional partnerships and expand sources of funding into future phases of this plan.

Environmental Risks

Environmental risks pose a significant threat to ecosystem restoration on the ANF. The threat of uncharacteristic wildfire is ever-present and can potentially negate the gains made through years of recovery implementation. The threat of fire can also impact accessibility to the forest and reduce opportunities to conduct work. El Niño events can strongly influence regional weather patterns and

affect precipitation, impact hydrology and stream morphology, and result in huge sediment loads after storm events even in areas that haven't been disturbed by fire. Recently, long term severe drought in the region has increased stress on vegetation and aquatic communities and heightened the risk of catastrophic fire. Simultaneously, impacts from insect infestation and disease have increased tree mortality, and pose threats for large landscape level ecosystem change; phytophthera and the goldspotted oak borer (*agrilus coxalis*) are two pathogens of particular concern to the ANF. Additionally, the effects of climate change may be influencing a departure from historical conditions toward 'new normals' that are still in transition. As a result, referencing past conditions or statistical trends may not always be appropriate.

Mitigating strategies: Select projects based on their ability to reflect the conditions where they are located, and to the extent practicable, design projects to account for the potential influence those environmental risks may have on the success of the project. For example, given the high likelihood of fire on the Angeles National Forest, road-stream crossings should be designed to pass water and sediment flows equivalent to that expected post-fire events, which may be significantly greater than under 'typical' forest conditions. Require all projects proposed to this program to document the potential environmental risks that may influence their activities and expected outcomes and include options to minimize the impact of those risks to the project. Where appropriate, encourage projects that focus on solutions that adapt to or combat these risks, such as insect infestation and disease. Projects selected for funding through this program will be reviewed by a technical advisory group or other qualified reviewers, and projects will be approved, modified, or denied based on these considerations.

Scientific Risks

The ability to effectively plan and prioritize activities to direct conservation efforts is limited on the ANF due to incomplete data on fire impacts and the lack of resources within the Forest to adequately investigate the full extent of impacts from the fire.

Mitigating strategies: Support preliminary assessment and planning projects to help answer key questions and further develop priority actions to address critical gaps in information and our understanding of the resource issues. Work with other natural resource managers throughout the region and share information on cause and effect relationships and best practices applicable to the ANF environments to expand the Forest's capacity to plan and implement sound projects.

Social Risks

Given that the ANF are public lands used by groups with varied interests, the strategies selected by the Forest Service to conduct restoration may not be the preferred approach by all parties. For instance, the proposal of prescribed fire as a management tool may lead to public opposition which could then impact the options and associated costs of management. In addition, the vast size of the forest, and limited personnel capacity, means that enforcement of rules and protection of sensitive areas or restoration projects are at times at risk. For example, the eradication of invasive weeds could be negated through subsequent intentional or incidental re-introductions.

Mitigating strategies: Disseminate information to the public about the issues related to fire restoration and the protection of natural resources on the ANF. As priority actions and projects continue to be identified and refined throughout this program, budget for and incorporate outreach and education strategies into the project goals to ensure appropriate awareness and discourse among stakeholders. Engage early and often with stakeholders early to help resolve issues, clarify rationale, and provide opportunities for discussion and involvement while allowing for flexibility and adaptability of project actions. These activities will also contribute to the long term support and maintenance of projects on the forest.

Institutional Risks

Insufficient agency capacity may lead to bottlenecks and potentially more limited engagement from FS employees who already have huge workloads and limited resources to accomplish their assigned tasks.

Mitigating strategies: One of the major benefits of this program comes from the added capacity gained through establishing partners via grant opportunities. These opportunities can help fill a number of needs including on the ground implementation of projects, assistance with the development of regulatory compliance documents, engineered designs, and sampling and analysis plan development and execution. The grant process instituted through this program helps attract partners, build networks and relationships, and strengthens the collaboration among all parties interested in the restoration and proper management of the ANF.

Appendix A – Plant and Animal Species of Particular Interest on the Angeles National Forest

Table A.1 – Threatened and Endangered Species on the Angeles National Forest

SPECIES	SCIENTIFIC NAME	FEDERAL STATUS	CRITICAL HABITAT ON ANF
BIRDS			
California condor	*Gymnogyps californianus*	Endangered	No
Least Bell's vireo	*Vireo bellii pusillus*	Endangered	No
Southwestern willow flycatcher	*Empidonax traillii extimus*	Endangered	Yes
Coastal California Gnatcatcher	*Polioptila californica californica*	Threatened	Yes
Western Yellow-billed cuckoo	*Cocczyus americanus*	Threatened	No
REPTILES			
Desert tortoise	*Gopherus agassizii*	Threatened	No
AMPHIBIANS			
Arroyo toad	*Anaxyrus californicus*	Endangered	Yes
California red-legged frog	*Rana aurora draytonii*	Threatened	Yes
Mountain yellow-legged frog	*Rana muscosa*	Endangered	Yes
FISH			
Unarmored threespine stickleback	*Gasterosteus aculeatus williamsoni*	Endangered	No
Santa Ana sucker	*Catostomus santaanae*	Threatened	Yes
PLANTS			
Braunton's Milkvetch	*Astragalus brauntonii*	Endangered	No
Slender-horned Spineflower	*Docecahema leptoceras*	Endangered	No
Nevin's Barberry	*Berberis nevinii*	Endangered	No
Thread-leaved Brodiaea	*Brodiaea filifolia*	Threatened	Yes
San Fernando Valley Spineflower	*Chorizanthe parryi var. Fernandina*	Candidate	No

Table A.2 – Forest Service Sensitive Animals and Plants on the Angeles National Forest

SPECIES	SCIENTIFIC NAME
BIRDS	
Northern Goshawk	*Accipiter gentilis*
Bald Eagle	*Haliaeetus leucocephalus*
California Spotted Owl	*Strix occidentalis occidentalis*
Gray Vireo	*Vireo vicinior*
MAMMALS	
Pallid Bat	*Antrozous pallidus*
Townsend's Big-eared Bat	*Corynorhinus townsendii*
Fringed Myotis	*Myotis thysanodes*
Nelson's (San Gabriel Mountains) Bighorn Sheep	*Ovis Canadensis nelson*
Tehachapi Pocket Mouse	*Perognathus alticolus inexpectatus*
AMPHIBIANS	
San Gabriel Mountains Slender Salamander	*Batrachoseps gabrieli*
Yellow-Blotched Salamander	*Ensatina eschscholtzii croceater*

REPTILES		
Western Pond Turtle	*Actinemys marmorata*	
California Legless Lizard	*Anniella pulchra*	
San Bernadino Ringneck Snake	*Diadophis punctatus modestus*	
San Bernadino Mountain Kingsnake	*Lampropeltis zonata parviruba*	
Coastal Rosy Boa	*Lichanura orcutti*	
Two-striped Garter Snake	*Thamnophis hammondii*	
FISH		
Arroyo Chub	*Gila orcutti*	
Santa Ana Speckled Dace	*Rhinichthys osculus* ssp. *8*	
TERRESTRIAL INVERTEBRATES		
San Gabriel Mountains Elfin	*Callophrys mossii hidakupa*	
San Gabriel Mountains Blue Butterfly	*Plebejus saepiolus aureoles*	
San Emigdio Blue Butterfly	*Plebulina emigdionis*	
PLANTS		**CNPS STATUS**
Abram's flowery puncturebract	*Acanthoscyphus parishii* var. *abramsii*	1B.2
San Gabriel manzanita	*Arctostaphylos glandulosa* ssp. *Gabrielensis*	1B.2
Interior manzanita	*Arctostaphylos parryana* ssp. *Tumescens*	4.3
Crested milk-vetch	*Astragalus bicristatus*	4.3
San Antonio milk-vetch	*Astragalus bicristatus*	1B.3
Scalloped moonwort	*Botrychium crenulatum*	2B.2
Club-haired mariposa lily	*Calochortus clavatus* var. *clavatus*	4.3
Slender mariposa lily	*Calachortus clavatus* var. *gracilis*	1B.2
Late-flowered mariposa lily	*Calochortus fimbriatus*	1B.3
Palmer's mariposa lily	*Calochortus palmeri* var. *palmeri*	1B.2
Alkalai mariposa lily	*Calochortus striatus*	1B.2
Pygmy poppy	*Canbya candida*	4.2
Mt. Gleason's paintbrush	*Castilleja gleasonii*	1B.2
Mojave paintbrush	*Castilleja plagiotoma*	4.3
Parry's spineflower	*Chorizanthe parryi* var. *parryi*	1B.1
California saw-grass	*Cladium californica*	2B.2
Peirson's spring beauty	*Claytonia lanceolate* var. *peirsonii*	3.1
Mojave tarplant	*Deinandra mohavensis*	1B.3
Ewan's cinquefoil	*Drymocallis cuneifolia* var. *ewanii*	1B.3
San Gabriel River dudleya	*Dudleya cymosa ssp. Crebrifolia*	1B.2
San Gabriel Mountains dudleya	*Dudleya densiflora*	1B.1
Many-stemmed dudleya	*Dudleya multicaulis*	1B.2
Forest Camp sandwort	*Eremogone macradenia* var. *arcuifolia*	No ranking
Southern alpine buckwheat	*Eriogonum kennedyi* var. *arcuifolia*	1B.3
Johnston's buckwheat	*Eriogonum microthecum* var. *johnstonii*	1B.3
San Gabriel bedstraw	*Galium grande*	1B.2
Abram's alumroot	*Heuchera abramsii*	4.3
Urn-flowered alumroot	*Heurchera caespitosa*	4.3
Mesa horkelia	*Horkelia cuneate* var. *puberula*	1B.1
San Gabriel Mountains sunflower	*Hulsea vestita* ssp. *Gabrielensis*	4.3
Pygmy hulsea	*Hulsea vestita* ssp. *Pygmaea*	1B.3
California satintail	*Imperata brevifolia*	2B.1
Fragrant pitcher sage	*Lepechinia fragrans*	4.2

Ross' pitcher sage	*Lepechinia rossii*	1B.2
Short-sepaled lewisia	*Lewisia brachycalyx*	2B.2
Lemon lily	*Lilium parryi*	1B.2
San Gabriel linanthus	*Linanthus concinnus*	1B.2
Peirson's lupine	*Lupinus peirsonii*	1B.3
Jokerst's monardella	*Monardella australis jokerstii*	1B.1
Hall's monardella	*Monardella macrantha* spp. *hallii*	1B.3
Rock monardella	*Monardella saxicola*	4.2
Baja navarretia	*Navarretia peninsularis*	1B.2
Robbins' nemacladus	*Nemacladus secundifloris robbinsii*	1B.2
Short-joint beavertail	*Opuntia basilaris* var. *brachyclada*	1B.2
Wolly mountain-parsley	*Oreonana vestita*	1B.3
Rock Creek broomrape	*Orobanche valida* spp. *valida*	1B.2
Rock-loving oxytrope	*Oxytropis oreopjila oreophila*	2B.3
San Bernadino grass-of-Parnassus	*Parnassia cirrata* var. *cirrata*	1B.3
Southern skullcap	*Scutellaria bolanderi* spp. *austromontana*	1B.2
Parish's checkerbloom	*Sidalcea hickmanii* spp. *parishii*	1B.2
Salt Spring checkerbloom	*Sidalcea neomexicana*	2B.2
Chickweed starry puncturebract	*Sidotheca caryophylloides*	4.3
Southern jewelflower	*Streptanthus campestris*	1B.3
Mason's neststraw	*Stylocline masonii*	1B.1
San Bernadino aster	*Symphyotrichum defoliatum*	1B.2
Sonoran maiden fern	*Thelypteris puberula* var. *sonorensis*	2B.2
Rigid fringepond	*Thysanocarpus rigidus*	1B.2

California Native Plant Society (CNPS) Status codes:
1A = Plants Presumed Extirpated in CA and Either Rare of Extint Elsewhere
1B = Plants Rare, Threatened, or Endangered in CA and Elsewhere
2A = Plants Presumed Extirpated in CA, But Common Elsewhere
2B = Plants Rare, Threatened, or Endangered in CA, But More Common Elsewhere
3 = Plants About Which More Information is Needed
4 = Plants of Limited Distribution – A Watch List

Threat Ranks:
0.1 – Seriously Threatened in CA (>80% of occurrences threatened/high degree and immediacy of threat)
0.2 – Moderately Threatened in CA (20 – 80% of occurrences threatened/moderate degree and immediacy of threat)
0.3 – Not Very Threatened in CA (less than 20% of occurrences threatened/low degree and immediacy of threat or no current threats known)

Appendix B - Monitoring and Evaluating Performance of Conservation Outcomes Using the USFS Watershed Condition Classification Framework: Review and Summary

Introduction

The Watershed Condition Classification (WCC) is an approach employed nationally by the United States Forest Service to evaluate watershed conditions across a variety of attributes, and subsequently aid in the strategic focus of investments in watershed improvement and conservation practices at landscape and watershed scales. This process is intended to help with the systematic and consistent evaluation of watershed conditions and strengthen the effectiveness of the Forest Service to maintain and restore the productivity and resilience of watersheds and their associated aquatic systems on NFS lands.

WCC Process

Watersheds are evaluated at the 12-digit, 6-level HUC (subwatershed) scale and are described in one of three classes:

1. Class 1 = Functioning Properly
2. Class 2 = Functioning at Risk
3. Class 3 = Impaired Function

The WCC consists of 12 watershed condition indicators. These 12 indicators are grouped and weighted to represent four general processes that drive watershed function: Aquatic Physical Processes (Weight = 30%), Aquatic Biological Processes (Weight = 30%), Terrestrial Physical Processes (Weight = 30%), and Terrestrial Biological Processes (Weight = 10%).

Each indicator contains one or more attributes which are assigned a numeric score to reflect the relative condition of that attribute for the subwatershed being evaluated. Attributes are scored as 1 (Good), 2 (Fair), 3 (Poor). Attribute scores are then summed and averaged to produce the score representative of that indicator.

The indicator scores are assigned based on criteria provided in the WCC Technical Guide[1]. Depending on the attribute, scoring criteria may be numeric, descriptive, or GIS-based in nature. In particular, the descriptive attributes are qualitative or semiquantitative variables subject to some degree of interpretation by users. The WCC process, regardless of the scoring criteria, is intended to serve as a diagnostic tool to promote discussion and understanding about of relative watershed conditions. It relies on local professional expertise and judgment from an interdisciplinary team, GIS data, national databases to the extent they are available, and written criteria, referred to as a "rule set" for proper evaluation and interpretation. Indicators and attributes used in the WCC process are described at the end of this memo.

[1]U.S. Department of Agriculture, Forest Service, 2011. Watershed Condition Classification Technical Guide.

The goal of the process is to use the best available information and data to assess the ecological conditions of the watersheds of interest. As such, the WCC allows flexibility for the adjustment of attributes depending on local knowledge and/or applicability of the criteria to local physiographic settings. Attributes may be adjusted through modification of the default ranges, substitution of higher quality data, or assigned a value of Not Applicable (if appropriate). Only two indicators (Forest Cover and Rangeland Vegetation) and two attributes (large woody debris and mass wasting) may be rated N/A subject to FS Regional Oversight Team approval.

Use of the WCC for Monitoring and Evaluation in the Business Plan for Angeles National Forest

The WCC approach appears to align well with the goals of the Fire Restoration grant program. The primary goal of the Angeles National Forest – Wildfires Restoration Grant program is to restore and improve the watersheds impacted by wildfire to increase ecosystem integrity and resilience. The WCC identifies and addresses the major factors that influence watershed health and reviews those factors independently and collectively. Although it was designed to support initial assessments of watershed health to inform priority setting and restoration planning, it can be modified to evaluate and monitor how those factors change in response to restoration actions over time. The WCC provides flexibility to adapt and refine the metrics by which those factors are evaluated to best represent the geographies and local conditions of the watersheds being reviewed. As such, NFWF plans to use the WCC as the foundation for a monitoring and evaluation plan to track and monitor program activities and outcomes over time. NFWF will work to integrate the WCC, as needed, so that it satisfies the management goals of both the USFS and NFWF and can be applied in other Forests where similar work is occurring.

WCC Rating Metrics (Indicators most relevant to the ANF Wildfires Recovery program denoted with *):

1. Aquatic Physical Process
   - **a. Water Quality Indicator**
     - i. *Impaired Waters (303d listed)* – Criteria: % of stream miles/lake area listed on 303d or 305b lists
     - ii. *Water Quality Problems* – Criteria: Qualitative judgment of non-listed wq issues
   - **b. Water Quantity Indicator**
     - i. *Flow Characteristics* – Criteria: Qualitative judgement on departure from natural hydrograph regime
   - **c. Aquatic Habitat Indicator**
     - i. ** Habitat Fragmentation* – Criteria: % of connectivity among historic aquatic habitats
     - ii. *Large Woody Debris* – Criteria: Qualitative judgment on presence/absence of LWD recruitment based on expectations for that system
     - iii. ** Channel Shape and Function* – Criteria: % of width/depth ratios and channel entrenchment displaying increase from expected conditions

2. Aquatic Biological Process
   - **a. Aquatic Biota Indicator**
     - i. ** Life Form Presence* – Criteria: % of expected aquatic life form and communities present
     - ii. ** Native Species* – Criteria: Qualitative judgement of presence and self-sustaining populations of native species

iii. ** Exotic and/or Invasive Aquatic Species* – Criteria: % of historic native aquatic life-bearing habitats with exotic/invasive species present, and trends in expansion

b. Riparian/Wetland Vegetation Indicator

i. ** Vegetation Condition* – Criteria: % of native vegetation presence and success

3. Terrestrial Physical Process

a. Roads and Trails Indicator

i. *Open Road Density* – Criteria: road/trail density (mi/mi^2)

ii. ** Road and Trail Maintenance* – Criteria: % of roads/trail displaying appropriate BMPs

iii. ** Proximity to Water* – Criteria: % of road/trail length within 300 feet of streams/waterbodies, or hydrologically connected to them

iv. ** Mass Wasting* – Criteria: Qualitative judgment of road/trail stability and potential for delivery to stream channel

b. Soils Indicator

i. *Soil Productivity* – Criteria: % soil and hydrologic cycling process functioning normally throughout the watershed

ii. ** Soil Erosion* – Criteria: % of watershed displaying evidence of accelerated surface erosion

iii. *Soil Contamination* – Criteria: Qualitative judgment of areas of soil contamination, and atmospheric deposition related to terrestrial critical load

4. Terrestrial Biological

a. Fire Regime OR Wildfire Indicator

i. ** Fire Regime Condition Class* – Criteria: Fire Regime Condition Class rating (USFS)

ii. *Wildfire Effects* – Criteria: Qualitative judgment on expected recovery of soil and ground cover conditions

b. Forest Cover Indicator

i. ** Loss of Forest Cover* – Criteria: % of NFS land with cut-over, denuded, or deforested forest cover in relation to desired/expected conditions

c. Rangeland Vegetation Indicator

i. ** Rangeland Vegetation Condition* – Criteria: Qualitative judgment of annual plant production in comparison to production potential and condition

d. Terrestrial Invasive Species Indicator

i. ** Extent and Rate of Spread* – Criteria: % of watershed with established terrestrial invasive species and qualitative judgment of potential impact and rate of spread

e. Forest Health

i. ** Insects and Disease* – Criteria: % of forested land in watershed at risk of abnormally high levels of tree mortality

ii. *Ozone* – Criteria: % of years evaluated where ozone causes decrease in biomass

Table B.1– Fire Affected Watersheds and WCC

Watershed	Indicator Categories Rated As Impaired Function	Indicator Categories Rated As Functioning At Risk
Copper Fire Watersheds		
San Francisquito Creek	Aquatic Biota - Life Form Presence Aquatic Biota - Native Species Aquatic Biota – Riparian Vegetation Roads/Trails – Proximity to Water Soils – Soil Contamination Terrestrial Biota – Forest Cover Terrestrial Invasive – Extent and Rate of Spread	Aquatic Habitat – Habitat Fragmentation Aquatic Biota – Aquatic Invasive Species Roads/Trails – Open Road Density Roads/Trails – Road Maintenance Soils – Soil Productivity Soils – Soil Erosion Terrestrial Biota – Wildfire Effects
Lower Castaic	Water Quality – Impaired Waters Aquatic Biota – Lifeform Presence Aquatic Biota – Native Species Aquatic Biota – Riparian Vegetation Soils – Soil Contamination Terrestrial Biota – Wildfire Effects Terrestrial Biota – Forest Cover Terrestrial Invasive – Extent and Rate of Spread	Water Quality – Water Quality Problems Aquatic Habitat – Habitat Fragmentation Aquatic Habitat – Channel Shape and Function Aquatic Biota – Aquatic Invasive Species Roads/Trails – Open Road Density Roads/Trails – Road Maintenance Soils – Soil Productivity
Lower Bouquet	Aquatic Biota – Riparian Vegetation Soils – Soil Contamination Terrestrial Biota – Wildfire Effects Terrestrial Invasive – Extent and Rate of Spread	Water Quality – Water Quality Problems Water Quantity – Flow Characteristics Aquatic Habitat – Habitat Fragmentation Aquatic Habitat – Channel Shape and Function Aquatic Biota – Aquatic Invasive Species Aquatic Biota – Life Form Presence Aquatic Biota – Native Species Roads/Trails – Open Road Density Roads/Trails – Road Maintenance Roads/Trails – Proximity to Water Soils – Soil Productivity Soils – Soil Erosion Terrestrial Biota – Forest Cover
Ranch Fire Watersheds		
Lake Piru – Piru Creek	Aquatic Habitat – Habitat Fragmentation Aquatic Biota – Aquatic Invasive Species Terrestrial Biota – Wildfire Effects Terrestrial Biota – Forest Cover	Water Quality – Impaired Waters Water Quality – Water Quality Problems Water Quantity – Flow Characteristics Aquatic Habitat – Large Woody Debris Aquatic Habitat – Channel Shape and Function Aquatic Biota – Lifeform Presence Aquatic Biota – Native Species Aquatic Biota – Riparian Vegetation Soils – Soil Productivity Soils – Soil Erosion Terrestrial Biota – Range Land

Fish Creek – Piru Creek	Water Quality – Impaired Waters Water Quantity – Flow Characteristics Aquatic Habitat – Habitat Fragmentation Aquatic Biota – Aquatic Invasive Species Terrestrial Biota – Wildfire Effects Terrestrial Biota – Forest Cover	Water Quality – Water Quality Problems Aquatic Habitat – Large Woody Debris Aquatic Habitat – Channel Shape and Function Aquatic Biota – Life Form Presence Aquatic Biota – Native Species Aquatic Biota – Riparian Vegetation Soils – Soil Productivity Soils – Soil Erosion Terrestrial Biota – Range Land
Sayre Fire Watersheds		
South Fork Santa Clara River	Terrestrial Biota – Wildfire Effects	Water Quality – Water Quality Problems Aquatic Habitat – Habitat Fragmentation Aquatic Habitat – Channel Shape and Function Aquatic Habitat – Riparian Vegetation Roads/Trails – Open Road Density Roads/Trails – Road Maintenance Roads/Trails – Proximity to Water Soils – Soil Productivity Soils – Soil Contamination Terrestrial Biota – Forest Cover Terrestrial Invasives – Extent and Rate of Spread
Bull Creek	Soils – Soil Contamination	Water Quality – Water Quality Problems Aquatic Habitat – Habitat Fragmentation Aquatic Habitat – Channel Shape and Function Aquatic Biota – Life Form Presence Aquatic Biota – Native Species Aquatic Biota – Aquatic Invasives Aquatic Biota – Riparian Vegetation Soils – Soil Productivity Terrestrial Biota – Wildfire Effects Terrestrial Biota – Forest Cover Terrestrial Invasives – Extent and Rate of Spread
Lower Pacoima	Soils – Soil Productivity Soils – Soil Contamination	Aquatic Biota – Invasive Species Roads/Trails – Open Road Density Roads/Trails – Proximity to Water Soils – Soil Erosion Terrestrial Biota – Wildfire Effects Terrestrial Biota – Forest Cover

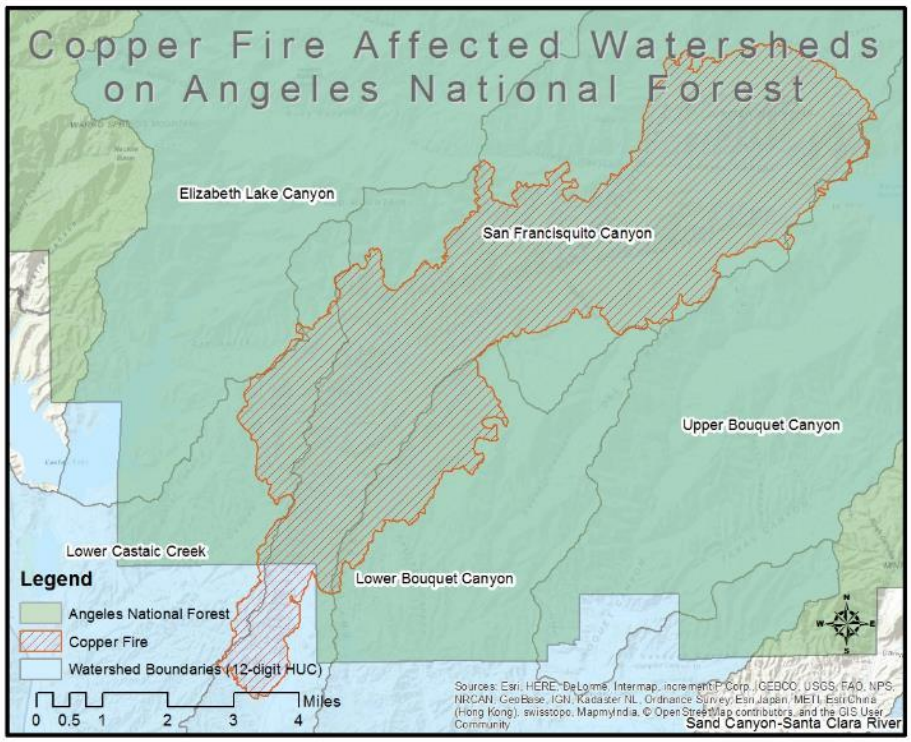

Figure B.1 Copper Fire Affected Watersheds

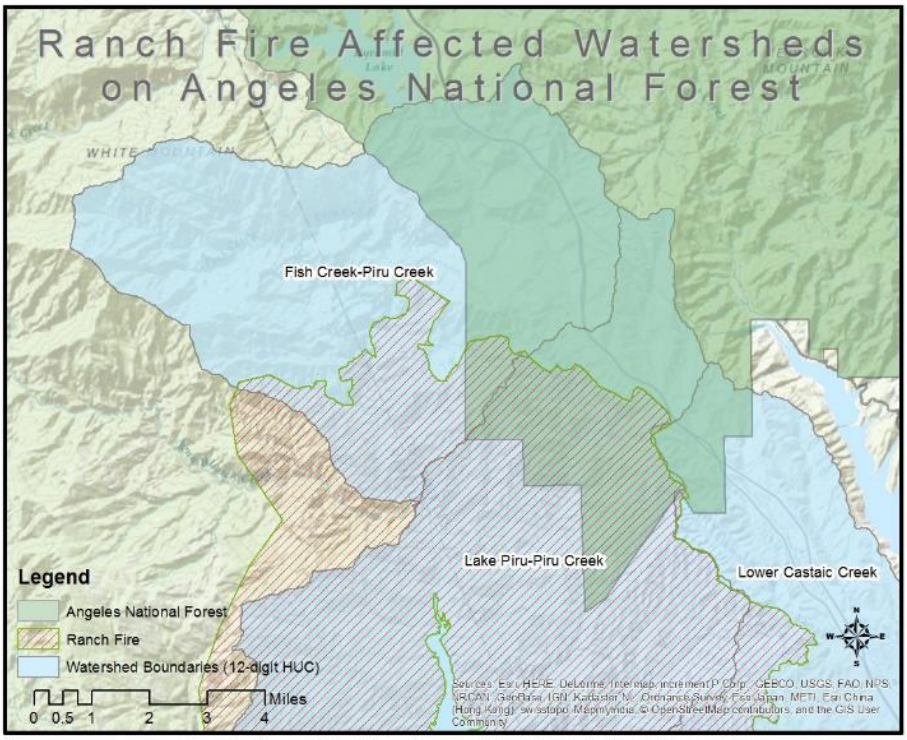

Figure B.2 Ranch Fire Affected Watersheds

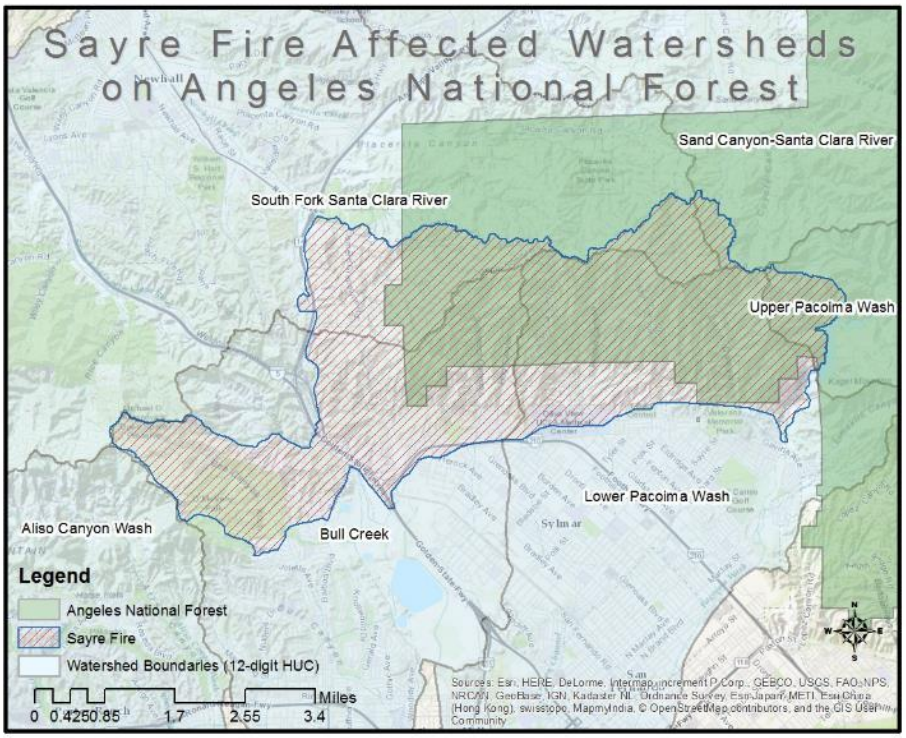

Figure B.3 Sayre Fire Affected Watersheds