

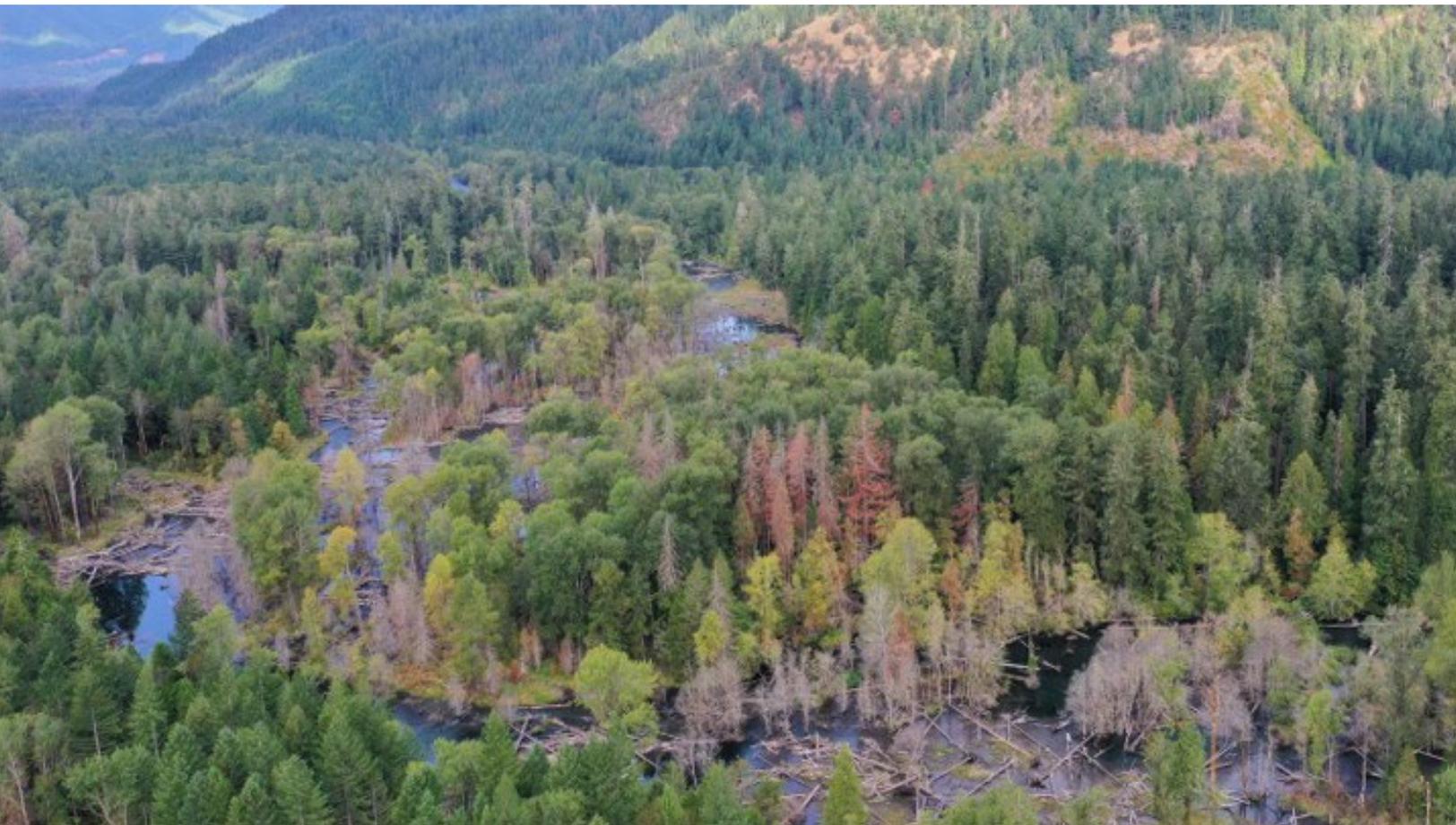


Forest Service
U.S. DEPARTMENT OF AGRICULTURE

FS-1191 | February 2022

Watershed Condition Framework

2011–2020 | 10 Years of Restoration





Above photo: Newly installed 52-foot bridge in place of previously perched culvert on the Greys River, Bridger-Teton National Forest, WY, enabling successful fish passage to the Greys River headwaters. The scour pool was filled in with boulders and grade control structures were placed downstream and upstream of the new bridge. Willows were planted on the banks by Trout Unlimited volunteers and Bridger-Teton fisheries biologists on Wyoming Public Lands Day. Courtesy photo by Leslie Steen, Trout Unlimited

Cover photo: South Fork McKenzie River, Willamette National Forest, OR, after restoration of full hydrologic connectivity and complexity to 200 acres of the watershed through removal of levees, filling and aggrading the incised channel, and placement of large wood. USDA Forest Service photo.

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LIST OF ACRONYMS

AOP	Aquatic Organism Passage
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
ESA	Endangered Species Act
FSR	Forest Service Road
HU	Hydrologic Unit
NFS	National Forest System
USDA	United States Department of Agriculture
WCF	Watershed Condition Framework
WRAP	Watershed Restoration Action Plan

RECOMMENDED CITATION

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INTRODUCTION

The Nation's forests and grasslands provide abundant, clean water that sustains ecosystems and communities across the country. The U.S. Department of Agriculture (USDA), Forest Service is responsible for stewarding over 193 million acres of public land, including the waters arising from those lands. More water originates from National Forest System (NFS) lands than from any other ownership in the continental United States, supplying approximately 18 percent of the Nation's water.¹ About 60 million people rely on National Forest System lands to capture, collect, and filter their drinking water.² As a public land steward, the Forest Service is responsible for providing sustainable flows of water and managing NFS watersheds for resilience and adaptation to changes in land use, climate, and user needs. To achieve these goals, the Forest Service works with partners at Federal, State, and local levels to help ensure that NFS lands function effectively to collect, store, filter, and deliver high-quality waters that sustain people and the resources on which they depend. Over the last 10 years, partner support for the Watershed Condition Framework (WCF) has propelled Forest Service watershed management from small, single-project

activities toward holistic watershed-scale actions. Partners have contributed \$21.5 million to priority watershed restoration work that has benefitted over 3.3 million acres of Federal and non-Federal lands.

The Forest Service launched the Watershed Condition Framework in 2010 to establish a nationally consistent approach to assessing watershed condition and prioritizing watershed restoration on national forests and grasslands. The framework consists of assessments of existing watershed condition, identification of work needed to restore or maintain condition in priority watersheds, implementation of integrated restoration activities, monitoring of implementation, and aggregation of performance data for national reporting.³ By using the WCF, the Forest Service has increased the effectiveness of watershed restoration activities, improved cross-disciplinary integration of watershed work, and standardized the assessment and reporting of watershed condition at the local, regional, and national levels.

Planning and implementation at the local level allows the agency to collaborate with communities to focus on what is most important to them. Implementation



Stream crossing restoration site on the Gunnison Ranger District, Grand Mesa, Uncompaghre, and Gunnison National Forests, Colorado. First, a contractor ripped the illegal crossing with a bulldozer and used a backhoe to reshape the banks and place willow plugs. Then, High Country Conservation Advocates volunteers planted over 500 additional willows between plugs and along the streambank for added stabilization. USDA Forest Service Photo.

by local staff is fundamental to the WCF because they have both the working knowledge of existing conditions and the partner relationships necessary to ensure successful projects. Examples of these partnership-driven watershed projects are highlighted throughout this report. WCF projects help the Forest Service, communities, and hundreds of partners improve watershed conditions across the Nation. These projects range from restoring aquatic organism passage (AOP) for at-risk or recreationally important fish to upgrading trails to decrease sediment input into streams.

The Watershed Condition Framework Process

The WCF is a six-step process that helps land managers identify, develop, implement, and monitor watershed projects. In step A, watershed condition (the state of the physical and biological characteristics and processes within a watershed that affect the soil and hydrologic functions supporting aquatic ecosystems) is assessed at the

subwatershed scale (6th level, 12-digit hydrologic unit [HU12]) using a weighted 12-indicator protocol.⁴ All 15,082 subwatersheds containing at least 5 percent NFS land were initially assessed in 2010, and 24 percent have been reassessed in the past 10 years because of changing conditions or new information. From 2011 to 2020, the total number of watersheds functioning properly increased slightly from 7,892 to 7,995, while both the total number of watersheds functioning at risk and functioning impaired have decreased (6,759 to 6,703 and 430 to 424, respectively). As of 2020, 53 percent of NFS watersheds were functioning properly, 44 percent were functioning at risk, and 3 percent had impaired function (fig. 2). A partial reassessment in fiscal year 2021 updated information on the condition of about 3,300 subwatersheds.

Step B, the prioritization of watersheds, is a locally based interdisciplinary process with the goal of aligning watershed restoration work with both agency and community priorities. Designating a “priority watershed” is intended to concentrate restoration

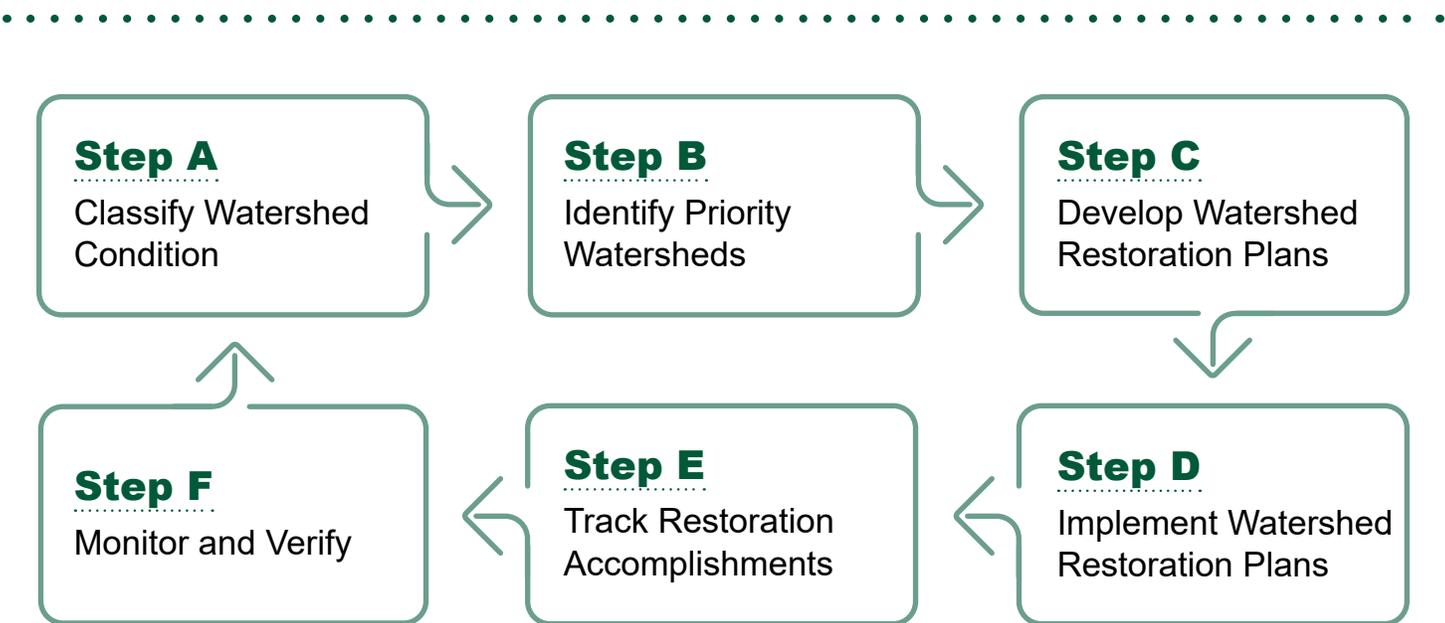


Figure 1. Watershed Condition Framework Process.

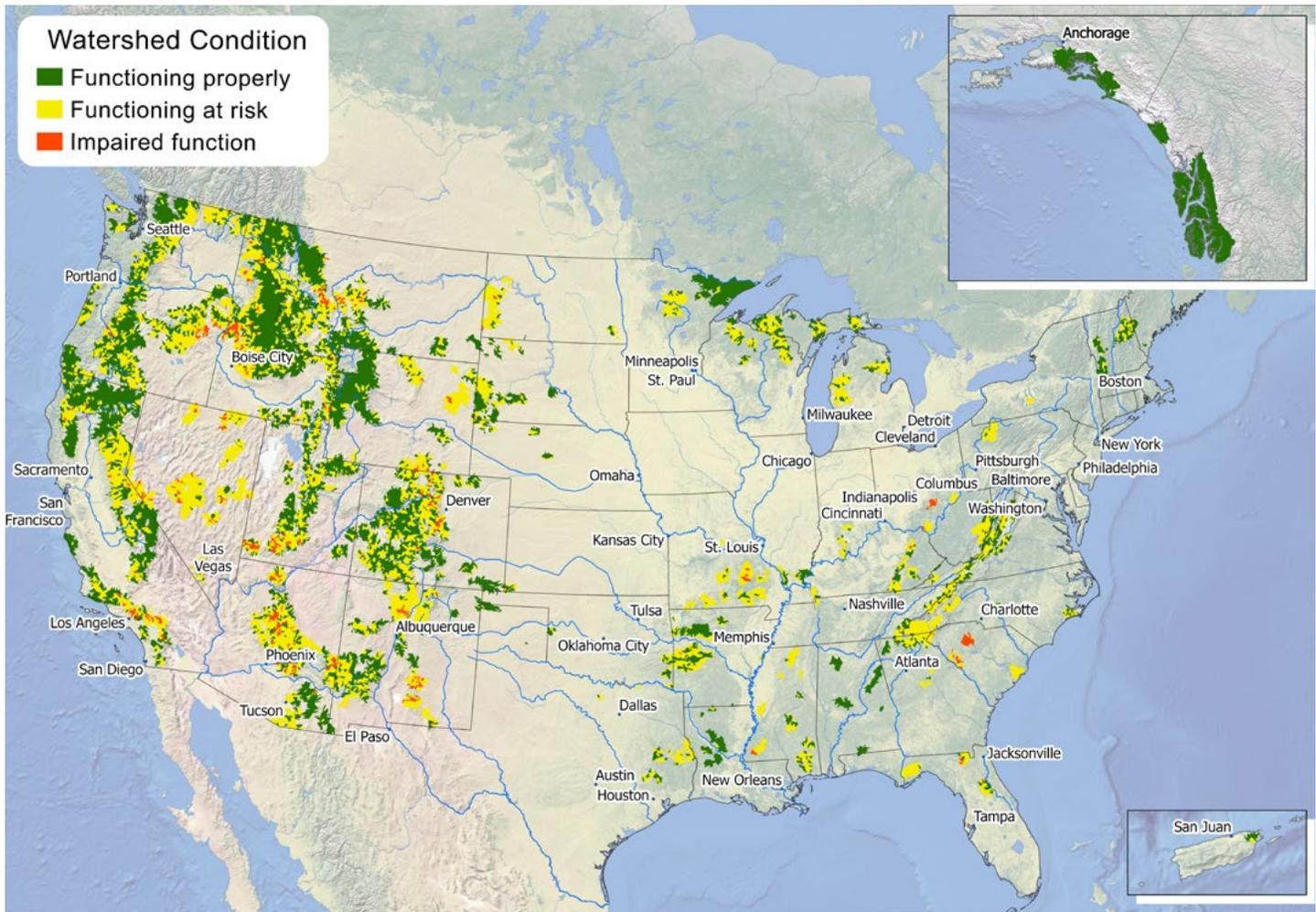


Figure 2. Watershed condition on National Forest System lands as of 2020.

activities in that watershed with the explicit goal of maintaining or improving its condition. Priority watersheds are selected based on agency restoration priorities, the urgency of management action to address conditions and threats to the watershed, and/or alignment with community and partner strategies and priorities. By 2020, the agency had identified 423 priority watersheds among the 15,082 watersheds on NFS lands.

In step C, national forests and grasslands develop Watershed Restoration Action Plans (WRAPs) to restore, improve, or maintain watershed condition for each designated priority watershed based on detailed field assessments by interdisciplinary teams.

The WRAP outlines specific problems that affect watershed condition and identifies the projects that are essential to addressing those problems, as well as timeframes, partners, approximate costs, and funding sources for these projects. These “essential projects” are a discrete group of conservation actions that are implemented as an integrated suite of management activities intended to improve or maintain watershed condition.

Watershed Restoration Action Plans identify from one to a dozen or more essential projects. In steps D and E, activities identified in the action plan are implemented and reported to track outcomes. This accomplishment report is part of step E in the

Framework and is intended to provide insight into watershed improvement and maintenance efforts during the first 10 years of implementation for the WCF. Step F completes the WCF cycle by monitoring conditions after essential projects are complete and verifying that the projects have achieved their objectives. Information gained from Step F is then used to inform and improve the next cycle in the WCF.

As of 2020, 53 percent of NFS watersheds were functioning properly, 44 percent were functioning at risk, and 3 percent had impaired function.



Forest Service staff install coir logs in a breached, abandoned beaver dam to restore water flow to the wetland above the site. Willow stakes are planted in the coir logs after installation. Pike and San Isabel National Forests, Colorado. USDA Forest Service photo.



Functioning wetland after restoration of adjacent decommissioned road. Medicine Bow-Routt National Forest and Thunder Basin National Grassland, Wyoming. USDA Forest Service photo.

SUMMARY OF WATERSHED ACCOMPLISHMENTS

Between 2011 and 2020, all restoration and maintenance projects identified in Watershed Restoration Action Plans were completed in 135 priority watersheds encompassing 3.3 million acres. The 135 completed watersheds range from remote areas like Thatcher Creek on the Mendocino National Forest, CA, which is in the Yuki Wilderness, to heavily recreated watersheds like Portage Creek on the Chippewa National Forest in Minnesota.

The implemented essential projects directly improved more than 148,000 acres, 432 stream miles, and 2,746 miles of road or trail. These projects provide a variety of benefits, including threatened and endangered species aquatic habitat restoration, improved water quality, and enhanced recreation. Thirty-four percent of the priority watersheds directly contribute to municipal or domestic water supply

(fig. 3). This work was made possible through the assistance of 575 partnerships (354 unique partners) that contributed \$21.5 million to improve watershed condition, or about one-third of the total investment of \$59 million.

For purposes of this report, essential projects were organized into seven descriptive categories: aquatic and riparian, hazardous fuels, range vegetation, forest vegetation, recreation, roads, and soils. The most common types of essential projects (fig. 4) are those that directly benefit aquatic and riparian areas (43 percent) and decommissioning or improving roads (24 percent).

While the WCF is implemented across all nine regions of the Forest Service, the specific challenges and needed restoration activities often



Piru Creek, Los Padres National Forest, CA. USDA Forest Service photo.

WATERSHED IMPROVEMENT FOR DRINKING WATER SUPPLIES

Source watershed protection is an important component of Forest Service management of public lands. Section 8404 of the 2018 Farm Bill established a Water Source Protection Program for the agency to carry out watershed protection and restoration projects on NFS land. It clarifies the ability of the Forest Service to enter multiyear water source investment partnership agreements with end water users to restore the condition of NFS watersheds. From 2011 to 2020, 34 percent of the 135 watersheds improved directly contributed to improving source water quality and quantity. Restoration in these watersheds protects the drinking water supply for 15 communities in rural California, Oregon, and Utah. There are six watersheds where more than 95 percent of the area is within a source-water protection area for municipal water supply.

vary geographically (fig. 5). In the Southern and Intermountain Regions, about 15 percent of all projects were associated with recreation—for example, reducing impacts from dispersed site recreation and trail improvement—whereas in the Pacific Southwest Region, no projects were

associated with recreation. With more than 380,000 miles of roads and tens of thousands of road-stream crossings on NFS lands, all regions have essential projects that focus on the decommissioning or improvement of roads. Overall, 70 percent of all projects included roadwork to improve or maintain

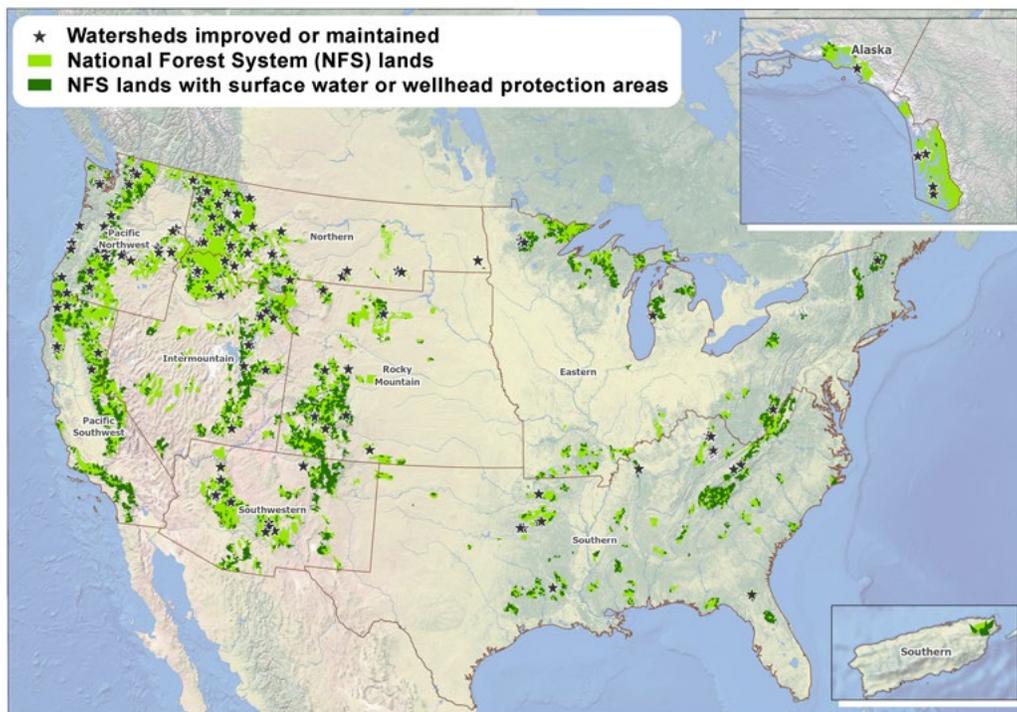


Figure 3. National Forest System lands with U.S. Environmental Protection Agency (EPA) surface water or well head protection areas and location of 135 watersheds maintained or moved to an improved condition between 2011 and 2020. EPA source water areas were generalized for display.

watershed conditions, and 50 percent included work to improve road-stream crossings and the ability for aquatic organisms to move unimpeded through stream networks. Nationwide, in WCF priority watersheds, more than 1,099 road-stream crossings have been improved or removed; 1,446 miles of road were decommissioned; and 1,046 miles of road were improved to increase aquatic habitat connectivity and reduce erosion and sedimentation (fig. 6).

The variety of levels of investment in watershed restoration mirrors the diversity of projects and degree of need within the 135 watersheds completed. Total WCF-related restoration investment on individual priority watersheds improved or maintained ranged from \$18,000 in the Muddy Creek watershed

on the Bridger-Teton National Forest in Wyoming to \$3.1 million on the Upper Newsome Creek watershed on the Nez Perce-Clearwater National Forests in Idaho. Restoration costs varied based on the degree of degradation and the type of work necessary to improve or maintain conditions. For example, the work in the Muddy Creek watershed consisted of minor aquatic organism passage (AOP) and road improvements. The Upper Newsome Creek watershed projects included regrading over 300,000 cubic yards of dredge material, realigning 5 miles of stream channels, and installing over 150 large wood structures.

Whether restoring a priority watershed identified through the WCF or completing work in other

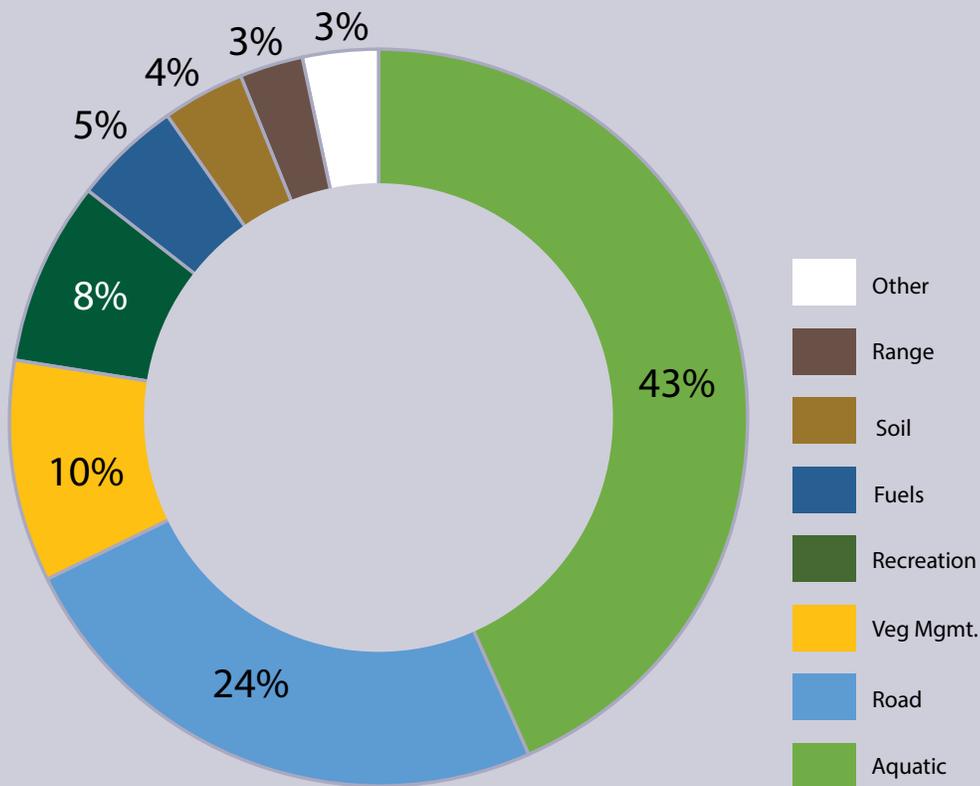


Figure 4. Percent of essential projects by category for all National Forest System priority watersheds completed, 2011–2020.

watersheds, partnerships with local communities are key. Of the 135 watersheds improved or maintained, 90 percent included at least 1 partner in the effort. Contributions came from Federal partners such as the Bonneville Power Administration, which contributed \$650,000 toward restoration activities in the Chicken Creek watershed on the Wallowa-Whitman National Forest, and from local partners such as the nonprofit Freshwater Trust that provided \$1.4 million for instream restoration in the Still Creek watershed on the Mt. Hood National Forest, both in Oregon. State and local governments also play an important role in this work. Over half of all watershed projects had a State or local government partner. For example, Catron County in New Mexico contributed \$10,000 to road drainage improvement work on

the Gila National Forest. Tribes also supported watershed restoration, with 8 Tribes investing in 11 different watersheds. The Nez Perce Tribe contributed over \$2.5 million to the restoration of Upper Newsome Creek on the Nez Perce-Clearwater National Forests in Idaho. Upper Newsome Creek is an important refugia for steelhead and bull trout, both listed under the Endangered Species Act. Figure 7 shows the many partners that have assisted in watershed maintenance and improvement efforts.

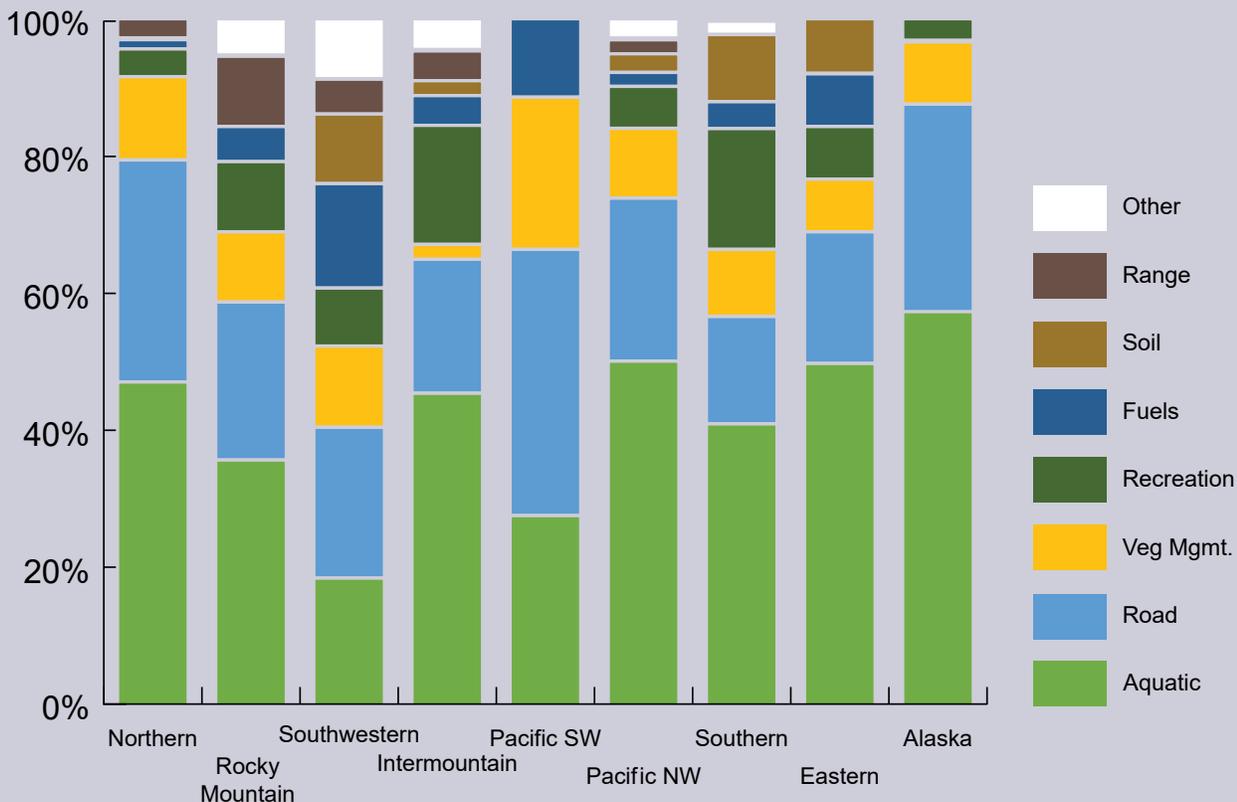


Figure 5. Essential project categories by Forest Service region for completed priority watersheds from 2011 to 2020.



4,244 acres of riparian areas improved, or wetlands/ meadows restored



1,099 road- and trail-stream crossings removed or improved



17,204 acres of nonnative plant treatment



208 miles of trail improved



1,446 miles of road decommissioned and 1,046 miles of road improved



12,339 acres of rangeland improved through fencing and off-stream water sources



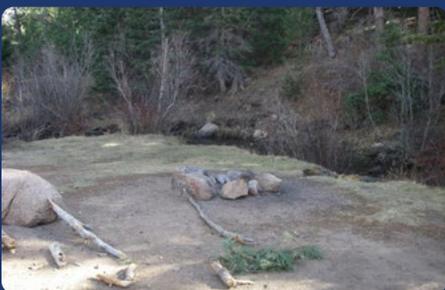
432 miles of stream improved through channel reconstruction or restoration of hydrologic function



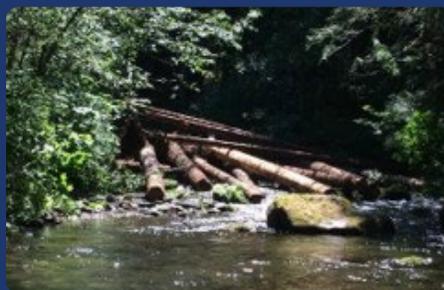
264 acres of soil improved through erosion control activities



83,960 acres of hazardous fuel reduction



1,201 acres improved by repairing land impacted by dispersed recreation



143 miles of stream habitat improved through placement of large woody pieces



753 aquatic organism passage structures improved

Figure 6. Summary of 2011–2020 accomplishments for all priority watersheds completed. USDA Forest Service photos.

LOOKING AHEAD

Over the last 10 years, the WCF has become an important tool to foster focused restoration in priority areas. In part, because the WCF can integrate across multiple initiatives and objectives, its use has been incorporated into the 2012 land management planning process (2012 planning rule) and formally authorized in the Agricultural Improvement Act of 2018 (2018 Farm Bill). During the planning process, forests are directed to use the priority watershed designation (WCF Step B) as a tool for priority setting and long-term planning. Since this regulation was adopted, all forests undergoing revision of their land management plans have used the WCF to identify at least one priority watershed and associated restoration actions.

Due to the provisions in the 2018 Farm Bill and the learning that has been gained over the decade of its use, the Forest Service initiated a two-phase review of the WCF beginning in March 2019. Phase one was a review of step A (classify watershed condition) to identify adjustments mandated by the 2018 Farm Bill language, opportunities to leverage current data sets to inform condition, and to look for ways to make the condition assessment process more efficient. The second phase was a review of steps B to F to identify changes needed to respond to the 2018 Farm Bill language, to incorporate lessons from implementation, and to identify opportunities for

process efficiencies. Both reviews were conducted in conjunction with community of practice surveys of agency staff. The survey results served to ground the recommended changes to the WCF in the needs and experiences of the Forest Service watershed specialists around the country. Together, these 2 reviews identified 19 discrete recommendations to meet the current legislative requirements and to serve its intended purpose more effectively. Examples of recommended updates include identifying new data sets, developing new technology for watershed condition assessments, reviewing the weighted-indicator model parameters, and finding new ways to better engage partners. In February 2021, a WCF advisory team of staff from across the agency was chartered to help implement the updates in time for a planned fiscal year (FY) 2026 reassessment of all watersheds on NFS lands.

Throughout the last decade, the WCF has been increasingly utilized in agency initiatives beyond watershed management (box 1). Through these agency-wide initiatives and the day-to-day work of the agency, the WCF provides a foundation for focused work for a broad suite of programs.

As success stories detailed in the following regional sections illustrate, partner involvement is a critical component of the WCF. However, additional

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Volunteers from the Northwest Youth Corp American Sign Language Crew remove invasive scotchbroom to promote native riparian revegetation on the banks of the Lower Muddy River on the Gifford Pinchot National Forest, WA. USDA Forest Service photo.



USING THE WATERSHED CONDITION FRAMEWORK TO IMPLEMENT AGENCY INITIATIVES

Climate Preparedness

The Forest Service began monitoring the climate readiness capacity of the agency in 2011 with the Climate Change Performance Scorecard. In 2020, an updated Sustainability Scorecard⁵ (scorecard) was implemented that included a new element: watershed stewardship. The watershed stewardship element was added after agency-wide, interdisciplinary discussion found resource managers were seeking ways to implement watershed projects in response to climate change. In practice, these types of projects facilitate conservation of aquatic natural resources and ecosystems resilient to changing conditions. Local units also use the Watershed Condition Framework to prioritize climate-focused projects in priority watersheds. By including climate preparedness essential projects in watershed restoration action plans, units maintain or improve watershed resilience to current and projected climate impacts, including wildfires, hurricanes, floods, droughts, and other stressors such as increased community water demands and land-use changes.

Wilderness Stewardship

The Forest Service has formally monitored its management of wilderness areas for many decades. In 2014, the agency updated its wilderness area monitoring protocols to allow greater flexibility for local units to select elements of wilderness stewardship that most applied to their wilderness and to clarify the connection between stewardship actions and preservation of wilderness character. During the development of the Wilderness Stewardship Performance program, the agency conducted a community of use survey and chartered an interdisciplinary team to develop the new performance measure guidelines. Water was identified as a key performance element for the Wilderness Stewardship Performance program. The water element is based on the use of the Watershed Condition Framework to assess watershed condition in the wilderness, and to identify and plan needed management actions. The incremental rating system is based on the adaptive management framework of the WCF where watershed condition is assessed, management actions are identified, planned, implemented, and then monitored for effectiveness.

Rise to the Future: National Fish and Aquatic Strategy

First developed in 1987, the National Fish and Aquatic Strategy (Rise to the Future)⁶ is an agency-wide strategic initiative to integrate Forest Service programs related to fish and aquatic stewardship through watershed-scale restoration and partnerships. The most recent update to the strategy in 2017 emphasized the agency's commitment to recreational

fishing and outdoor aquatic activities and addressed the economic value of fish and aquatic resources. The latest strategy also emphasizes the concept of "conservation watersheds" which help managers prioritize work in key watersheds for fish and aquatic species stewardship. Conservation watersheds are defined as complementary to WCF priority watersheds. Additional aspects of the strategy commit to tracking aquatic stewardship progress through the WCF and capitalizing on existing partnerships in priority watersheds.



Volunteers from the Northwest Youth Corp American Sign Language Crew remove invasive scotchbroom to promote native riparian revegetation on the banks of the Lower Muddy River on the Gifford Pinchot National Forest, WA. USDA Forest Service photo.

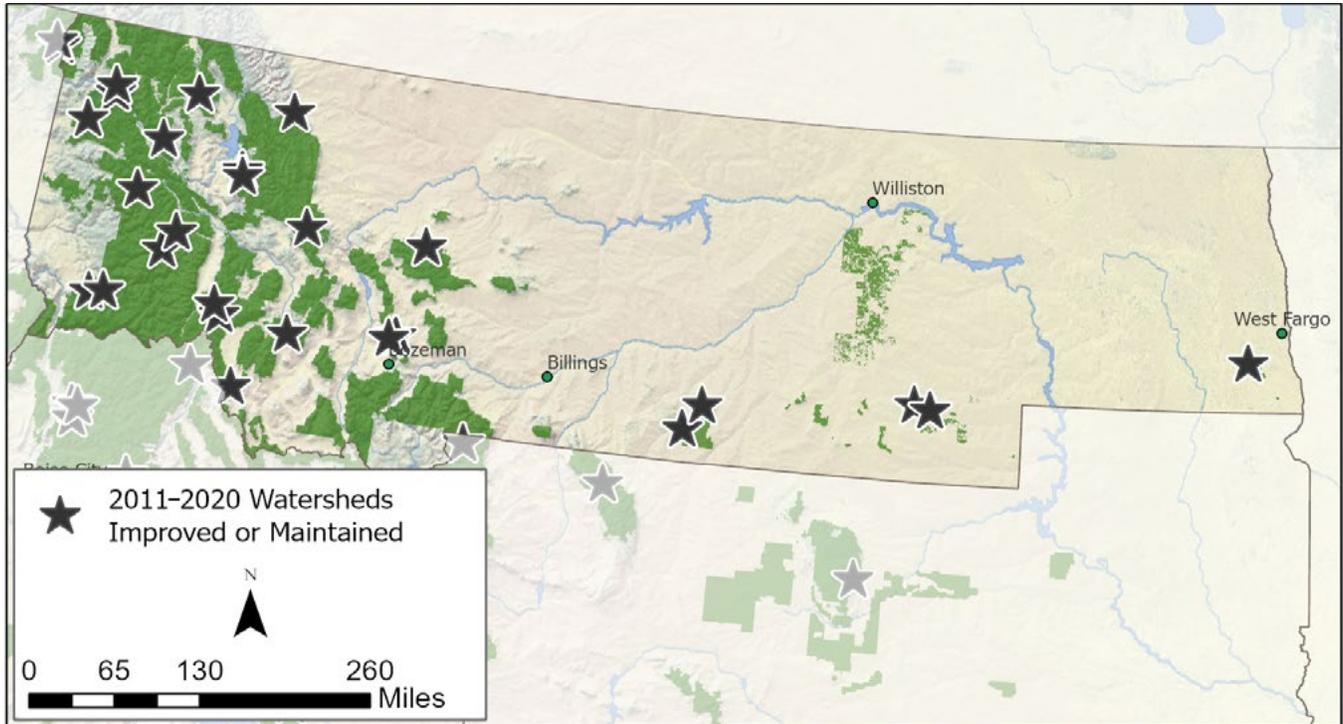
REGIONAL SUMMARIES

The Scott River outwash plain in the Eyak River-Frontal Gulf of Alaska watershed on the Chugach National Forest, AK. A user-created, off-road vehicle trail was rerouted out of salmon streams. This project reduced damage to aquatic habitat while simultaneously improving access for forest visitors. USDA Forest Service photo.



Northern Region

Idaho, Montana, North Dakota, South Dakota



- 26 priority watersheds improved or maintained
- \$1,361,492 invested in priority watershed improvement by the Forest Service
- \$700,966 invested in priority watershed improvement by State, local, Tribal, and national partners

National Forest System Unit	Watershed Improved or Maintained
Beaverhead-Deerlodge National Forest	Selway Creek Upper Divide Creek
Bitterroot National Forest	East Fork Bitterroot River-Bartie Lord Creek Upper Sleeping Child
Custer Gallatin National Forest	O'Dell Creek Pass Creek Upper Beaver Creek Upper South Fork Creek
Dakota Prairie Grasslands	Deer Creek-North Fork Grand River Giles Creek-North Fork Grand River Pigeon Point-Sheyenne
Flathead National Forest	Cold Creek Jim Creek Sheppard Creek
Helena-Lewis and Clark National Forest	Copper Creek Lower Dry Fork Belt Creek Lower South Fork Two Medicine River
Idaho Panhandle National Forests	Bruin Creek-St. Joe River Iron Creek-Little North Fork Coeur d'Alene River Lower Lightning Middle Lightning
Lolo National Forest	Cache Creek West Fork Fishtrap Creek
Nez Perce-Clearwater National Forests	Fishing Creek Meadow Creek Upper Newsome Creek

WATERSHED WORK IN THE NORTHERN REGION

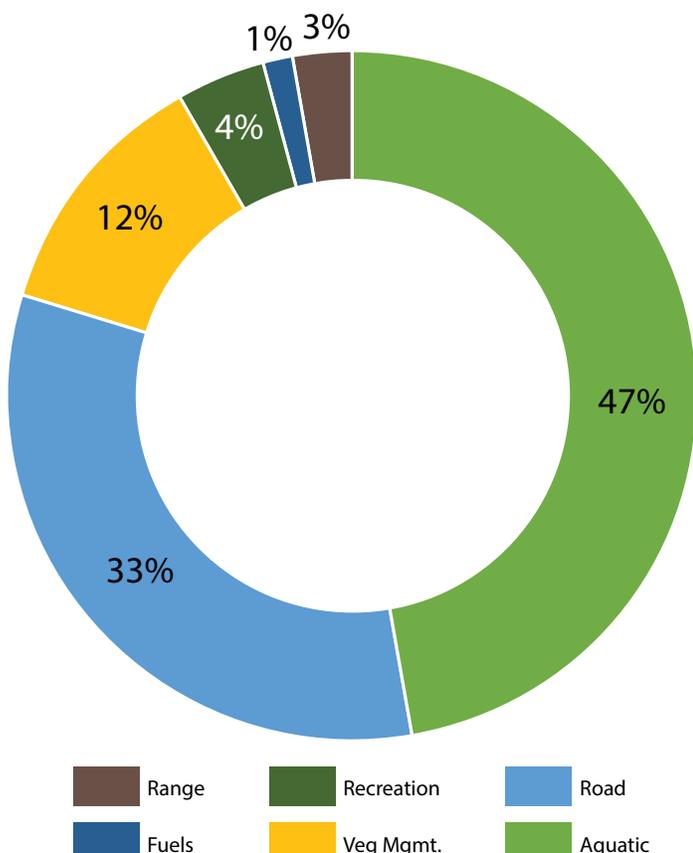


Figure 8. Percent of essential projects by category for Northern Region priority watersheds completed, 2011–2020.

Fuels Improvements:

- 1,000 acres of prescribed fire

Recreational Improvements:

- 1 mile of trail
- 112 acres of dispersed recreation

Aquatic Improvements:

- 396 stream crossings
- 131 acres impacted by gullies
- 41 acres of restoration and improvement

Aquatic Improvements:

- 15 acres of tree planting
- 1,265 acres treated for nonnative plants
- 4,741 acres improved through fencing and other rangeland improvements

Road Improvements:

- 490 miles decommissioned
- 79 miles improved



Before (left) and after (right) photos of Upper Newsome Creek on the Nez Perce-Clearwater National Forests in Idaho. Relict dredge piles restricted the flood plain, and the straight stream channel did not provide aquatic or riparian habitat. During restoration, dredge piles were removed, the flood plain was widened, and a meandering channel now exists to provide good woody habitat. USDA Forest Service photos.

NORTHERN REGION WATERSHED SPOTLIGHT

Upper Divide Creek, Beaverhead-Deerlodge National Forest, Montana

The Big Hole River Valley is a scenic, remote river valley in southwest Montana whose primary land use is agriculture. The majority of the valley's residents are multigenerational ranch families. The Beaverhead-Deerlodge National Forest has capitalized on the institutional knowledge of these families to assist in reconstructing historic land uses and landscape processes that have created existing conditions across this portion of the forest. From both onsite evidence and discussion with residents, Upper Divide Creek, a tributary to the Big Hole River, used to support a fishery and vigorous riparian community. A robust beaver population created a network of dams that facilitated seasonal water storage and augmented downstream water supply and aquatic habitat viability for fish communities (including grayling, a species of concern).

Restoration work was initiated in 2019. Members of the Big Hole Watershed Committee and the Forest Service removed conifers across 13 acres to promote

deciduous species vigor. Wood from these fallen conifers was used by the volunteer workforce to install 12 beaver dam analogs (BDAs). BDAs were primarily constructed by plugging relict beaver dams scattered throughout the project area.

Project monitoring clearly showed a small but measurable increase in water availability resulting from project activities across the 2018–2019 monitoring year. An additional 0.3 acre-feet of storage was produced by the project and streamflow was elevated through the course of the water year. Continued monitoring will improve understanding of the effects of project activities on hydrologic dynamics in the watershed.

Partner agencies and parties included the Montana Department of Fish, Wildlife and Parks; the Montana Department of Environmental Quality; the U.S. Army Corps of Engineers; and the Big Hole Watershed Committee.



Project area prior to initiation of restoration work. USDA Forest Service photo.



Volunteers construct a beaver dam analog using fallen conifers. USDA Forest Service photo.



Before restoration. USDA Forest Service Photo.



After restoration. USDA Forest Service Photo.

Accomplishments

- Completed a wetland delineation report (establishing location and size of wetland), hydrologic assessment, and project summary report.
- Increased onsite water storage by approximately 0.3 acre-feet.
- Increased annual surface flow measured during the 2018–2019 monitoring timeframe.
- Restored 13 acres of meadow by removing encroaching conifer trees.
- Constructed 12 beaver dam analog (BDA) structures.
- Restored 1 mile of stream habitat.
- Restored 2 miles of native westslope cutthroat habitat.
- Partner-produced video documenting the restoration effort: “Holding Back the Snowpack,” available on YouTube (<https://www.youtube.com/watch?v=UG8YWqSHF88>)

Partners

- Big Hole Watershed Committee
- Montana Department of Fish, Wildlife and Parks
- Private landowner
- U.S. Army Corps of Engineers

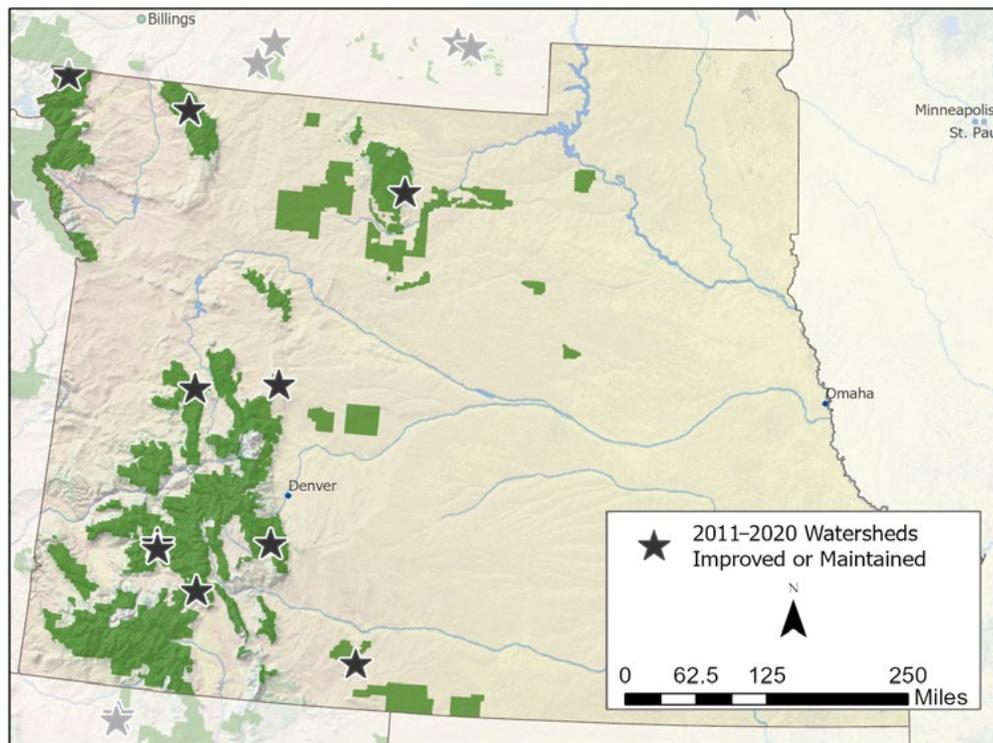
Costs

- Forest Service: \$6,000
- Big Hole Watershed Committee: \$19,000

Rocky Mountain Region

Colorado, Kansas, Nebraska, South Dakota, Wyoming

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- 10 watersheds improved or maintained
- \$653,988 invested in watershed improvement by the Forest Service
- \$338,512 invested in watershed improvement by State, local, Tribal, and national partners

National Forest System Unit	Watershed Improved or Maintained
Bighorn National Forest	Upper Tongue River
Black Hills National Forest	Iron Creek
Grand Mesa, Uncompahgre, and Gunnison National Forests	Coal Creek Marshall Creek Oh-be-Joyful Creek-Slate River
Medicine Bow-Routt National Forest	East Fork Encampment River Upper Middle Crow Creek
Flathead National Forest	Cold Creek Jim Creek Sheppard Creek
Pike and San Isabel National Forests	Minnie Canyon-Purgatorie River West Creek
Shoshone National Forest	Squaw Creek-Clarks Fork Yellowstone River

WATERSHED WORK IN THE ROCKY MOUNTAIN REGION

Recreational Improvements:

- 22 miles of trail
- 182 sites improved

Road Improvements:

- 50 miles decommissioned
- 51 miles improved
- 46 miles of road maintenance

Fuels Improvements:

- 190 acres of prescribed fire or thinning

Aquatic Improvements:

- 10 stream crossings
- 23 miles of improved stream function and habitat
- 12 acres of meadow and wetland restoration
- 82 acres of riparian improvements

Range and Vegetation Improvements:

- 1,133 acres improved through fencing and other rangeland improvements
- 141 acres thinned to improve habitat
- 7 acres of trees planted
- 200 acres improved through fencing

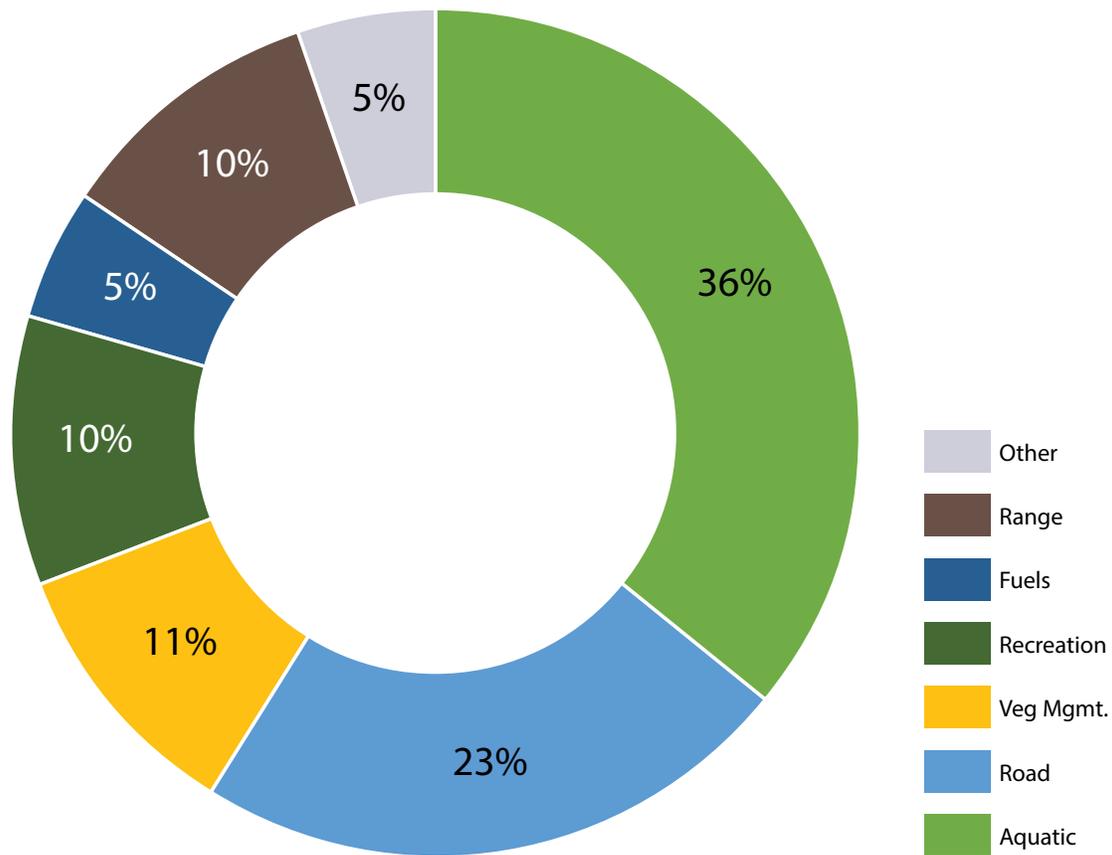


Figure 9. Percent of essential projects by category for Rocky Mountain Region priority watersheds completed, 2011–2020.



Volunteers and Forest Service staff (pictured above) closed 2.3 miles of illegal routes in the Oh-be-Joyful Slate River watershed on the Grand Mesa, Uncompahgre, and Gunnison National Forests in Colorado. Fences and signs (pictured right) were used to close user-created routes. USDA Forest Service photos.



ROCKY MOUNTAIN REGION WATERSHED SPOTLIGHT

East Fork Encampment River, Medicine Bow-Routt National Forest and Thunder Basin National Grassland, Wyoming and Colorado

The East Fork Encampment River watershed has many important resource values. The East Fork Encampment River is tributary to the Encampment River, which has been designated as a Class 1 Outstanding Water by the Wyoming Department of Environmental Quality and is also managed as an eligible wild and scenic river. In addition, a portion of the Mount Zirkel Wilderness is within the boundaries of this watershed. The streams within the watershed are important fisheries, with an abundance of brook and brown trout. The wetlands within this watershed provide potential habitat for a variety of amphibian species, as well as contributing to a rich diversity of plant and aquatic life.

The primary concern within the watershed was aquatic habitat fragmentation due to three streamflow measurement weirs and several road culverts which were acting as barriers to aquatic organism passage. A secondary concern was a dense road network in timber harvest areas located on the eastern and southern portions of the watershed. Most of the roads within timber harvest areas had been closed to the public but remained system roads, so there was still potential for these roads to contribute sediment material to local streams. Another concern was aquatic habitat alterations caused by excessive livestock grazing in some areas, resulting in altered stream channel morphology and riparian and wetland vegetation.



Before (left) and after (right) photos of Coon Creek in the East Fork Encampment River watershed. The weir was a barrier to aquatic organism passage, restricting upriver and downriver movement of fish and other aquatic organisms. After the removal of the weir, fish and other aquatic organisms have unobstructed access to additional habitat. USDA Forest Service photos.

This watershed was selected as a priority because of its important values and the resource concerns that were identified. The many partnerships with groups and individuals, all interested in improving the watershed, also contributed to its being chosen. Over the past decade, watershed conditions have improved through a partnership between the Forest Service, Wyoming Game and Fish Department, and Trout Unlimited. Additional financial support was provided by the Wyoming Wildlife and Natural Resource Trust and the Secure Rural Schools Act (Carbon County) Resources Advisory Committee.

Olson Excavating (Laramie, WY), OneFish Engineering, LLC (Fort Collins, CO). The Forest Service Region 2 Specialty Pack String helped implement the restoration work. Projects to restore fragmented aquatic habitat, restore channel shape and function, improve riparian and wetland vegetation and function, and improve aquatic habitat and water quality via sediment reduction were all implemented.



Wetland area before cattle enclosure fence (left) and after fence installation (right). USDA Forest Service photos.

Unnecessary Forest System road before decommissioning (left) and after restoration (right). USDA Forest Service photos.



Trail maintenance in a wetland area to reduce user impacts on wetland habitat (left) and trail relocation off eroding slope (right). USDA Forest Service photos.

Accomplishments

- Removed three streamflow measurement weirs and one road culvert to restore connectivity to 19.5 miles of fish habitat.
- Fenced an 11-acre expanse of vulnerable wetland/riparian area to protect and improve riparian and wetland conditions.
- Decommissioned 8 miles of unnecessary roads to decrease the amount of fine sediment entering streams (actions were taken to stabilize and restore these unneeded roads to a more natural state).
- Performed maintenance on 7 miles of trail to reduce the sediment being added to local streams.
- Relocated segments of the East Fork Trail so that the trail no longer closely parallels the stream or repeatedly crosses wetlands.
- Approximately 14 acres of streamside and wetland areas are no longer being negatively impacted by the trail.

Partners

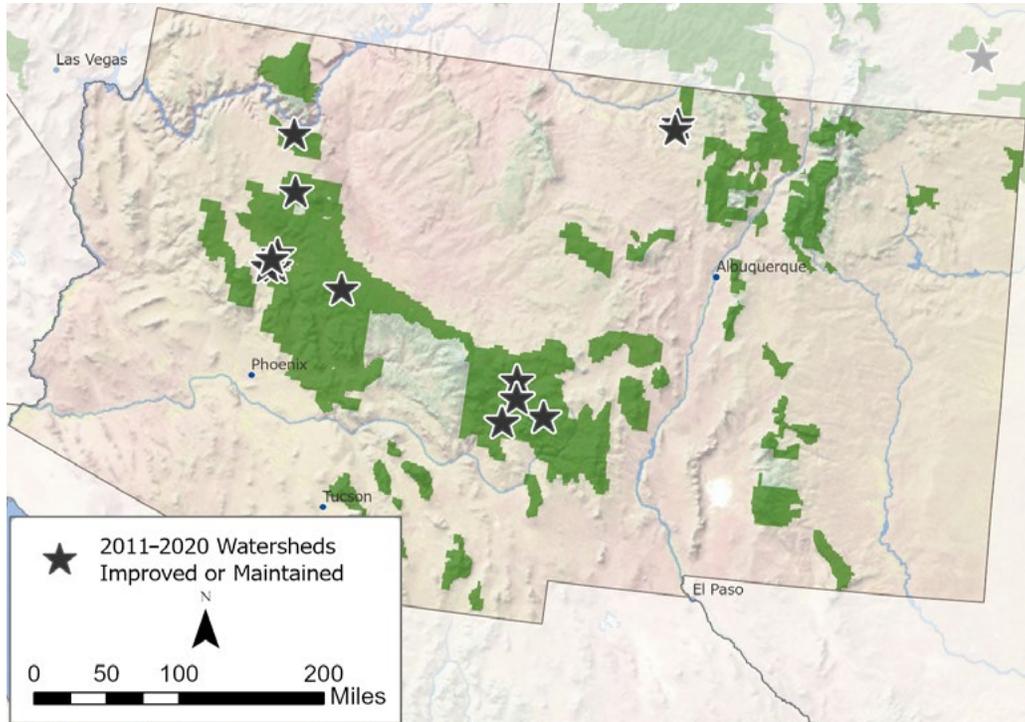
- Wyoming Game and Fish Department
- Trout Unlimited
- Wyoming Wildlife and Natural Resource Trust
- Secure Rural Schools Act (Carbon County) Resources Advisory Committee.
- Olson Excavating (Laramie, WY)
- OneFish Engineering, LLC (Fort Collins, CO)

Costs

- Forest Service: \$101,600
- Partners: \$151,800

Southwestern Region

Arizona, New Mexico



- 13 priority watersheds improved or maintained
- \$3,578,579 invested in priority watershed improvement by the Forest Service
- \$367,380 invested in priority watershed improvement by State, local, Tribal, and national partners

National Forest System Unit	Watershed Improved or Maintained
Carson National Forest	Muñoz Canyon Martinez Canyon-Carrizo Canyon
Coconino National Forest	Barbershop Canyon
Gila National Forest	Snow Canyon Vigil Canyon Outlet Saliz Canyon Big Canyon-San Francisco River
Kaibab National Forest	Coconino Wash Headwaters Upper Spring Valley Wash
Prescott National Forest	Black Canyon Cherry Creek Upper Ash Creek Oak Wash-Verde River

WATERSHED WORK IN THE SOUTHWESTERN REGION

Recreational Improvements:

- 3 miles of trail
- 230 acres of dispersed recreation sites

Road Improvements:

- 70 miles improved
- 72 miles decommissioned

Fuels Improvements:

- 24,462 acres of prescribed fire, thinning, or hazardous fuels reduction
- 27,055 acres of management of wildlife

Aquatic Improvements:

- 1 stream crossing
- 31 acres of gully restoration
- 45 acres of meadow restoration
- 740 acres of riparian habitat

Aquatic Improvements:

- 1,460 acres improved through fencing and other rangeland improvements
- 6,830 acres treated for non-native plants
- 2,530 acres thinned to improve habitat

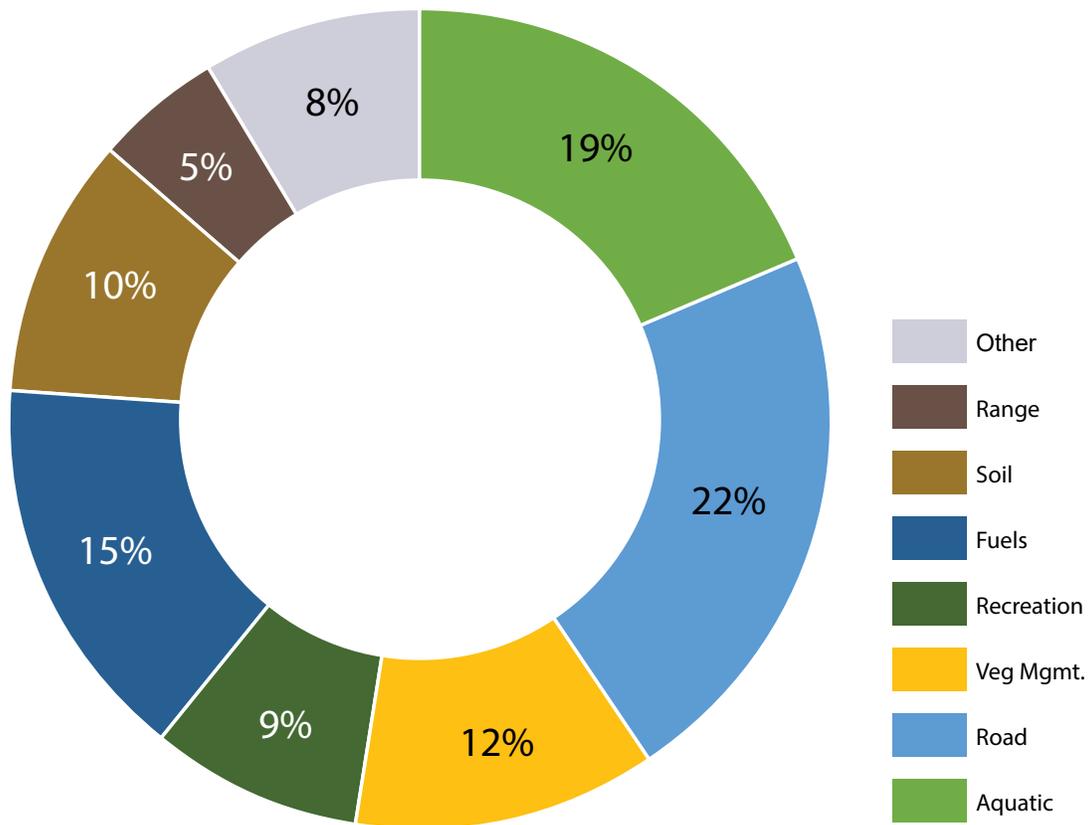


Figure 10. Percent of essential projects by category for Southwestern Region priority watersheds completed, 2011–2020.



The Adair Spring on the Gila National Forest in New Mexico is an important water source for livestock. Before work began in the Big Canyon-San Francisco River watershed, livestock directly utilized the spring head of Adair Spring, resulting in trampled ground and dewatering of the spring and adjacent meadow (left). With support from the Upper Gila Watershed Alliance in the form of a river stewardship grant from the New Mexico Environment Department and donated materials from the oil and gas industry in Farmington, NM, the spring head was fenced and a new, solar-powered well was installed to provide an alternate water source for the livestock (right). USDA Forest Service photos.

SOUTHWESTERN REGION WATERSHED SPOTLIGHT

Oak Wash, Prescott National Forest, Arizona

Oak Wash watershed was identified as a priority watershed in 2015 to address water quality issues stemming from unstable soils and unmanaged past and present land uses. The watershed is in the transitional zone between the Basin and Range and Colorado Plateau physiographic provinces in central Arizona. Headwaters drain the northeasterly flank of Mingus Mountain and the downstream area is in the Verde Valley. The watershed is in the Oak Wash-Verde River 5th level HUC, which drains into the Verde River. The Verde River is the only free-flowing, perennial drainage in central Arizona and is one of two major surface water sources for the Phoenix metropolitan area. The river corridor supports diverse flora and fauna with endangered and sensitive species designations. The Verde River is designated as critical habitat for southwest willow flycatcher, razorback sucker, spikedace, and loach minnow and is proposed critical habitat for narrow-headed garter snake, northern Mexican garter snake, and western yellow-billed cuckoo. The designated National Wild and Scenic River segment of the Verde is below the Oak Wash.

Land uses include grazing, historic mining, timber and fuelwood harvest, wildlife habitat, and recreation. There is one Forest Service campground, Mingus Mountain, and several day-use sites in the basin.

Primary concerns in the watershed are related to soil and water resources and their influence on the Verde River. Water quality issues in the watershed stem from sedimentation associated with inherently unstable limestone and lacustrine parent material. Potential stresses within the watershed include roads, unmanaged recreation, mining, and continuing effects from historic grazing. Forest Service staff

sought to improve the preexisting watershed condition class of “functional at risk” to “proper functioning” (based on WCF metrics).

Staff implemented a broad range of on-the-ground activities and changes in how the resources are managed. This resulted in fewer miles of unauthorized roads, fewer acres of unstable soils disturbed, and more acres and miles of land and waterways protected. Specific actions included road decommissioning, road drainage improvements, recreation site improvements, and trail restoration and reconstruction. Additionally, erosion control measures included juniper and mesquite thinning, spreading slash across the soil surface to protect the soil from accelerated erosion, seeding, wattle installation, and forming mounds on the soil surface (moguling). One spring enclosure was reestablished to alleviate livestock grazing concentration, allow the riparian ecosystem to achieve functional channel characteristics, support riparian vegetation potential,



Abandoned well closure. Managing and closing abandoned wells is an important activity that improves water quality. USDA Forest Service photo.

and recruit large woody debris. Noxious weeds were treated with herbicides and an abandoned well was closed to alleviate potential groundwater contamination. A Comprehensive Environmental

Response, Compensation, and Liability Act (CERCLA) action was used to clean up a historic landfill site and material associated with concentrated firearm shooting.



Moguling (left) was conducted to abate active gully. Spreading slash across the previous road entrance of decommissioned roads helps prevent access and limit erosion (right). USDA Forest Service photos.

Accomplishments

- Decommissioned 8 miles of unauthorized roads where widespread erosion and vegetation loss was occurring.
- Decommissioned 1 mile of system road (FSR 9710E) that had accelerated erosion in the form of active gully.
- Converted four entrances of unauthorized vehicle usage into defined pullout/parking sites.
- Stabilized gullies across 133 acres of land.
- Removed 3 miles of trail and reconstructed an additional 3 miles for soil and water improvements across 13 acres of land.
- Reestablished one spring enclosure to alleviate livestock grazing concentration and improve riparian ecosystem.
- Initiated monitoring on 534 acres for soil condition and rangeland allotment.
- Treated noxious weeds with herbicides across 140 acres of land.
- Closed an abandoned well to alleviate potential groundwater contamination.
- Used a CERCLA action to clean up a historic landfill site and material associated with concentrated firearm shooting across 20 acres of land.

Partners

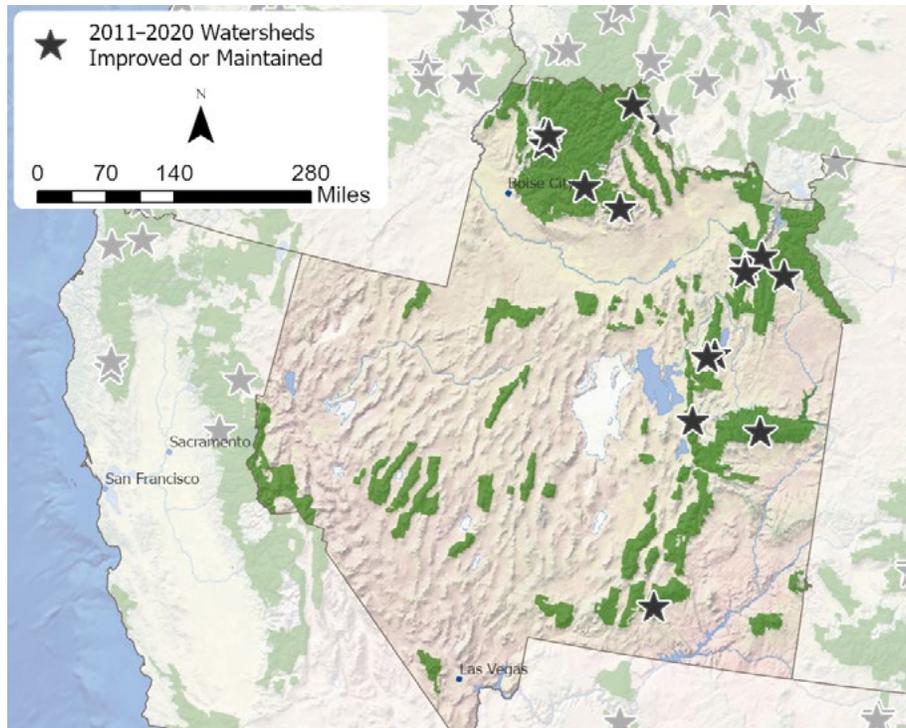
- Youth Conservation Corps
- Arizona State Parks and Trails

Costs

- Forest Service: \$670,000
- Partners: \$23,000

Intermountain Region

Idaho, Nevada, Utah, Wyoming



- 15 priority watersheds improved or maintained
- \$2,505,631 invested in priority watershed improvement by the Forest Service
- \$1,661,213 invested in priority watershed improvement by State, local, Tribal, and national partners

National Forest System Unit	Watershed Improved or Maintained
Ashley National Forest	Swift Creek
Boise National Forest	Bull Creek Curtis Creek Stolle Creek-South FOrk Salmon River
Bridger-Teton National Forest	Muddy Creek Fall Creek
Caribou-Targhee National Forest	Jackknife Creek Jensen Creek-McCoy Creek
Dixie National Forest	Birch Creek
Salmon-Challis National Forest	Upper Star Hope Creek Moose Creek
Sawtooth National Forest	Pole Creek
Uinta-Wasatch-Cache National Forest	Left Hand Fork Blacksmith Fork Canyon Saddle Creek Headwaters Mill Creek

WATERSHED WORK IN THE INTERMOUNTAIN REGION

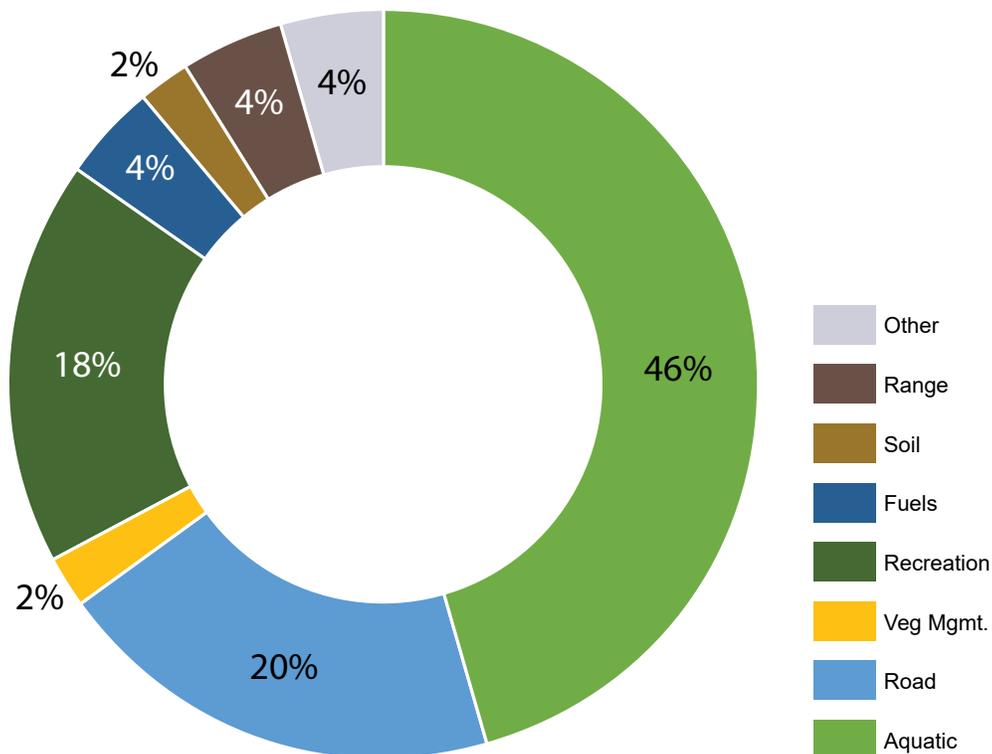


Figure 11. Percent of essential projects by category for Intermountain Region priority watersheds completed, 2011–2020.

Recreational Improvements:

- 62 miles of trail
- 102 acres of dispersed recreation sites

Road Improvements:

- 90 miles decommissioned
- 26 miles improved

Aquatic Improvements:

- 140 acres of trees planted
- 265 acres improved through fencing and other rangeland improvements

Aquatic Improvements:

- 169 stream crossings
- 10 acres of riparian habitat
- 16 acres of meadow or wetland restoration
- 15 miles of stream restoration

Fuels Improvements:

- 5,315 acres of prescribed fire

Soil Improvements:

- 5 acres of erosion control

INTERMOUNTAIN REGION WATERSHED SPOTLIGHT

Mill Creek, Uinta-Wasatch-Cache National Forest, Utah

A project to restore Mill Creek and its native fish population was initiated in 2011. The scope of the project was identified, and a public involvement plan was developed. Mill Creek was selected as a priority watershed to improve habitat for the native Bonneville cutthroat trout, and to improve access and use of a high-profile recreation area next to a large population center. Websites helped the public track the project's progress, and onsite tours have been given to local public officials, legislative staffers, and the media. Several media stories have been written about the project.

The total cost of watershed restoration work, once completed, is estimated to be about \$2.5 million. All essential projects have been completed on NFS land and the watershed was reported as complete in 2019, but there are some additional projects that could be completed on private land. The Forest Service has contributed about \$1 million in funds, while over 20 different partners have contributed more than \$1 million towards project costs. Many volunteers worked on the project and private companies donated supplies and labor.



The upper Greys River-Spring Creek watershed on the Bridger-Teton National Forest in Wyoming suffered from deferred road maintenance for many years. Sedimentation issues and degraded fish spawning conditions from the existing road network and several aquatic organism passage (AOP) barriers negatively impacted native Snake River fine-spotted cutthroat trout habitat. Left photo: A perched 12-foot AOP barrier on Greys River creating a large scour pool below the structure. The structure blocked fish passage to upstream tributaries and the main stem of the Greys River, blocking approximately 15 miles of high-quality Snake River fine-spotted cutthroat trout spawning habitat. Right photo: The newly installed 52-foot bridge in place of the previously perched culvert on the Greys River now enables successful fish passage to the Greys River headwaters. The scour pool was filled in with boulders and grade control structures were placed downstream and upstream of the new bridge. Willows were planted on the banks by Trout Unlimited volunteers and Bridger-Teton fisheries biologists. USDA Forest Service photo (left). Trout Unlimited photo (right).



Culvert replacements went from undersized pipes (left) to enlarged box culverts (right) to improve AOP. USDA Forest Service photos.

An abandoned, 14-foot-high dam was removed (top left) and the stream channel morphology restored (top right). Riparian vegetation returned (bottom left) and, finally, a new boardwalk was installed (bottom right). The new boardwalk enhanced stream access for the public while preserving riparian vegetation. USDA Forest Service photos.



A diversion weir (left) was eliminated by building up the streambed to allow fish to swim over the barrier (right). USDA Forest Service photos.

Accomplishments

- Restored native fish populations in 12 miles of stream (including removal of nonnative fish species).
- Installed a fish migration barrier at the mouth of the canyon to avoid repopulation of the drainage with nonnative brown trout.
- Improved AOP and runoff capacity on NFS lands by replacing 10 culverts and removing a weir and an abandoned 14-foot-high dam.
- Improved AOP across a historic weir on private lands.
- Replaced a 25-year-old boardwalk to enhance stream access for the public while preserving riparian vegetation.
- Provided education and improved recreation opportunities for the public.
- Maintained and improved riparian conditions around picnic areas.
- Removed nonnative weed species in the drainage.

Partners

- Utah Division of Wildlife Resources
- National Forest Foundation
- U.S. Fish & Wildlife Service
- PacifiCorp
- Great Salt Lake Council of Boy Scouts of America
- Trout Unlimited (National)
- Utah Council Trout Unlimited
- Stonefly Society
- Salt Lake County
- Salt Lake City
- Utah Anglers Coalition
- Flying Cloud Enterprise, Inc.
- Western Native Trout Initiative
- PacifiCorp
- Bonneville Cutthroat Trout Conservation Team
- George S. and Dolores Dore Eccles Foundation
- Richard K. and Shirley S. Hemingway Foundation
- Utah Habitat Council
- Weber Basin Job Corp Welding Department
- Dominion Energy
- Boeing
- EcoVantage
- USDA Forest Products Laboratory
- Lonza Wood Protection
- Simpson Strong Tie

Costs

- Forest Service: \$1,000,000
- Partners: \$1,000,000
- Donated supplies and labor: \$500,000

Pacific Southwest Region

California, Hawaii



- 6 priority watersheds improved or maintained
- \$1,114,627 invested in priority watershed improvement by the Forest Service
- \$550,300 invested in priority watershed improvement by State, local, Tribal, and national partners

National Forest System Unit	Watershed Improved or Maintained
Klamath National Forest	Canyon Creek
Mendocino National Forest	Bear Creek-Elk Creek Thatcher Creek
Plumas National Forest	Big Grizzly Creek
Six Rivers National Forest	Bluff Creek
Tahoe National Forest	Peavine-North Fork/Middle Fork American River

WATERSHED WORK IN THE PACIFIC SOUTHWEST REGION

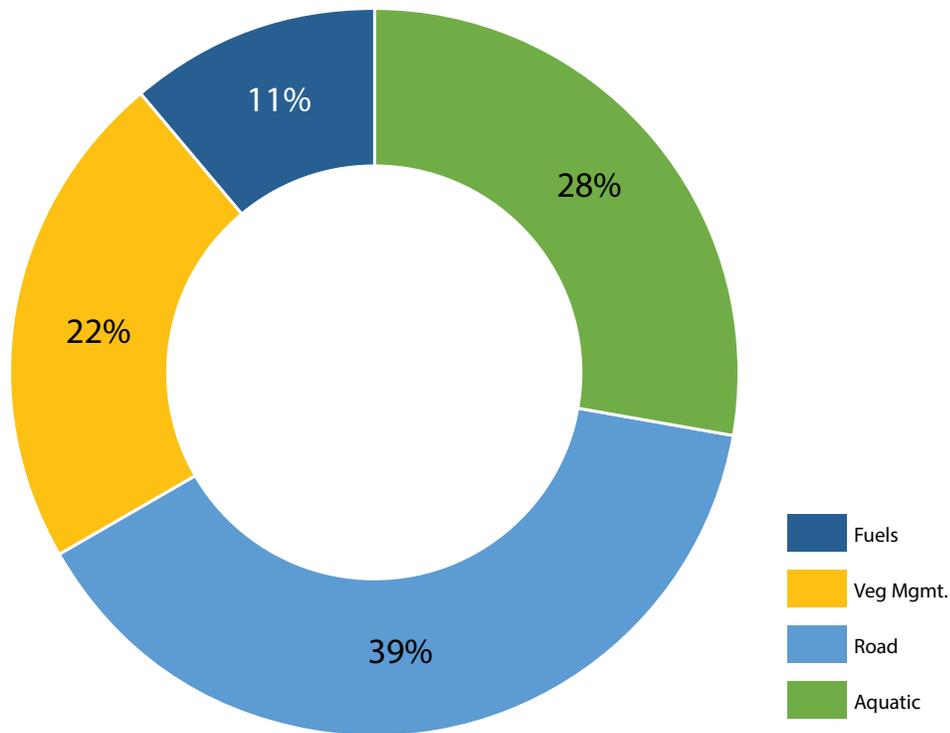


Figure 12. Percent of essential projects by category for Pacific Southwest Region priority watersheds completed, 2011–2020.

Recreational Improvements:

- 30 miles decommissioned
- 30 miles improved

Aquatic Improvements:

- 1 stream crossing
- 23 acres of meadow restoration

Fuel Improvements:

- 1,280 acres of thinning

Vegetation Improvements:

- 40 acres of nonnative plant treatment
- 3 acres of revegetation
- 260 acres of thinning



On Six Rivers National Forest in California, roads are a leading source of management-related sediment inputs and are predominantly associated with mass wasting features such as shallow debris slides and debris torrents. Much road-related erosion and sediment delivery occur with large storm events that trigger culvert failures, stream diversions, and mass wasting such as debris slides and smaller slumps within the roadbed. In the Bluff Creek watershed, road decommissioning is a key tactic for reducing sediment input to streams. One section of FSR 11N19 was decommissioned by removing a culvert (top) and recontouring to a more natural stream channel morphology (bottom). USDA Forest Service photos.

PACIFIC SOUTHWEST REGION WATERSHED SPOTLIGHT

Deer Creek-North Yuba River, Tahoe National Forest, California

The Yuba Project on the Tahoe National Forest is in progress in the headwaters of the North Yuba River within the Deer Creek-North Yuba River priority watershed. The project covers over 7,000 acres of treatments including meadow restoration, removal of encroaching conifers in meadows and aspen stands, road decommissioning and road drainage improvements, development of an off-channel water source, and thinning and fuels reduction for forest health. Implementation began in 2018 and is now over 70 percent complete. Meadow conifer removal will be complete in 2021 and additional meadow channel restoration is currently in the planning phase with implementation expected in 2023.

An accelerated implementation schedule for the project was made possible with the help of over a dozen partners including Blue Forest Conservation, National Forest Foundation, Yuba Water Agency, State of California, Sierra County, South Yuba River Citizens League, and American Rivers. Blue Forest is a key partner and creator of the Forest Resilience Bond, which was piloted on the Yuba Project. The bond provides upfront funding for implementation using private capital investments which are reimbursed by stakeholders benefitting from the environmental and societal improvements of the project. This accelerates the pace of implementation. The bond helped fund most of the project while



Removal of encroaching conifers in a meadow promotes replacement with wetland vegetation and habitat. USDA Forest Service photo.



Commercial thinning of forest stands reduces the buildup of fuels that contribute to high-severity wildland fire which can destabilize soils and create sediment runoff into adjacent streams. USDA Forest Service photo.

additional work on meadows and roads were funded through more conventional grants and partnerships. Over \$4 million in outside funding was obtained for implementation.

The success of the Forest Resilience Bond model in this project has resulted in a large partnership-driven planning effort to improve forest and watershed conditions throughout the entire 275,000-acre North Yuba River watershed.

Accomplishments

- Restored 72 acres of meadow.
- Removed 318 acres of conifer trees in meadow habitats.
- Completed commercial thinning across 1,171 acres.
- Removed conifer trees from 125 acres of aspen stands.
- Improved 15 miles of road.

Partners

- Blue Forest Conservation
- National Forest Foundation
- Yuba Water Agency
- State of California
- Sierra County
- South Yuba River Citizens League
- American Rivers

Costs

- \$4 million Forest Resilience Bond invested as of 2020



Off-channel water sources help reduce grazing impacts on stream banks and adjacent riparian areas by providing livestock with a steady water supply. USDA Forest Service photo.



Removal of encroaching conifers in aspen stands promotes aspen replacement. Aspen are a key species for riparian ecologic function. USDA Forest Service photo.



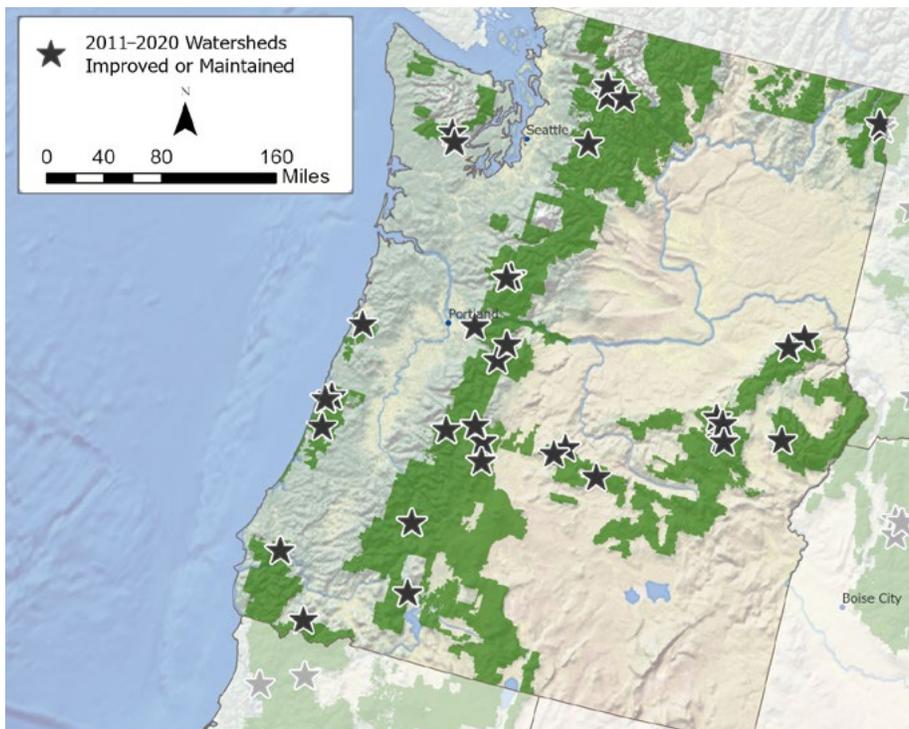
Prescribed fire (control line pictured here) is a key tactic used to reduce overloaded fuels in forest stands. Overloaded fuels contribute to high-severity fire which can lead to increased sedimentation of impacted soils to adjacent streams. USDA Forest Service photo.



Road drainage improvement helps reduce sediment runoff from roads and increases the longevity of the road by reducing erosion during storm events. USDA Forest Service photo.

Pacific Northwest Region

Oregon, Washington



- 34 priority watersheds improved or maintained
- \$16,575,488 invested in priority watershed improvement by the Forest Service
- \$12,060,450 invested in priority watershed improvement by State, local, Tribal, and national partners

National Forest System Unit	Watershed Improved or Maintained
Columbia River Gorge National Scenic Area	Latourell Creek
Colville National Forest	East Branch LeClerc Creek West Branch LeClerc Creek
Deschutes National Forest	Lower Lake Creek Upper Whychus Creek
Fremont-Winema National Forest	Sevenmile Creek
Gifford Pinchot National Forest	Lower Clear Creek Lower Muddy River
Mt. Baker-Snoqualmie National Forest	Upper South Fork Skykomish River Sulphur Creek Big Creek Circle Creek-Suiattle River
Mt. Hood National Forest	Upper West Fork Hood River Still Creek
Ochoco National Forest	Crazy Creek-Deep Creek Opal Creek Upper McKay Creek
Olympic National Forest	South Fork Skokomish River
Rogue River-Siskiyou National Forest	Headwaters South Fork Coquille River Grayback Creek
Siuslaw National Forest	Farmer Creek-Nestucca River Lower Drift Creek (Alsea River) Upper North Fork Siuslaw River Eckman Creek-Alsea River
Umatilla National Forest	Upper North Fork Touchet Cummings Creek
Wallowa-Whitman National Forest	Lower Meadow Creek Middle Meadow Creek North Fork Catherine Creek Sheep Creek Chicken Creek
Willamette National Forest	Staley Creek Marion Creek Soda Fork

WATERSHED WORK IN THE PACIFIC NORTHWEST REGION

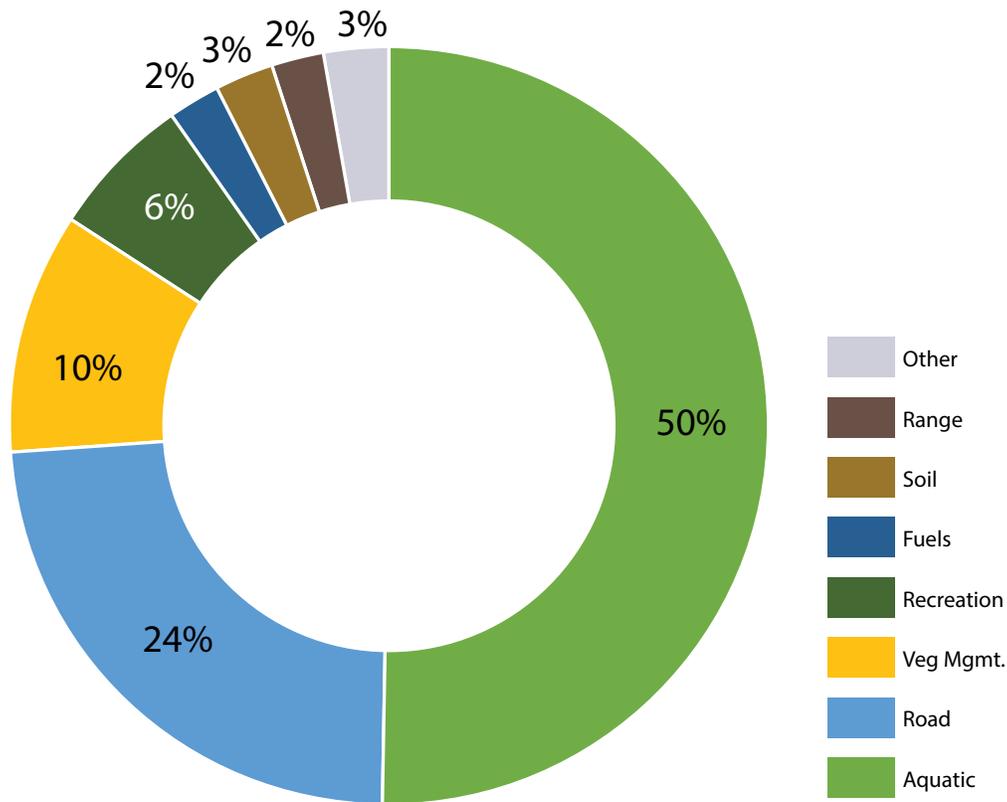


Figure 13. Percent of essential projects by category for Pacific Northwest Region priority watersheds completed, 2011–2020.

Recreational Improvements:

- 60 miles of trail improvement
- 36 acres of dispersed recreation sites

Road Improvements:

- 237 miles improved
- 261 miles decommissioned

Fuel Improvements:

- 1,358 acres of prescribed fire or thinning

Aquatic Improvements:

- 90 stream crossings
- 853 acres of meadow or wetland restoration
- 1,508 acres of riparian habitat
- 98 miles of stream restoration

Range and Vegetation Improvements:

- 5,912 acres treated for nonnative plants or thinned
- 10 acres improved through fencing



Partners invested \$1.7 million in the Sheep Creek watershed (top left) on the Wallowa-Whitman National Forest in Oregon. Work included wood placement for stream channel function (top right) and upgrading aquatic organism passage structures to provide increased habitat connectivity (left). USDA Forest Service photos.

PACIFIC NORTHWEST REGION WATERSHED SPOTLIGHT

Cougar Creek-South Fork McKenzie River, Willamette National Forest, Oregon

The Lower South Fork McKenzie River and its broad alluvial valley were once an ecological hotspot supporting spring Chinook salmon and bull trout (listed as threatened under the Endangered Species Act [ESA]). The area succumbed to degradation and incision after construction of Cougar Dam and extensive levees, as well as a long history of logging and in-stream wood removal. Partners recognize

that the watershed has tremendous potential for ecological uplift as one of the only large river valleys located entirely on federally managed land with minimal infrastructure. Given this context, restoration here provides a unique opportunity to give the river back to its valley.

Large-scale, interdisciplinary projects implemented across the landscape aim to restore watershed

processes and connectivity. These projects increase ecosystem resilience through culvert removal, wildlife habitat enhancements, weed treatments, riparian planting, thinning, fuels reduction, recreation improvements, and youth employment and education. An ambitious 600-acre valley reconstruction project on the Lower South Fork is a keystone of the efforts. The first two phases, completed in 2018 and 2019, restored full hydrologic connectivity and complexity to 200 acres through removal of levees, filling and aggrading the incised channel, and placement of large wood.

The Lower South Fork valley reconstruction project is applying an innovative approach to restoration, known as Process-Based Restoration to Stage 0.⁷ Learning and adaptive management is an essential component. Extensive physical and biological monitoring and research from multiple agencies and universities at this and other projects in the Pacific Northwest should help inform future valley-scale

restoration at other locales. Initial results from the “South Fork Laboratory” are intriguing and encouraging. Partners plan to complete the 600-acre project on the South Fork and continue similar work on an additional 1,400 acres of the Middle McKenzie River Valley over the next 10 years in hopes of improving watershed function and water quality, increasing biodiversity and resilience to climate change, and making a significant contribution to the recovery of ESA-listed fish.

In fall 2020, the Holiday Farm Fire burned 173,000 acres of the McKenzie River subbasin, along with several other megafires in Oregon’s worst fire season on record. Observations indicate that hydrologic connectivity and geomorphic and vegetative complexity is greater in the project area, and the fire burned more as a mosaic. In areas outside of the project, where there was less hydrologic connectivity, the fire burned more intensely and uniformly. Studies are being conducted to test these observations.



Observations after the 2020 Holiday Farm Fire indicate that healthy watersheds (top left) can reduce the intensity of wildland fire compared to areas with less hydrologic connectivity (top right). Filling of incised stream channels (bottom left) and placement of large wood (bottom right) restore hydrologic connectivity and complexity to support the recovery of ESA-listed fish. USDA Forest Service photos.

Initial Monitoring Results

- Reconnected and restored 200 acres of river valley.
- A 41-fold increase in large woody material.
- A 3-fold increase in base flow wetted area.
- A 5-fold increase in fish density.
- A 3- to 10-fold increase in suitable salmonid and lamprey rearing habitat.
- A 36-fold increase in suitable salmonid and lamprey spawning habitat.
- A 6-fold increase in the number of spring Chinook salmon redds (depressions created by female salmon for laying eggs).
- Restoration reach changed from having one of the lowest redd densities to the highest by far within the McKenzie subbasin.
- Increased resilience to wildfire.

Accomplishments

- Restored 8 miles (200 acres) of stream.
- Removed 1 culvert to restore AOP.
- Improved 309 acres of wildlife habitat.
- Performed weed and invasive plant treatment on 425 acres.
- Planted vegetation on 10 acres of riparian zone.
- Improved 466 acres of timber stands through planting, thinning, and fuels reduction.
- Performed fuels reduction and wildfire mitigation across 516 acres of land.

Partners

- McKenzie Watershed Council
- Oregon Watershed Enhancement Board
- U.S. Fish & Wildlife Service
- Bonneville Power Administration
- Pacific States Marine Fisheries Commission
- Drinking Water Providers Partnership
- National Fish and Wildlife Foundation
- Intel Corporation
- Lane County Wetland Mitigation
- Eugene Water & Electric Board
- Oregon Department of Fish and Wildlife
- Oregon State University
- Colorado State University
- Lane Metro Youth Crew
- Northwest Youth Corps
- Youth Conservation Corps
- McKenzie High School

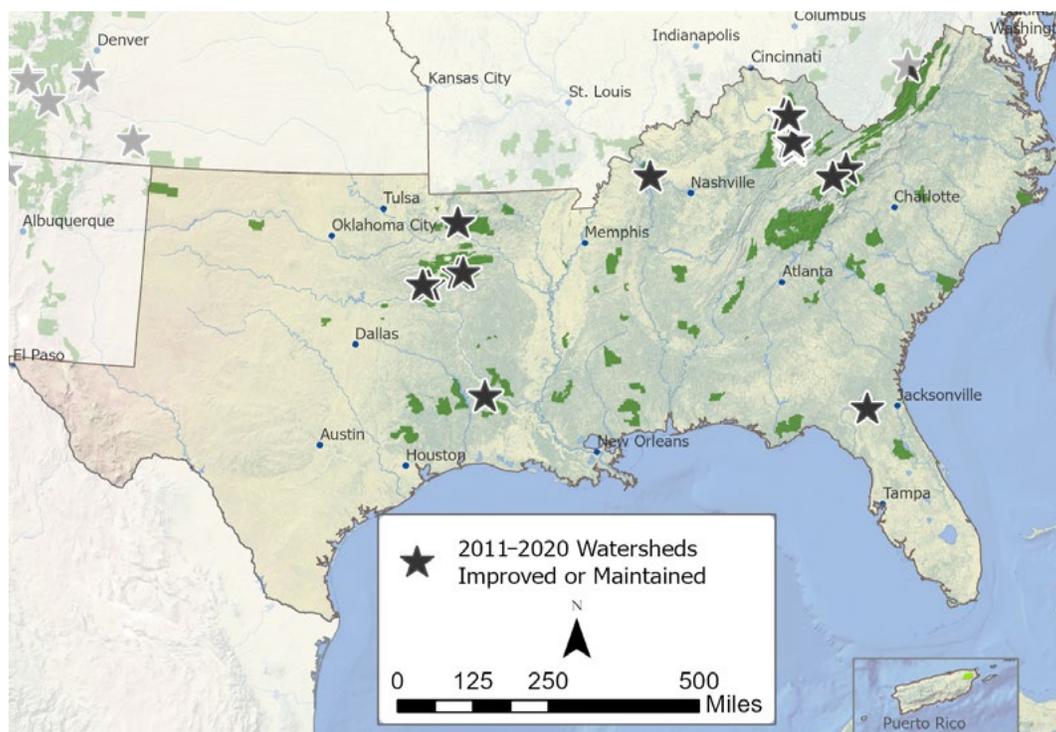
Costs

- Forest Service: \$600,000
- Contracted services: \$1.9 million

Southern Region

Arkansas, Alabama, Georgia, Florida, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, Tennessee, Texas, South Carolina, Virginia, Puerto Rico

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- 19 watersheds improved or maintained
- \$7,426,491 invested in priority watershed improvement by the Forest Service
- \$924,157 invested in priority watershed improvement by State, local, Tribal, and national partners

National Forest System Unit	Watershed Improved or Maintained
Cherokee National Forest	Nolichucky River-Clark Creek Watauga Lake
Daniel Boone National Forest	Clifty Creek-Red River Gladie Creek-Red River Indian Creek-Red River Phillips Fork-Red Bird River Bowen Creek-Red Bird River Big Double Creek-Red Bird River Big Creek Hector Branch-Red Bird River Swift Camp Creek
Kisatchie National Forest	Steep Hill Creek-Kisatchie Bayou
Land Between the Lakes National Recreation Area	Dry Creek-Cumberland River
National Forests of Florida	Impassable Bay
Ouachita National Forest	Carter Creek Holly Creek Mountain Fork Middle South Fork Ouachita River Upper South Fork Ouachita River
Ozark-St. Francis National Forests	Fleming Creek-White River

WATERSHED WORK IN THE SOUTHERN REGION

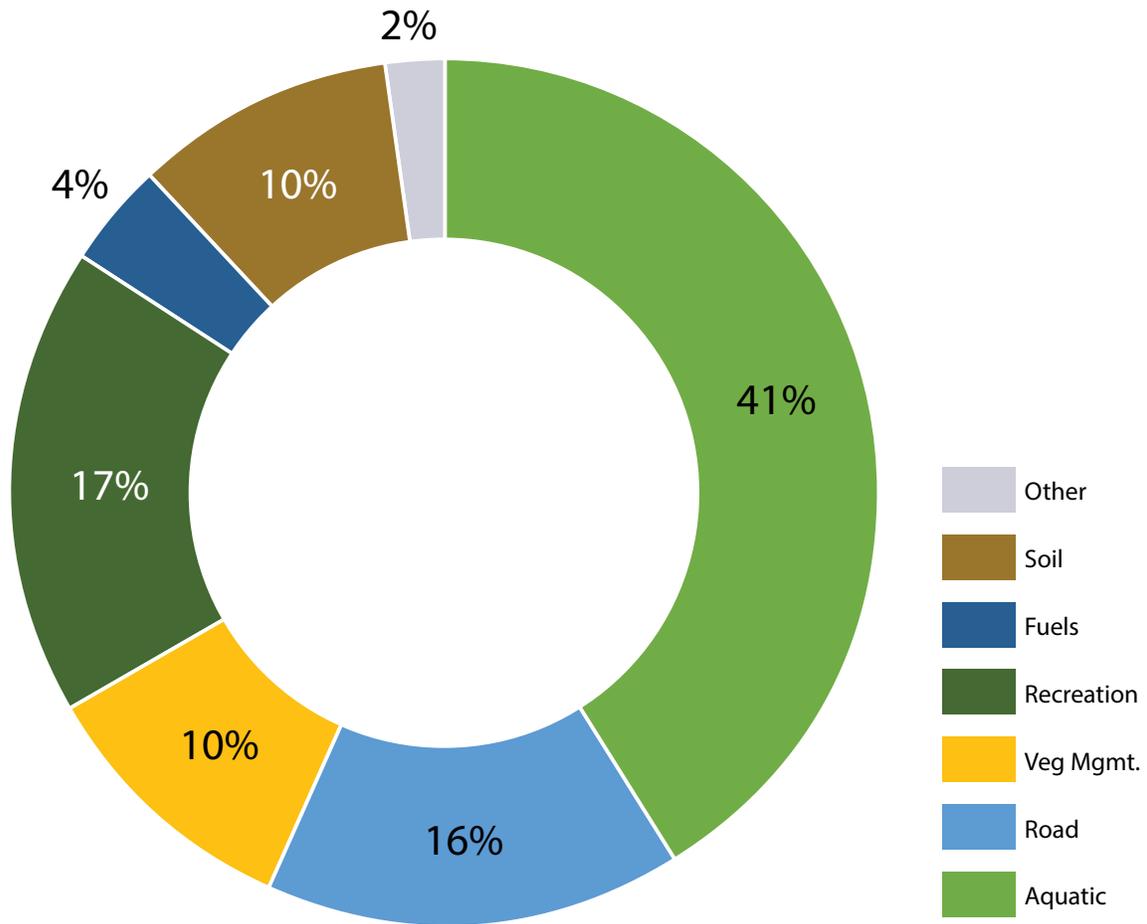


Figure 14. Percent of essential projects by category for Southern Region priority watersheds completed, 2011–2020.

Road Improvements:

- 461 miles improved
- 2 miles decommissioned

Recreational Improvements:

- 20 miles of trail
- 429 acres of dispersed recreation sites

Fuel Improvements:

- 47,636 acres of prescribed fire

Soil and Vegetation Improvements:

- 270 acres treated for non-native vegetation
- 256 acres of erosion control
- 132 acres of revegetation

Aquatic Improvements:

- 28 stream crossings
- 219 miles of stream restoration and water quality improvement



Forest Service staff (top) and volunteers (bottom) removed trash from 11 miles (133 acres) of streams in the Swift Camp Creek Watershed on the Daniel Boone National Forest in Kentucky to improve water quality. The watershed is in the Red River Gorge, known for its free-flowing streams, abundant natural stone arches, unusual rock formations, and spectacular sandstone cliffs. Special designations within the area include the Red River Gorge Geological Area, National Wild and Scenic River, State Wild River, Outstanding National Resource Water, Clifty Wilderness, National Natural Landmark, National Archaeological District, and a National Scenic Byway. The EPA 319 Grant Program helped fund this work, along with the efforts of partners including the Kentucky Division of Water, Kentucky Department of Fish and Wildlife Resources, Kentucky Waterways Alliance, Red River Gorge Trail Crew, Wolfe County local government, Student Conservation Association, American Conservation Experience, and the Friends of the Red River. USDA Forest Service photos.

SOUTHERN REGION WATERSHED SPOTLIGHT

Upper South Fork Ouachita River Watershed, Ouachita National Forest, Arkansas

The Upper South Fork Ouachita River watershed was classified in 2010 as “functioning properly” in the Watershed Condition Framework despite an “impaired function” subscore for the road and trail network. As early as 2011, the watershed was designated by the Ouachita National Forest as a priority watershed due to the high density of unpaved roads, its utilization as a municipal water source (Mt. Ida, AR), and because it forms the headwaters above known populations of Arkansas fatmucket (*Lampsilis powellii*), a federally listed threatened freshwater mussel.

In 2015, an updated Watershed Restoration Action Plan (WRAP) for the Upper South Fork Ouachita River identified several roads needing improvements,

including resurfacing and culvert replacements. Many of these improvements were made in concert with timber sales to improve haul routes. During a closeout inspection of the watershed, an additional project, Road 68, was identified and added to the WRAP.

Road 68 shares the valley bottom with the headwaters of the South Fork Ouachita River. Numerous channels flow from the surrounding uplands to form the incipient perennial stream. Due to the flat topography, the stream utilized the natural stream channel, the roadside ditches, and even the road itself as the preferential flow path. To correct flow conditions, reduce erosion, and improve water quality, the Road 68 Project entailed reconstructing

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Road 68 before reconstruction with little elevation difference between the stream, ditch, and road surface. Culverts were damaged and occluded. The unvegetated roadway acted as the preferred water flow route during storm events as evidenced by potholes and washboard. USDA Forest Service photo.



Road 68 after reconstruction is elevated above the surrounding terrain and provides adequate cover above right-sized culverts. Flat-bottom ditches reduce erosion and efficiently convey water without concentrating flow. USDA Forest Service photo.

1 mile of graveled system road by elevating the road surface more than 1 foot above the surrounding terrain, construction of flat-bottom ditches, and enlarging cross-draining culverts. Finally, a 0.25-mile section of Road 68 that was being directly impacted by impinging flows of the South Fork Ouachita River was relocated to a benched hillside to reduce bank erosion and improve long-term stability of the road.

An additional \$25,000 of 2018 Joint Chiefs Landscape Restoration Partnership funds was directed toward the reconstruction of Road 68. In 2018, the watershed was reevaluated, and all projects identified in the WRAP, including Road 68, were certified as completed. The watershed remains classified as “functioning properly,” and the road and trail network subscore is improved one class to “functioning at risk.”



Road 68 before relocation paralleling the South Fork Ouachita River. Flow is from the top of the photo to the bottom. During high-flow events, the stream would impinge on the bank and undermine the roadway. Bank- and road-derived sediment would enter the stream and travel downstream where it could impact known populations of the Arkansas fatmucket. USDA Forest Service photo.



Following relocation, Road 68 is shown upslope and away from the South Fork Ouachita River (within the tree line). Roots and slash are seen along the relic roadbed. High flows no longer impinge on the roadway and a vegetated buffer reduces sediment delivery from the roadway to the stream. USDA Forest Service photo.

Accomplishments

- Improved 13 miles of road.
- Improved 65 acres of aquatic habitat.

Partners

- Montgomery County
- Arkansas State University
- Arkansas Game and Fish Commission

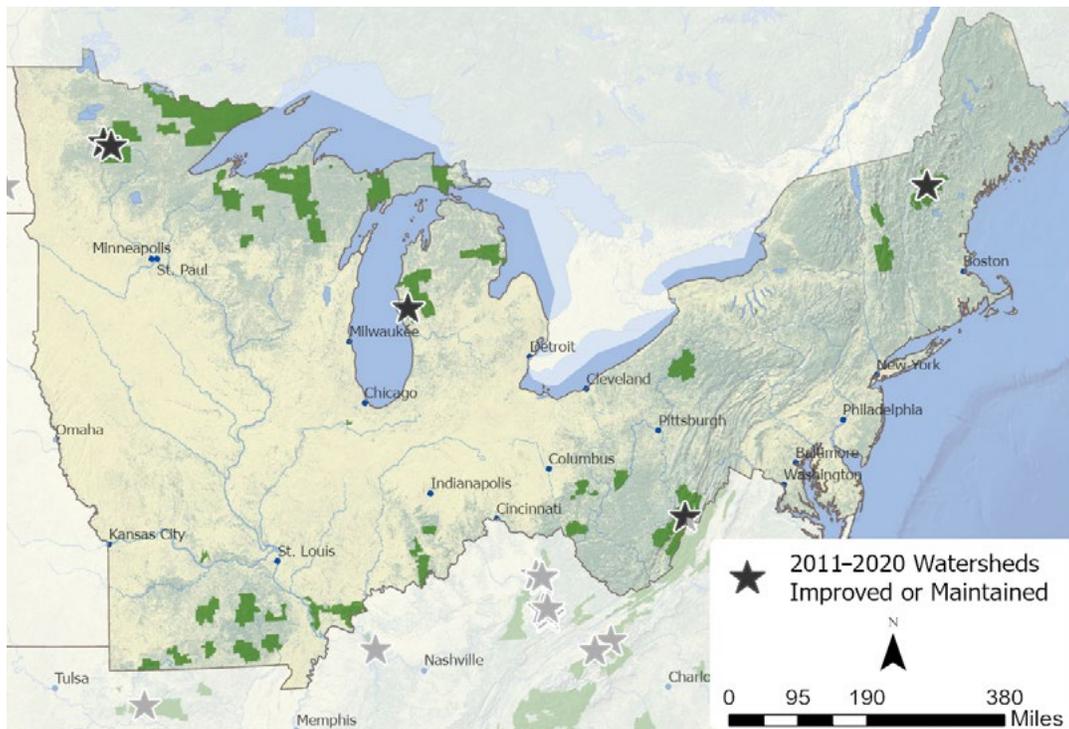
Costs

- Forest Service: \$413,361
- In-kind contribution for postproject monitoring by partners

Eastern Region

Illinois, Indiana, Michigan, Minnesota, Missouri, Ohio,
Pennsylvania, Vermont, West Virginia, Wisconsin

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- 5 priority watersheds improved or maintained
- \$1,874,400 invested in priority watershed improvement by the Forest Service
- \$821,350 invested in priority watershed improvement by State, local, Tribal, and national partners

National Forest System Unit	Watershed Improved or Maintained
Chippewa National Forest	Cass Lake Portage Creek
Huron-Manistee National Forest	Osborn Creek-North Branch White River
Monongahela National Forest	East Fork Greenbriar River
White Mountain National Forest	Headwaters Ammonoosuc River

WATERSHED WORK IN THE EASTERN REGION

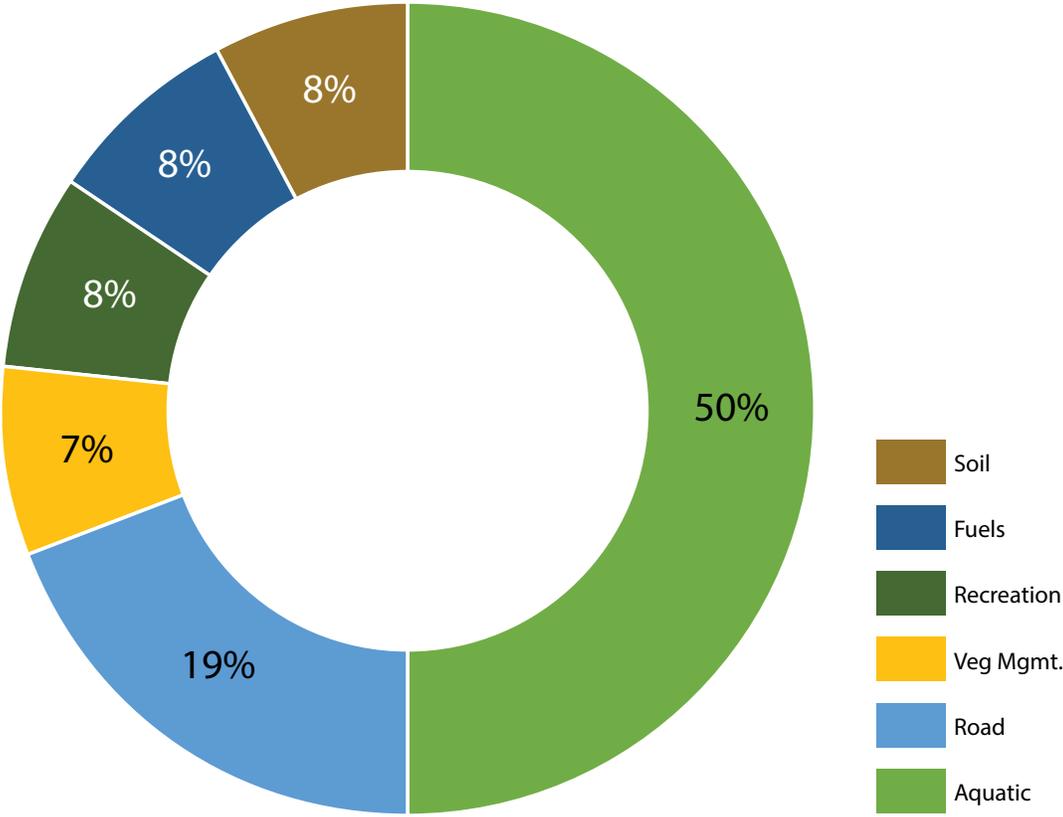


Figure 15. Percent of essential projects by category for Eastern Region priority watersheds completed, 2011–2020.

Recreational Improvements:

- 4 miles of trail improvement

Road Improvements:

- 12 miles improved
- 21 miles decommissioned

Fuel Improvements:

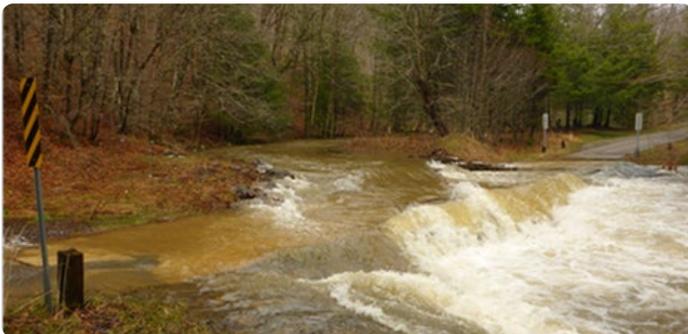
- 2,699 acres of fuel treatment

Aquatic Improvements:

- 14 stream crossings and 1 dam removal
- 27 miles of stream restoration
- 199 acres of riparian improvement

Range and Vegetation Improvements:

- 3 acres of erosion control or soil improvement
- 17 acres treated for nonnative vegetation



The Monongahela National Forest in West Virginia has worked in partnership with Trout Unlimited to implement various essential projects in designated priority watersheds. Partnership accomplishments during FY 2019 included the completion of two aquatic organism passage (AOP) projects in WCF priority watersheds that reconnected 23 miles of high-quality stream habitat for populations of brook trout and other native coldwater-associated species such as the federally listed (endangered) candy darter and eastern hellbender, listed as a Regional Forester Sensitive Species. Pictured at left, AOP project site WF15 in the Little River priority watershed is shown during preproject base flow condition (top), preproject bankfull flow condition (middle), and postproject implementation base flow condition (bottom). Simulation design for road-stream crossing structures reduces risks to public safety and vital infrastructure, restores continuity of inherent stream functions such as aquatic habitat connectivity, and improves soil and water quality. These project results greatly reduce the frequency and cost associated with infrastructure maintenance while enhancing the resiliency of aquatic ecosystems. Proactively managing for benefits such as these becomes increasingly important with changing climate that can produce more frequent environmental irregularities and extremes (e.g., stream flows and temperatures). USDA Forest Service photos.

EASTERN REGION WATERSHED SPOTLIGHT

South Branch Pine River Watershed, Huron-Manistee National Forest, Michigan

The South Branch Pine River watershed, located in northeastern Lower Michigan, is part of the greater Au Sable River watershed (Lake Huron). The South Branch Pine River is a priority watershed due to the high economic and ecological value of its coldwater and coolwater fisheries. Buhl Dam, situated on national forest lands, was identified as the primary concern in the watershed. The existing dam and structures were in poor-to-failing condition, impeding aquatic organism passage (AOP) and altering the flow of the river.

The goal of this project was to restore natural stream function and improve pedestrian access across the river. The South Branch Pine River provides quality coldwater fish habitat for brook, brown, and rainbow

trout. Additionally, the area is used locally for fishing, hunting, and other recreational activities. During the summer of 2017, the dam and existing structures were removed, the floodplain reconnected, and a new footbridge installed. Approximately 29 miles of upstream habitat were reconnected for AOP, 500 feet of floodplain were reconnected, and 2,500 feet of trail were enhanced.

This project was made possible with funds and other support from Great Lakes Restoration Initiative, Huron Pines, Michigan Department of Natural Resources, National Fish and Wildlife Foundation, Pine River-Van Etten Lake Watershed Coalition, and the U.S. Fish & Wildlife Service.



Buhl Dam (left) presented an obstacle to aquatic organism passage. A new pedestrian footbridge replaced the previous dam (right) and now provides improved AOP and visitor access. USDA Forest Service photos.

Accomplishments

- Improved 2,500 feet of trail.
- Replaced a relict dam with new footbridge for improved AOP.
- Reconnected 29 miles of upstream habitat for AOP.
- Reconnected 500 feet of floodplain.

Partners

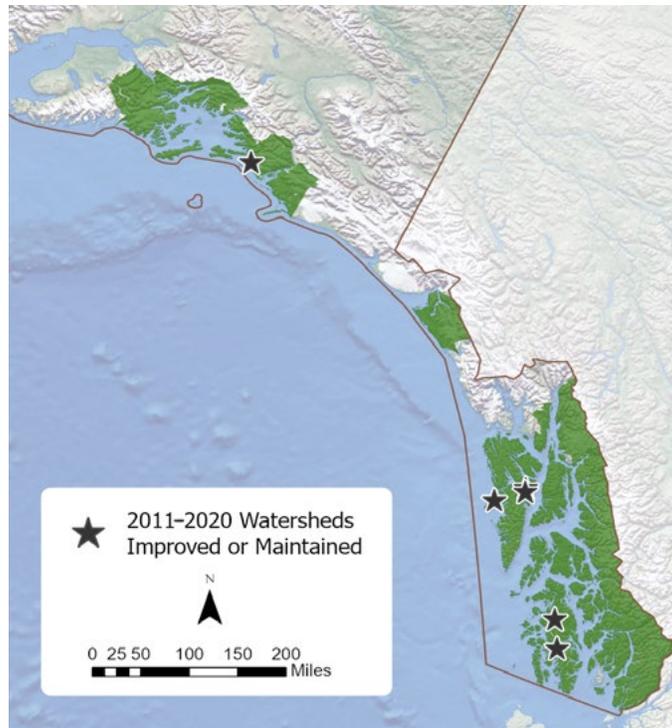
- Great Lakes Restoration Initiative
- Huron Pines
- Michigan Department of Natural Resources
- National Fish and Wildlife Foundation
- Pine River-Van Etten Lake Watershed Coalition
- U.S. Fish & Wildlife Service

Costs

- Forest Service: \$413,361
- In-kind contribution for postproject monitoring by partners

Alaska Region

Alaska



- 7 priority watersheds improved or maintained
- \$2,483,928 invested in priority watershed improvement by the Forest Service
- \$3,745,139 invested in priority watershed improvement by State, local, Tribal, and national partners

National Forest System Unit	Watershed Improved or Maintained
Chugach National Forest	Eyak River-Frontal Gulf of Alaska
Tongass National Forest	Indian Creek-Harris River Sitkoh Creek Sitkoh River Twelvemile Creek Iris Meadows Staney Creek

WATERSHED WORK IN THE ALASKA REGION

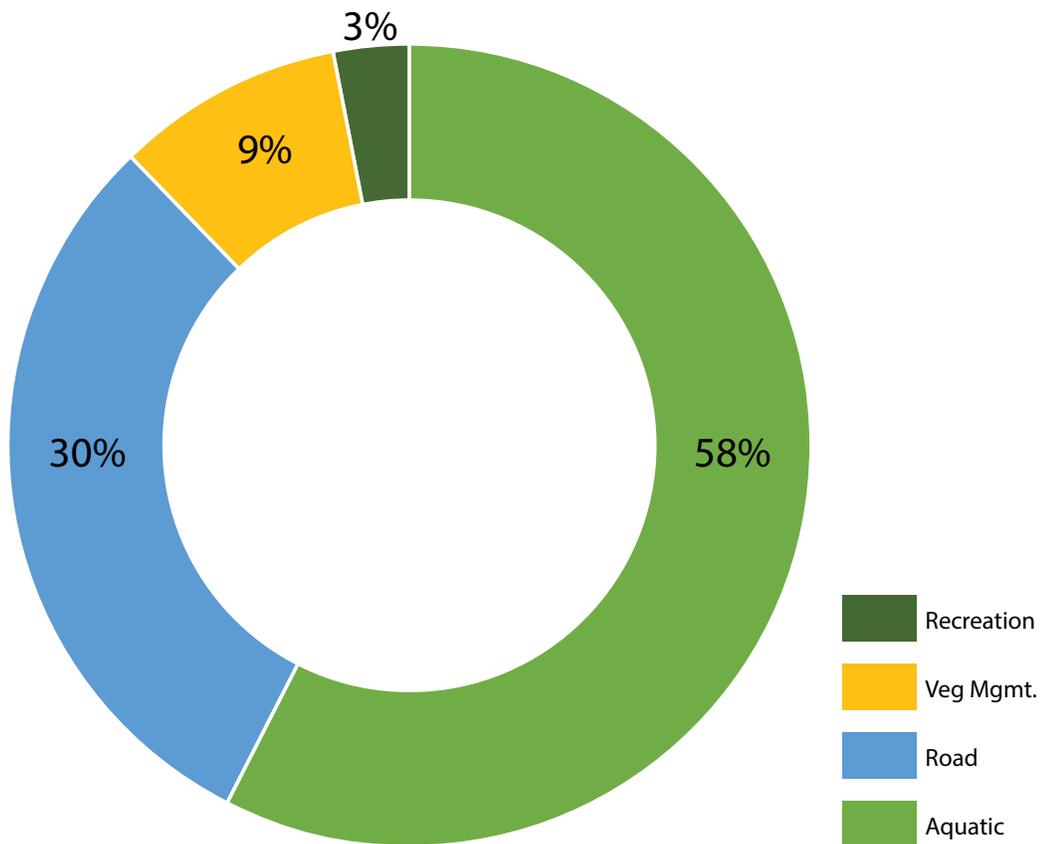


Figure 16. Percent of essential projects by category for Alaska Region priority watersheds completed, 2011–2020.

Recreational Improvements:

- 36 miles of trail
- 110 acres of dispersed recreation

Aquatic Improvements:

- 390 stream crossings
- 50 miles of stream restoration
- 756 acres of riparian improvement

Road Improvements:

- 80 miles improved
- 36 miles decommissioned

Vegetation Improvements:

- 4,740 acres improved through fencing and other rangeland improvements
- 2,870 acres treated for nonnative plants



Heavy use by subsistence and recreational anglers has impacted streambank and watershed condition along Eyak River and Ibeck Creek on the Chugach National Forest in Alaska. Hardening low-water crossings helps reduce these impacts. Student Conservation Association crew members helped the Forest Service stabilize an eroding streambank and apply coarse substrate to prevent stream widening and erosion at this active ford (inset). USDA Forest Service photos.

ALASKA REGION WATERSHED SPOTLIGHT

Staney Creek Watershed, Tongass National Forest, Alaska

The Staney Creek watershed is an ecologically diverse, highly valued, economic powerhouse located on the west side of Prince of Wales Island, Southeast Alaska. The mainstem has one of the longest, continuous U.S. Geological Survey streamflow records in Southeast Alaska and is currently a pilot for climate forecasting analysis. Staney Creek supports three species of salmon, as well as resident and anadromous forms of coastal cutthroat, rainbow, and steelhead trout and Dolly Varden char. Staney Creek has the highest amount of stream miles used by coho salmon and one of the top pink salmon escapements on Prince of Wales Island, making it vital to healthy commercial, sport, and subsistence fisheries. The watershed contains 97 miles of anadromous fish streams and 70 miles of resident fish streams. In addition, Staney Creek watershed also routinely produces the highest harvest numbers for Sitka black-tailed deer in Southeast Alaska—a key resource for island residents.

The watershed was identified as a priority watershed for restoration in 2011 because of concerns for the long-term health and function of aquatic and riparian habitat. Stream channels were incised and

disconnected from the floodplain and had little habitat complexity. A significant percentage of riparian area associated with large wood-dependent stream channels had been harvested with young growth vegetation years away from providing adequately sized wood sources. Many of the riparian areas had been traversed by roads, and water crossings were impacting fish passage. Thirty-three percent of the riparian area had been harvested since 1965. The Staney Creek Watershed Assessment identified restoration opportunities and the Watershed Restoration Action Plan was updated and completed in 2016 as the mechanism to restore some of these historic impacts.

The objectives for Staney Creek included restoring stream condition, stream channel processes, natural quantities of large wood, and fish habitat, as well as maintaining optimum water temperatures for fish. By leveraging internal and external partnerships, stream restoration was completed using heavy equipment and hand tools; work included riparian thinning, extensive road decommissioning and storage (reclassifying a road to eliminate vehicle travel), and culvert replacements.



A 2018 stream restoration project in Scout Creek, a tributary to East Middle Fork Staney Creek. Photos compare prerestoration in 2016 (left) to postrestoration in 2017 (right). USDA Forest Service photos.



A 2018 stream restoration site in East Middle Fork Staney Creek. Photos compare prerestoration in 2017 (left) to postrestoration in 2018 (right) to bolster existing large wood in the floodplain and create more pools and habitat diversity. USDA Forest Service photos.



The Stoney West-Middle Fork before restoration (left) and after restoration (right). Large wood was added to the stream to restore natural wood quantities that provide key habitat and channel structure. USDA Forest Service photos.

Accomplishments

- Restored 6.3 miles of fish habitat in 10 streams.
- Removed 15 fish passage barrier structures from roads to reconnect 5.14 miles of fish habitat.
- Stored (decommissioned or reclassified) 13.6 miles of system road.
- Enhanced 6 AOPs to reconnect 3.65 miles of fish habitat.
- Decommissioned 1.47 miles of temporary road.
- Active maintenance on 7.08 miles of forest road.

Partners

- The Nature Conservancy
- Pricilla Bullitt Collins Grant
- State of Alaska Sustainable Salmon Fund
- Joint Chiefs’ Landscape Restoration Partnership
- National Forest Foundation
- National Fish and Wildlife Foundation
- The Wilderness Society
- Sitka Conservation Society

Costs

- Forest Service: \$870,921
- Partners: \$370,586

ENDNOTES

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- 2 Sedell J., Sharpe M., Apple D., Copenhagen M., and Furniss M. 2000. *Water & The Forest Service*. FS-660. U.S. Department of Agriculture, Forest Service, Washington Office. Washington, DC. 26 p.
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- 5 USDA, Forest Service. December 2020. *Sustainability Scorecard*. <https://storymaps.arcgis.com/stories/b5412bfb7159446cb0a9da0b76dd64ef>
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- 7 Powers, P.D., Helstab, M., and Niezgod, S.L. 2019. A process-based approach to restoring depositional river valleys to Stage 0, an anastomosing channel network. *River Research and Applications*, Vol. 35, Issue 1: 3-13. <https://onlinelibrary.wiley.com/doi/abs/10.1002/rra.3378>

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