MIDDLE TRUCKEE RIVER WATERSHED FOREST PARTNERSHIP
10-YEAR VEGETATION MANAGEMENT PLAN
2023-2033

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Adopted by:

Contents

Introduction

The Middle Truckee River watershed – the area draining into the Middle Truckee River – includes the 35-mile stretch of river that runs northeast from Tahoe City to the California-Nevada state line, and encompasses roughly 315,000 acres.. This watershed has a diversity of uses, including residential, , recreation, critical infrastructure, wildlife habitat, and several reservoirs. Like many areas in the West, the watershed is exposed to a growing risk of extreme wildfire impacts due to a combination of accumulating fuels, a warming climate, and development in fire prone landscapes. Past land use practices, drought, and an overemphasis on fire suppression has drastically increased wildfire risk.

The Middle Truckee River Watershed Forest Partnership (MTRWFP) 10-Year Vegetation Management Plan (Plan) will provide strategic direction to manage up to 60,000 acres of vegetation in the watershed (Figure 1) and accomplish the following goals:

- Improve and restore forest health and resilience;
- Reduce the risk of high severity wildfire;
- Protect communities from wildfire impacts;
- Protect and secure water supplies and infrastructure; and
- Identify and augment resource gaps to achieve implementation at an increased pace and scale.

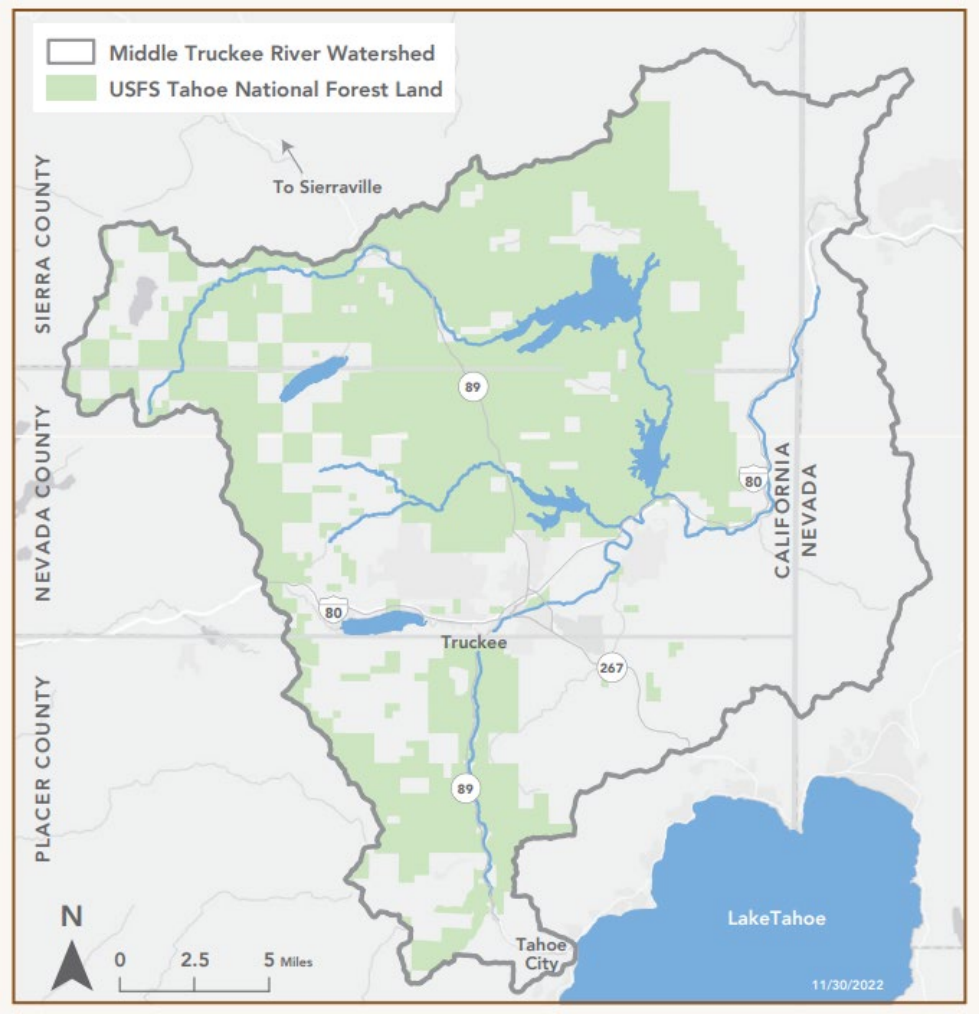


Figure 1. Middle Truckee River watershed boundary

The past 100 plus years of fire suppression and management in the Sierra Nevada have resulted in increased stand density, less fire frequency, and greater fire severity. These conditions have caused significant impacts to natural resources including forests, meadows, and streams, and have changed the composition and structure of these important ecological systems. Current conditions indicate that the forest and habitats in the Middle Truckee River watershed are likely not resilient to a variety of disturbances (e.g., fire and flood). These conditions greatly increase the likelihood of destructive wildfire causing significant damage to human communities and watershed health. In addition, many homes and communities have been built within and near forests making it more challenging to protect lives and property from high-severity wildfire and to allow for the use of prescribed fire or managed wildfire as a management tool.

More intensive restoration and fuels reduction efforts are needed across the broader landscape. In 2022 a comprehensive forest health assessment[1] was completed for the Middle Truckee watershed which provided an opportunity to coordinate ecological restoration planning efforts and actions across public and private land ownership. Recognizing that community safety, watershed resiliency, and forest health are complementary and interrelated, federal, state, and private stakeholders in the Middle Truckee watershed are acting together to reduce wildfire risk and to protect communities and water supply; stakeholders within the watershed agree that the pace and scale of such activities need to be significantly increased given the geographic scope and severity.

In order to promote the above goals, The Nature Conservancy (TNC), National Forest Foundation (NFF) Truckee River Watershed Council (TRWC), Truckee Meadows Water Authority (TMWA) and the United States Department of Agriculture (USDA) Forest Service (USFS), Tahoe National Forest signed a Memorandum of Understanding (MOU) to collaborate, communicate, and work together to promote healthier, more resilient forests on the Sierraville and Truckee Ranger Districts of the Tahoe National Forest within the Middle Truckee River watershed. Specifically, the Middle Truckee River Watershed Forest Partnership is interested in identifying forest restoration and fuels reduction projects on USFS lands within and surrounding the Middle Truckee River watershed, and to coordinate with private landowners and stakeholders to promote collaboration and efficiencies.

This Plan is intended to be a working document to guide the Partnership towards achieving its goals. The document will broadly identify actions that may be taken over the course of the next ten years. This includes some specific projects where planning work is in progress or already completed, identifying future projects or project areas for consideration, and beginning planning for projects that may occur beyond the 10-year time frame of this initial document. This document does not authorize any work to be completed; other documents will authorize work at the appropriate time. The MOU provided in Appendix A further describes the Partners, the goals, and the coordination structure.

Partnership Structure

The MOU provides a structure to collaboratively accomplish this work. The signatories of the MOU are identified as Core Team members. The Core Team members are responsible for making decisions to co-manage the landscape at the most appropriate scales. The Core Team will provide overall direction for the development and implementation of the 10-Year Vegetation Management Plan. Additionally, the Core Team will form technical advisory groups (TAGs) as needed and provide direction to the TAGs; each Core Team member commits to staffing for at least one TAG. Each signatory commits to fund or assist with seeking funds to implement the 10-Year Vegetation Management Plan, including in-kind services. The Core

[1] *TRWC - 2020: Middle Truckee River Watershed Forest Health Assessment*

Team is committed to substantially contributing to advance the goals of the MOU with staff time, financial resources, and other contributions.

In addition to TAGs, the MOU structure creates a stakeholder group. The MTRWFP Stakeholders (Stakeholders) will meet quarterly (or as needed) with the Core Team. The Core Team will share information with the Stakeholders and seek out collaborative opportunities (data and information sharing) where it would create efficiencies and advance the overall project goals. Stakeholders can serve as members of a TAG. The Stakeholders would not be required to commit any time or money to the project.

Geographic Scope

The Middle Truckee River watershed is located in California's northern Sierra Nevada and includes approximately 315,000 acres of land, of which 260,825 acres of land is managed by the USFS in the Tahoe National Forest. The mainstem of the Truckee River in the Middle Truckee watershed flows from the outlet of Lake Tahoe at Tahoe City, CA and the downstream outlet of the watershed is located near Verdi, NV.

The watershed spans Nevada, Placer, and Sierra counties in California counties and Washoe County in Nevada. It encompasses important forest and meadow ecosystems, the Truckee River, recreational resources, communities, and water supply reservoirs.

In addition to the Truckee River, the watershed includes several lakes and reservoirs, including Donner Lake, Independence Lake, Prosser Reservoir, Stampede Reservoir, Boca Reservoir, and Martis Lake. These waterbodies are key for municipal water supply, recreation, agriculture, and to provide instream flows to threatened and endangered fish species.

The partners chose to focus on this portion of the Truckee and Sierraville Ranger Districts because there are common interests and complementary goals that can be attained working on this landscape collaboratively. Work will continue by USFS and other organizations and agencies outside of the projects proposed in this plan. The MTRWFP will coordinate with other private and public landowners completing forest restoration and fuels reduction work in the watershed.

Goals

Plan Goals

The projects outlined in this plan are intended to improve forest health to increase climate resilience, reduce the risk of catastrophic wildfires, safeguard water and air quality, protect fish and wildlife habitat, enhance biodiversity, sequester carbon, improve recreational opportunities, and generate job and economic opportunities on up to 60,000 acres over the next decade. Specific goals are included below.

Improve Forest Health and Resilience: Current conditions indicate that the forest and habitats in the Middle Truckee River watershed are likely not resilient to a variety of disturbances. The long history of fire suppression in the region has led to high density stands in forests throughout the watershed. To improve forest health and resilience, the Core Team through this proposed 10-year management strategy seeks to treat up to 50,000 acres on the landscape. The goal is to complete ecologically-based thinning to recreate a diverse forest structure that protects wildlife and plant diversity and creates a system resilient to fire.

Reduce Risk of High Intensity Wildfires: While fire is a normal part of forest ecosystems in the Sierra Nevada, the high intensity fires occurring due to high stand densities are destructive ecologically, economically, and socially. By increasing the pace and scale of forest management work and decreasing fuel loads throughout the watershed, the goal is to reduce the risk of high intensity wildfires.

Protect Communities from Wildfire Impacts: Communities are more at risk from wildfires due to the high intensity fires that have been seen throughout the Sierra Nevada in recent years. The Middle Truckee River watershed includes several communities that would benefit from increased vegetation management efforts to improve forest health. There are many other California state-wide efforts to strengthen protection of communities through additional initiatives such as hardening homes, buildings and infrastructure, increasing defensible space and fuel breaks, and strengthening community planning and preparedness.

Protect and Secure Water Supplies and Infrastructure: The Middle Truckee River watershed includes critical water supply infrastructure for municipal, industrial, and agricultural uses in northern Nevada. Additionally, the reservoirs, lakes, meadows, and rivers in the watershed are important recreationally and ecologically. As seen throughout California, large wildfires have detrimental impacts to both water quality and water storage capacity. By increasing forest resiliency to wildfires near reservoirs and across the watershed, critical water supplies will be protected.

Increase Pace and Scale of Implementation: Current forest management work moves at a relatively slow pace due to multiple factors including project funding gaps, planning timelines, and organizational capacity and staffing limitations. Similarly, the scale of work is often limited due to similar reasons. To make a meaningful impact on the landscape, the Core Team recognizes that the pace and scale of vegetation management work must increase. This Plan outlines specific projects that will achieve the previously described goals through implementation of more projects at a faster pace.

National and State Wildfire Initiatives

California Wildfire and Forest Resilience Task Force: Created in 2021 by Governor Newsom to establish a more holistic and integrated approach to building forest health and community resilience to fires.

Shared Stewardship Agreement: In August 2020, Governor Newsom signed a Shared Stewardship Agreement with the USFS that establishes unprecedented coordination between state and federal agencies to each meet a goal of treating 500,000 acres annually by 2025 (total of 1 million acres) across California.

Sierra Nevada Landscape Investment Strategy: The Sierra Nevada Conservancy is implementing the Landscape Investment Strategy in the region. The intent of this strategy is to coordinate, leverage, and scale state and federal investment strategies across the region to accelerate the development and implementation of landscape-scale restoration initiatives.

Tahoe-Central Sierra Initiative (TCSI): Created as a partnership between state, federal, nonprofit, and private partners in response to state and federal mandates that call for increasing the pace and scale of forest management and restoration and better protection of communities from wildfire due to these increased risks.

Tahoe National Forest Land and Resource Management Plan: Created in 1990 and currently being updated, this plan guides resource decisions made by the USFS on the Tahoe National Forest.

Limitations

Wood processing facilities: Regionally, there are limited options for disposal of trees removed during forest thinning activities. There are few sawmills in the northern Sierra Nevada, and their capacity is often exceeded due to the abundance of trees available from burned areas. However, there has been some progress regionally to create additional facilities. A new sawmill is planned in Carson City, Nevada that will process small diameter trees removed as part of forest thinning projects. There are also potential plans for new biomass facilities in the region.

Organizational capacity: Staff at the Tahoe National Forest and other Core Team organizations is limited. To complete planning and implementation at a larger scale, current staffing levels may not be sufficient, and organizational capacity may need to increase for all tasks to be undertaken. Core Team organizations recognize this limitation and with adequate funding could increase their capacities.

Contractor capacity: If the pace and scale of forest restoration work is increased, there may be limitations in the number of contractors available to implement the proposed work. Increased contractor demand created by a substantial increase in pace and scale may substantially drive-up treatment costs in the short term.

Opportunities

State, federal, and private funding opportunities: Due to the heightened severity of wildfires across the western US, there has been recognition of the urgency of completing larger, landscape-scale restoration work. This has led to more funding opportunities being available in California and nationwide. The funding opportunities will allow Core Team member organizations to leverage funds to increase the pace and scale of forest restoration work.

Leveraging resources through collaboration: The partnership will allow the Core Team organizations to lead the planning and implementation of forest restoration and fuels reduction projects instead of the burden falling solely on USFS. Additionally, there may be the opportunity to leverage financial and capacity resources by working collaboratively on projects.

Vegetation Management Priorities

The vegetation management priorities fall under three categories – prior projects, initial priority projects, and future upcoming priority projects. Prior projects were already underway when the MTRWFP was established in 2022; however, some of the six prior projects have funding or other resource gaps that the MTRWFP is working collaboratively to address.

The seven initial projects priority projects are projects the MTRWFP is working to plan and implement over the next several years. The future upcoming priority projects encompass 10 projects that the Partners are working to plan and implement over the 10-year timeframe of this Plan. The individual project locations defined by category are identified in Figure 2.

The initial and future projects were selected after significant review of three modeling efforts:

a) The Middle Truckee River Watershed Forest Health Assessment (Truckee River Watershed Council, 2022);
b) Landscape Conservation Forecasting, a modeling effort that assesses the potential for ecological disturbances including wildfires and climate change, developed by The Nature Conservancy and;
c) ForSys, a model used by the U.S. Forest Service, Tahoe National Forest to prioritize geographic areas.

The models and outputs are described in Appendix B.

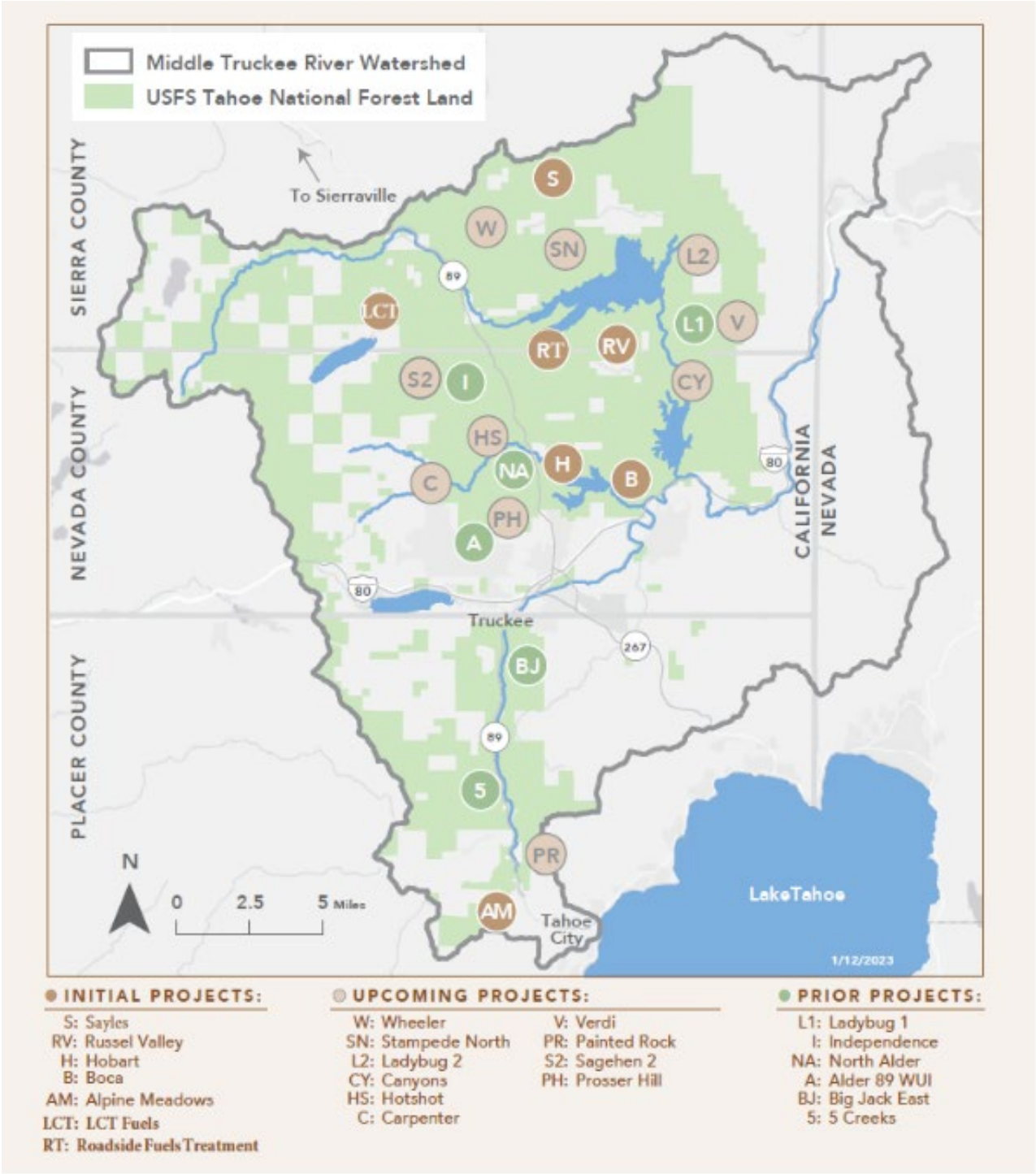


Figure 2. Prior, initial, and upcoming forest management projects identified by the MTRWFP

Prior Projects

These projects were underway when MTRWFP was established in 2022. Projects are listed in alphabetical order and not in order of priority or implementation timeline.

Alder 89 WUI

Overview

The Alder Creek, Highway 89 WUI Restoration project area is a high use area adjacent to the town of Truckee and along the busy highway 89 corridor. Popular non-motorized trails like the Emigrant Trail are present within the project area as well as the Prosser Off Highway Vehicle staging area and motorized trails. Dense housing developments including Tahoe Donner are present along the southern boundary of the project area. Alder Creek which drains into Prosser Reservoir and eventually the Truckee River also runs through the project area. Plantations from Donner Ridge Fire in 1960 occur within the project area. These plantations are overcrowded with interlocking crowns and signs of inter-tree competition and need to be thinned to restore tree vigor.

Scope of Work

The project is entirely within the WUI defense and threat zone and currently does not meet desired conditions as outlined in the Sierra Nevada Forest Plan Amendment (SNFPA 2004). Project work will thin densely forested areas and reduce hazardous accumulations of surface and ladder fuels which would burn in high severity under the right conditions. Project benefits include improving forest health, increasing resiliency to climate change, and restoring hydrologic functionality. The Alder Project proposes to treat vegetation and improve stand conditions on approximately 2,934 acres on National Forest Service lands.

Planning Status

This project qualifies for wildfire resilience categorical exclusion under the Healthy Forests Restoration Act (HFRA). The decision memo was signed by the Truckee Ranger District in July 2022. Planning documents are available here.

Funding Needs

Funding needed to complete forest health treatment across the 2,934 acre project site is anticipated to total approximately $7 million dollars. Project partners are actively working to identify funding opportunities and to obtain necessary monies to implement the project.

Project Lead and Partners

The lead on this project is the USFS, Truckee Ranger District. Project partners include the National Forest Foundation (NFF) (Others??)

Implementation Schedule

Project is slated to begin implementation during the calendar year of 2023. The Alder 89 project is slated for implementation in 2024 and may continue through 2027.

Big Jack East

Overview

The Big Jack East project area is located in northeastern Placer County, California, east of State Route 89 South, west of Martis Valley, and south of the Town of Truckee. The project area is largely surrounded by private property and it is the figurative backyard to hundreds of Truckee residents. The adjacent neighborhoods, including Sierra Meadows, Ponderosa Palisades, Martiswoods Estates, Ponderosa Ranchos and Martis Camp, plus a major utility corridor within the project area elevate the area's need for effective management of the wild land urban intermix (WUI) consistent with management direction in the Tahoe National Forest Land and Resource Management Plan (1990).

Scope of Work

The goals of the project include reducing fuel loadings and create a safer, more effective fire suppression environment in the WUI immediately south of the Town of Truckee, creating conditions that

would improve forest resiliency to fire, insects, disease, drought and climate change, protecting sensitive resources and providing access for fire suppression in the event of a wildfire and access for vegetation and fuels management, utility site management, and a recreation opportunities. The total project area treats or enhances 2,060 acres on USFS lands.

Planning Status

A final decision notice was signed into authorization in April of 2019 and the majority of project implementation efforts were completed in 2021. Planning documents are available here.

Funding Needs

Project elements that are still in need of funding include burning of remaining slash piles throughout the project area as a result of thinning and removal of small diameter trees and ladder fuels.

Project Lead and Partners

This project is a collaborative effort between the USFS Truckee Ranger District and the National Forest Foundation.

Implementation Schedule

Aside from the burning of remaining slash piles, project implementation has been completed in 2021.

Five Creeks

Overview

The Five Creeks project area lies within the busy highway 89 corridor south of the Town of Truckee to the northern boundary of Olympic Valley. This corridor experiences significant visitation and includes critical infrastructure including developed campgrounds, private residences, recreation residences, the Eastern Regional Landfill, mountain biking, hiking, and fishing trails, rock climbing destinations, and vehicles travelling from I-80 to Lake Tahoe. To enhance public safety, reduce potential wildfire severity, and restore forest health in this area, the Truckee Ranger District is proposing to complete forest restoration, fuels reduction, and habitat enhancement treatments within this corridor.

Scope of Work

The goals of the project include reducing wildfire severity risk, creating defensible space and promoting forest health and resilience. Proposed treatment types include stand thinning, removal of ladder fuels, and use of prescribed burning where appropriate. This is a multi-benefit project designed to reduce fire severity while protecting high quality habitat areas including meadows, aspen stands and wildlife. The total project area treats or enhances 6,212 acres.

Planning Status

Project planning, NEPA analysis and public scoping have been completed for this project. Planning documents are available here.

Funding Needs

Funding needed to complete forest health treatment across the 6,212-acre project site is anticipated to total approximately $11 million dollars. Project partners are actively working to identify funding opportunities and to obtain necessary monies to implement the project.

Project Lead and Partners

This project is a collaborative effort between the USFS Truckee Ranger District and the National Forest Foundation.

Implementation Schedule

The first round of the Five Creeks project is slated for implementation in 2024.

Independence

Overview

The project is located in the southern portion of the Sierraville Ranger District, in the area of Little Truckee Summit, mostly west of CA Hwy 89 and north of Sagehen Summit. The area has heavily overstocked forests that are highly susceptible to wildfire danger and there is a need to reduce stand density to improve forest health and reduce the risk of wildfire. Current stand conditions contain an average of 536 trees per acre with over 80% of the trees under 10" diameter breast height (DBH). The presence of such high densities of small diameter trees, in addition to the occurrences of brushy vegetation and surface fuels, have created continuous ladder fuels vertically throughout the stands. Potential wildfire behavior should it occur in the untreated stands would be characterized by 5-7 foot flame lengths and expected crown fire, which could result in a catastrophic stand-replacing event.

Scope of Work

The proposed treatment actions include either mechanical or hand thinning of trees that are less than 11"dbh to achieve desired stand conditions. Treatment will aim to reduce the number of trees less than 11"dbh by about 450 trees per acre, resulting in approximately 86 trees/ acres that are greater than 11" dbh in the residual stand. Machine piling of the thinned, small diameter trees will also target brushy vegetation and concentrations of surface fuels. Desired stand conditions post this treatment, and follow up prescribed fire treatments, would produce wildfire behavior characteristics with an anticipated flame length of 1 to 4 feet and surface fire behavior without crown fire potential, significantly reducing the possibility of a stand-replacing event.

Planning Status

Project components specified in this proposal have undergone analysis through two separate Environmental Assessments: 1) Transition EA and; 2) Middlin EA. A Decision Notice was signed by the Sierraville District Ranger for both Environmental Assessments in 2012. In 2022, 270 acres of the total 430 acres were treated. The remaining acreage within the Independence project site will be completed in 2023, resulting in total treatment acreage of 1,450 acres within the combined Middlin and Transition analysis areas.

Funding Needs

Project elements that are still in need of funding include burning of existing material piles throughout the project area as a result of thinning and removal of small diameter trees and ladder fuels.

Project Lead and Partners

The Project is a collaborative effort between the Truckee River Watershed Council (TRWC) and Tahoe National Forest.

Implementation Schedule

As noted above, 270 acres have been treated in 2022 and the remainder of the project site will be treated in 2023. Pile-burning withing the project area will likely occur within three years of completion of treatment activities.

Ladybug Phase 1

Overview

The Ladybug Forest Health and Fuels Reduction Project is located on the Truckee Ranger District, Tahoe National Forest. The project area is within a heavily recreated area just east of Stampede reservoir and west of the community of Verdi, Nevada along the western slope of the Verdi Range. The area consists of several medium and small drainages, in an area that are highly susceptible to wildfire. National Forest System land comprises much of the area, however 640 privately owned acres are also within the project

footprint and are considered part of the Wildland Urban Interface (WUI). Overcrowded forests, historic Comstock era logging and fire suppression combined with recent drought conditions have contributed to increased levels of tree mortality from various stressors, particularly insects and disease. Actions are needed to reduce the extent of insect infestations in the project area and increase resistance to new infestations and potential wildfire start.

Scope of Work

The proposed treatment actions include mechanical thinning of both commercial sale and non-commercial sale timber within the project area as well as mechanical mastication of non-commercial sale timber. Hand thinning treatments will occur on steep slopes to reduce the potential for erosion and other land impacts. Prescribed fire treatments will occur where site conditions allow and are expected to encompass a substantial portion of the project area. Maintenance of existing roadways and temporary road construction will be necessary to support forest health treatments. Temporary road ways will be decommissioned if determined not to be necessary upon completion of forest health treatments.

Planning Status

A final decision notice was signed into authorization in March of 2020 and partial implementation was completed in 2021. Planning for the remainder of project implementation is underway and is scheduled for 2023. Planning documents are available here.

Funding Needs

The majority of the funding for this project has been secured. Outstanding funding need is roughly $500,000 to accomplish an additional 328 acres of hazardous fuels mastication.

Project Lead and Partners

This project is a collaborative effort between the USFS Truckee Ranger District and the National Forest Foundation. Additional funding has been provided by The Nature Conservancy and TMWA.

Implementation Schedule

As noted above, partial project implementation was completed in 2021, with the remaining treatments expected to occur from 2023 to 2025.

North Alder

Overview

The North Alder Stewardship Project is an 853-acre timber stand improvement and hazardous fuels reduction project on the Truckee Ranger District of the Tahoe National Forest. The Project area is part of the 1960 Donner Fire that burned 40,000-acres at high intensity killing the native seed stock which prompted the Forest Service to plant Jeffrey Pine seedlings. Those pine plantations are now overstocked and create a hazardous fuel source near to the Town of Truckee. Post-harvest stand conditions will disrupt vertical and horizontal fuel continuity.

Scope of Work

The Project improves stand condition by thinning conifers with additional service work including mastication, biomass chip and haul, and road reconstruction. Thinning will produce an average of 20 foot spacing with a preference for the healthiest and most vigorous trees. Mastication will follow thinning to treat remaining trees and shrubs. This newly created spacing will disrupt fuel continuity and reduce resource competition for the next generation of seedlings. Lastly, the road will be improved in the project area to facilitate future access and monitoring.

Planning Status

All planning and NEPA requirements are complete. Implementation is ongoing.

Funding Needs

Partially funded. A roughly $300,000 budget gap exists for this project.

Project Lead and Partners

The project lead is the Tahoe National Forest with the National Forest Foundation as an implementation partner.

Implementation Schedule

Implementation for the Project began in the 2020 field season. Approximately 437 acres were completed during the first two field seasons. Wood utilization challenges stalled the project during 2022. 416 acres remain in the project. Implementation will likely occur between 2024 and 2027.

Initial Priority Projects

The projects below have been identified as a set of five initial priority projects that the MTRWFP will undertake over the next several years. Projects are listed in alphabetical order and not listed in order of priority.

Alpine Meadows

The Alpine Meadows and Olympic Valley Fire Protection project is focused on improving forest health and building defensible buffers around the community of Alpine Meadows and on the ridge between Alpine Meadows and Olympic Valley. This project will also reduce hazardous fuels along a portion of the highway 89 corridor, adding to the ingress and egress protection provided by the Five Creeks project. This project is currently undergoing a NEPA study. A decision is expected in early 2024. Implementation is slated to begin in summer 2025 with the project area being roughly 1,000 acres.

Boca

The Boca project area is located just west of Boca Reservoir and north of Highway 80. This project protects and enhances forest lands above critical water supply infrastructure for the metropolitan areas of Reno and Sparks in the State of Nevada. Overall tree health in the watershed has declined due to high stand density, recent prolonged drought, insects, and disease. Significant road networks have bisected existing meadow areas and disrupted the natural flow of surface and ground waters. Project assessment will examine opportunities to reduce wildfire severity, restore forest and meadow habitat. The project size is expected to be 2,000-3,000 acres.

Hobart

The Hobart Mills project area is located north and west of Prosser Reservoir and east of Highway 89. This project protects and enhances forest lands above critical water supply infrastructure for the metropolitan areas of Reno and Sparks in the State of Nevada. The area has experienced a long history of human use impacts including logging and railroad development. In addition to these human-use impacts, forest health conditions were further impacted by the 1960 Donner Ridge Fire, which burned a considerable area of the watershed, leaving largely homogeneous stand conditions. Project assessment will examine opportunities to reduce wildfire severity and restore forest and meadow habitat areas. The project size is expected to be 2,000-3,000 acres.

Lahontan Cutthroat Trout Fuels (LCT Fuels)

The LCT Fuels project area is located just upstream of Independence Lake on US Forest Service land. This project would reduce fuels in the area adjacent to the inflows to Independence Lake where Lahontan Cutthroat Trout spawn to protect the spawning habitat from high severity wildfire. Over the last several decades, a significant amount of restoration work has occurred to enhance spawning habitat for this species and protect the Independence Lake area. The project size is expected to be less than 1,000 acres.

Roadside Fuels Treatment

The project is located in multiple locations in both Truckee and Sierraville Ranger Districts, and crosses jurisdictional and county boundaries both within and outside of the Middle Truckee watershed. The project will create multiple strategically located fuel breaks on National Forest System (NFS) land in Plumas, Sierra, Placer and Nevada counties. The project area was selected because of its strategic importance in improving opportunities to control future fires threatening Forest Service (FS) and neighboring lands. Roads identified for this project, and for targeted treatments, will create defensible shaded fuel breaks within wildland-urban intermix (WUI) zones and on NFS lands. The fuel breaks will improve opportunities for managing wildfires and will provide critical and strategic wildfire suppression opportunities and advantage when necessary. The project size is expected to encompass approximately 227 linear miles of roadside treatment area.

Russell Valley

The Russell Valley project area is located just below Stampede Reservoir, east of the Highway 89 corridor and north-east of the Town of Truckee. This project encompasses the community of Russell Valley, where a small community of residents reside on a year-round basis. Multiple recreational opportunities and connectivity between residential areas and near-by reservoirs mean that the areas surrounding the project site see high visitation rates. Large meadow complexes are found within the project site, providing the opportunity to significantly enhance high-quality habitat conditions, while at the same time, reducing the potential wildfire severity, and restoring forest health conditions. The project size is expected to be 2,000-3,000 acres.

Sayles

The Sayles project area is located just north of Stampede Reservoir and east of the Highway 89 corridor in Sierra County. This project protects and enhances forest lands above critical water supply infrastructure for the metropolitan areas of Reno and Sparks in the State of Nevada. Large meadow complexes are found within the project site, providing the opportunity to significantly enhance high-quality habitat conditions, while at the same time, reducing the potential wildfire severity, and restoring forest health conditions. The project size is expected to be 2,000-3,000 acres.

Upcoming Priority Projects

The projects below have been identified as a set of upcoming priority projects that the MTRWFP will undertake over the next ten years. The details of these projects have not yet been determined, but they have been selected by the Core Team through the methodology described in this Plan. Details will be provided as individual projects are planned. Projects are listed in alphabetical order and not listed in order of priority.

- Canyons
- Carpenter Valley
- Hotshot
- Ladybug 2
- Painted Rock
- Prosser Hill
- Sagehen 2
- Stampede North
- Verdi
- Wheeler

Long-Term Funding Strategies

Total Estimated Costs

Understanding that an overall cost estimate helps convey the scope and scale of work to be completed, the Core Team used its collective recent experience in planning (NEPA) and on-the-ground treatment and restoration and estimated that the planning and implementation for the approximately 60,000 acres

identified in the Plan to be $140,000,000 (2023 dollars). The estimate reflects recent work in the northern and central Sierra Nevada mountains at high elevation and additionally reflects the ability to achieve efficiencies across projects, for example, in completing wildlife and cultural surveys.

Table 1 shows the cost estimates and estimated acres for each current and proposed project. Appendix C includes more detailed cost estimates based on project phases.

Projects scheduled for planning and implementation in the next five years have the most accurate estimates, whiles the upcoming priority projects have more generalized estimates.

Funding Secured

The Core Team partners have each secured local, regional, state, and/or federal funding toward planning and implementation. Collectively, this is approximately $10,000,000, as shown in Table 1.

Closing the Funding Gap

The MTRWFP recognizes funding the work of this Plan will require a multi-faceted strategy as outlined below:

<u>The MTRWFP will make use of the many and varied funding sources currently available.</u>
For example, funding is available from local and regional foundations, local government agencies, State of California agencies, and federal agencies, in addition to Core Team member agencies such as TNC and TMWA. If these sources are not sufficient, the MTRWFP will consider pursuing private and public bond initiatives as well as public-private partnerships. Partner and other private funding can assist in cash flow gaps created by grant funding. Partner funding can serve as a source of funding to pay contracts to expediate work and be refunded when grant monies are refunding. This model should allow for an increased scale and pace of work.

<u>The MTRWFP, when feasible, will collectively apply for and receive grant funds.</u>
To increase efficiency in raising and managing funds, the Partnership will collectively apply for and manage funds. For example, in spring 2023 the partnership applied for $24,000,000 for planning and implementation of eight of the projects.

<u>Core Team members will individually apply for and receive grant funds for projects.</u>

<u>The Tahoe National Forest will request federal appropriations and/or allocations.</u>
The Tahoe National Forest is funded and staffed to plan and implement projects within this plan (e.g. Five Creeks). They will request additional funds to pass through to Core Team partners for planning and implementation as available.

Table 1. Project Estimated Cost Summary

Project	Timeline	Total Project Budget	Committed Funding	Funding Gap	Acres
PRIOR PROJECTS					

Five Creeks	2022-2027	$12,280,000	$4,106,667	$8,173,333	6,100
Alder 89 WUI	2022-TBD	$7,040,000	$120,000	$6,920,000	3,000
North Alder	2022-TBD	$1,640,000	$1,350,000	$290,000	850
Big Jack East	2017-2023	$2,720,000	$2,440,000	$280,000	2,000
Independence	2019-2025	$565,000	$565,000	$0	430
Ladybug Phase 1	2019-2025	$3,880,000	$ 3,400,000	$480,000	3,400
INITIAL PRIORITY PROJEC					
Alpine Meadows	2022-TBD	$3,780,000	$500,000	$3,280,000	2,000
Russell Valley	2022-TBD	$7,020,000	$0	$7,020,000	3,000
Boca	2022-TBD	$8,020,000	$1,100,000	$6,920,000	3,000
Sayles	2022-TBD	$7,920,000	$1,000,000	$6,920,000	3,000
Hobart	2022-TBD	$7,320,000	$40,000	$6,920,000	3,000
UPCOMING PRIORITY PROJECTS					
Wheeler	2024-TBD	$7,120,000	$0	$7,120,000	3,000
Stampede North	2024-TBD	$7,120,000	$0	$7,120,000	3,000
Ladybug Phase 2	TBD	$7,120,000	$0	$7,120,000	3,000
Verdi	TBD	$7,120,000	$0	$7,120,000	3,000
Sagehen 2	TBD	$7,120,000	$0	$7,120,000	3,000
Hotshot	TBD	$7,120,000	$0	$7,120,000	3,000
Carpenter	TBD	$7,120,000	$0	$7,120,000	3,000
Prosser Hill	TBD	$7,120,000	$0	$7,120,000	3,000
Painted Rock	TBD	$7,120,000	$0	$7,120,000	3,000
Independence 2	2024 - TBD	$7,120,000	$130,000	$6,990,000	3,000
GRAND TOTAL		**$140,505,000**	**$15,111, 667**	**$125,393,333**	**59,780**

Future Vegetation Management Work

The MTRWFP is committed to identifying additional vegetation management projects beyond the 10-year timeframe of this Plan. Using the best modeling tools and technology available, the partners will continue to prioritize projects that complement the work completed during the 10-year effort. This Plan may include planning efforts for projects to be included in the next plan. By completing planning for additional acres, it will ensure sufficient work is available to be implemented early in the next plan.

The group recognizes that other areas of the watershed need vegetation management work to ensure landscape-level forest resiliency. Completed projects may also need additional funding to over time. Based on the successful implementation of this Plan, the MTRWFP will work on another plan prioritizing additional projects to address the continued and evolving challenges being faced in the Middle Truckee River watershed.

Appendices

Appendix A: MTRWFP Memorandum of Understanding

Appendix B: Project Selection Methodology

Appendix C: Treatment Types Detailed

Appendix A: Memorandum of Understanding

[to be added during PDF collation so signatures are included]

Appendix B: Project Selection Methodology

Overview

The specific projects detailed in this Plan were identified and selected using the outputs of several modeling efforts including:

a) The Middle Truckee River Watershed Forest Health Assessment (Truckee River Watershed Council, 2022);

b) Landscape Conservation Forecasting, a modeling effort that assesses the potential for ecological disturbances including wildfires and climate change, developed by The Nature Conservancy and;

c) ForSys, a model used by the U.S. Forest Service, Tahoe National Forest to prioritize geographic areas.

A description of models utilized in the analysis and development of the Plan are described below.

Results from all three models were reviewed by the MTRWFP Core Team. The models showed priority agreement for approximately 60,000 acres. The team adjusted project area boundaries to align with known project operational opportunities and constraints, including such variables as road access and location of planned or completed forest health projects on Tahoe National Forest lands. Figure 2 displays the final proposed projects based on the combined results of modeling and adjustments based on expert local knowledge.

The Middle Truckee River Watershed Forest Health Assessment

The Partnership started its project prioritization by examining the outputs of Middle Truckee River Watershed Forest Health Assessment (TRWC 2020 - Technical Report). This assessment uses the Land Tender model from Vibrant Planet. In the model, resources and assets of importance within the landscape are inventoried and appraised; resources and assets are aligned with management objectives; mapped treatment units are developed; and landscape departure and disturbance hazards are modeled. All of the pieces of information derived from these steps are then used to identify where treatments could have the greatest impact toward improving ecological health and reducing risk.

Strategic Areas, Resources, and Assets (SARAs). A first step in data collection entailed the identification, mapping and characterization of Strategic Areas, Resources, and Assets (SARAs) within the Middle Truckee River watershed landscape. SARAs are features on the landscape that are anthropogenic or ecological that have been identified as having societal value and are an important underlying driver of treatment prioritization across the landscape. SARAs are created using geographic base data that is acquired through a number of different sources, depending on the SARA in question. Sources include LiDAR, satellite and aerial imagery, federal agency enterprise geospatial data, state and local government agencies, published scientific papers, and open-source datasets.
SARAs can generally be categorized into the following definitions:

- **Strategic Areas**: Area on the landscape identified/designated/planned to serve a particular purpose (e.g., strategic fireshed, strategic watershed)
- **Resources**: Ecological resources with social value. (e.g., nest/den sites, meadows/fens)
- **Assets**: An item of property owned by a person or company (e.g., structures, infrastructure)

A total of 32 SARAs were identified and characterized within the Middle Truckee River watershed landscape. SARAs were then grouped into a series of “resilience pillars”. These pillars allow users to prioritize and weight specific management objectives when identifying geographical project boundaries

and creating project scenarios. The pillars of resilience were developed as part of the Tahoe-Central Sierra Initiative (TCSI) framework for promoting socio-ecological resilience across forested landscapes in the Sierra Nevada to represent desired landscape outcomes for both social systems and ecological systems. Each SARA was grouped into the associated pillar if it contributed to resilience of desired landscape outcome for the associated pillar. This method of using the pillars to group SARAs rather than use the specific metrics as identified by Manley et al. (2020) was conducted for several reasons:

- SARAs provided flexibility to use data that managers are directly familiar with using.
- SARAs allowed managers to identify their important resources rather than rely on predefined metrics.
- While SARAs can have similarities between regions, the wildland interface resilience environment lacks a common language. The pillars are an excellent approach to bridge and package disparate values into a single framework for any landscape where disturbance affects socio-ecologic value.

Pillars of Resilience. The ten pillars of resilience developed by TCSI include:

1) Air Quality
2) Biodiversity Conservation
3) Carbon Sequestration
4) Economic Diversity
5) Fire Adapted Communities
6) Fire Dynamics
7) Forest Resilience
8) Social and Cultural Well Being
9) Water Security
10) Wetland Integrity

In order to facilitate project identification and selection, the resilience pillars were ranked by members of the MTRWFP based on specific management objectives and desired outcomes of the team. The highest ranked pillars (Forest Resilience, Biodiversity Conservation, Fire Dynamics, and Water Security) were than assigned a "weight" to prioritize geographic areas that would provide the greatest return on investment while improving forest health conditions and reducing risk of unplanned disturbances (e.g., wildfires).

The four pillars identified and prioritized by the Forest Partnership are described below.

- **Forest Resilience**: When resilient forests experience disturbance (i.e. natural disturbances such as wildfire, or planned human disturbances such as thinning treatments), the structure and composition of the vegetation is within the desired range of conditions. Determination of SARA inclusion: SARAs are associated with the persistence of forest vegetation including structure, composition, distribution or species diversity.

- **Biodiversity Conservation**: Biodiversity conservation focuses on the diversity of native species and incorporates individual species, species diversity, and the health of the community. Biodiversity is essential for the persistence of individual species, suites of species, community interactions, and ecosystem functions. Determination of SARA inclusion: SARAs contribute to biodiversity including individual species identified or individual ecosystems identified as important for biodiversity.

- **Fire Dynamics**: Fire as a major disturbance agent is a key ecosystem process particularly for dry forests. Fire dynamics are influenced by the spatial and temporal variations in topography, climate, and fuel (including vegetation type). Functional outcomes can be evaluated by fire severity/intensity, fire frequency, and fire season which can identify if fire is functioning as desired (e.g. similar to historic fire regime). Determination of SARA inclusion: SARAs contribute to how fire burns on the landscape including severity, frequency, or spread across the landscape.

- **Water Security**: The quality, quantity, storage, and timing of hydrologic resources plays an important role and function for ecosystem health and resilience, terrestrial and aquatic biodiversity, and water resources management for anthropogenic purposes including municipal, agricultural, energy, and recreational uses. Determination of SARA inclusion: SARAs influence or monitor hydrologic dynamics on the landscape including quality, quantity, or storage of water.

Risk & Disturbance Modeling. In addition to the initial data gathering and categorization, a significant amount of modeling was conducted to determine risk and deviation from historic conditions across the watershed. Modeling conducted as related to the Middle Truckee River Forest Health Assessment helps to identify where unplanned disturbances (i.e., wildfire, drought) are most likely to occur ("disturbance probability") and how intense the disturbances are likely to be ("disturbance intensity"). Wildfire hazard is the probable intensity of a disturbance. For wildfire, it can be calculated as the product of burn probability and conditional flame length. Areas of greater hazard indicate both higher flame lengths and burn probabilities across multiple stochastic wildfire model runs. Once the disturbance modeling was complete, each SARA was assessed for risk to wildfire (and drought) by exposing the SARAs to the components of wildfire hazard (probability and conditional flame length) to determine how they would respond.

Input datasets for stochastic wildfire modeling include spatial data regarding:

- Landscape
- Topography (elevation, slope, aspect)
- Vegetation and fuels (canopy cover (aerial fuels), stand height (aerial fuels), canopy bulk density (aerial fuels), canopy base height (ladder fuels), surface fuel model (surface fuels))
- Weather conditions (wind speed, wind direction, fuel moisture content)
- Ignitions

Model outputs used in this analysis include:

- Conditional flame length: Estimate of the mean flame length for all the fires that burn a given point on the landscape across all simulations.
- Burn probability: Likelihood of a given location within the landscape burning across all simulations. Used to represent the probability of wildfire at a given location within a fire season (i.e. 1-year probability).

Drought was also included as a disturbance to be assessed for the Middle Truckee River watershed landscape. Because it is not possible to model drought stochastically in the same way that wildfire can be modeled, it was necessary to develop proxies for the same model output layers as the wildfire modeling in order to assess the impact of drought on SARAs (and impact of treatment on changing drought risk to SARAs) within the same framework as wildfire as a disturbance (i.e. probability and intensity). Drought in the context of the Forest Health Assessment refers more to drought-related forest mortality due to insects and other agents (a forest-structure density dependent disturbance, or FSDD); when trees are more water-stressed during drought conditions they are more susceptible to insects and disease.

Drought as a disturbance was assessed for the Middle Truckee River watershed landscape by producing an annual drought vulnerability spatial layer (as a proxy for annual probability) and by using the mapped composite forest structure departure metric as a proxy for the spatial variability in intensity at which a drought-driven forest mortality event would occur.

Stewardship Atlas. A key component of data collection and modeling for the Forest Health Assessment was the development of a Stewardship Atlas. The Stewardship Atlas provides a comprehensive set of landscape segments that serve as an ecological-based package for summarizing landscape metrics. Additionally, it feeds the scenario construction and tradeoff analysis that were completed as a part of the project development and sequencing.

The Stewardship Atlas is composed of polygons that are relatively homogenous in terms of their horizontal and vertical vegetation structure, slope, biophysical class, and ownership class. These Stewardship Atlas units can be associated with attributes such as treatment types, forest structure metrics (i.e. average canopy height, tree diameter, ladder fuels), disturbance and forest health metrics (i.e. vegetation departure, fire hazard, drought hazard, etc.), and descriptive/topographic attributes (i.e. average slope, ownership). The Stewardship Atlas units are further populated with a likely treatment type using an objective ruleset; these mapped treatments are then used to assess the impacts of potential treatments across the landscape.

Scenario Development. A final step in project identification and selection included integration of a spatial scenario planning model. Initial locations and spatial boundaries of project areas were developed for the Middle Truckee River landscape to explore landscape management scenarios and optimize where and how to achieve different outcomes and outputs at different scales. The modeling efforts have assisted the project team in prioritization of management efforts and to allocate funding to high priority areas to address a host of management needs coupled with finite budgets. The prioritization models used in this planning effort are aimed at helping managers target areas that will contribute most to management goals and objectives while producing a wide range of ecosystem services from National Forest System lands.

Modeling efforts were used to determine which identified project areas to treat first to achieve the highest levels of intended outcomes based on the priority weighting of the ten TCSI forest resilience pillars for the Middle Truckee River watershed. Pillar weights were based on input from the MTRWFP and informed by the Partnership's MOU and the purpose and need for this Project.
The primary input into the prioritization modeling is a GIS shapefile (here, the Stewardship Atlas) that is attributed with the management objectives identified via resilience pillar weighting and user defined project constraints (acres and cost of treatment per polygon). Scenario development includes a matrix of polygon adjacency in order to utilize the aggregation function to build projects that are composed of a set of contiguous polygons. The models then use the aggregation logic to group individual Stewardship Atlas segments together to maximize the restorative return on investment for a project, subject to constraints in project size and/or cost. Each scenario is made up of a user-defined number of projects, and each resultant project contains a set of adjacent polygons that can be treated as a single project area.

Using this method, the MTRWFP generated a set of projects that are designed to maximize restoration and forest health opportunities, while reducing the risk of unplanned disturbances (wildfire/drought). In order to establish project areas that are a manageable size, the acreage limit was established at a of 2,500 per project. Scenario development resulted in 16 projects comprised of 2,500 acres each, totaling 40,000 acres of proposed treatment actions within the Middle Truckee River watershed.

The Nature Conservancy
Protecting nature. Preserving life.™

Landscape Conservation Forecasting:

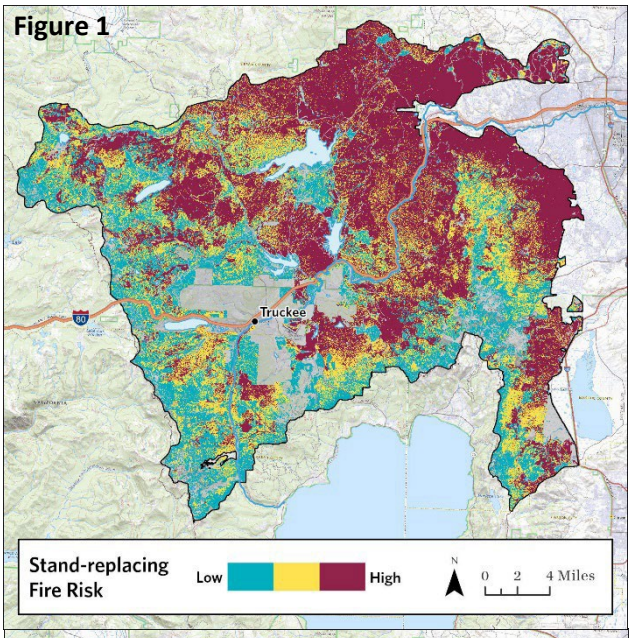
From Summer 2017 – Spring 2019, The Nature Conservancy (TNC) conducted a scientific study of 389,000 acres of the Middle Truckee River Watershed that demonstrated forested areas within the watershed, including those in the wildland urban interface (WUI), are at high risk for stand-replacing fires. The study used Landscape Conservation Forecasting (LCF), a mapping and state-and-transition modeling approach first developed by TNC scientists in Nevada, to assess the risk of uncharacteristically large and intense wildfires and develop strategies for reducing risk. LCF assessed wildfire risks through modeling vegetation succession under different future site condition scenarios. Outputs from LCF were then coupled with hydrologic and sediment transport modeling to analyze post-fire runoff. Various scenarios of climate change and disturbances such as wildfire, floods, and droughts were simulated, followed by an assessment of water resource impacts that would likely result from those disturbances.

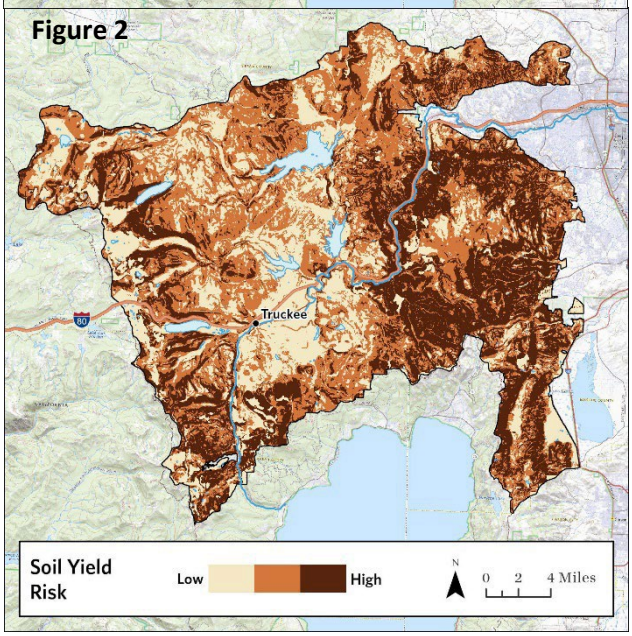
LCF uses field-verified high-resolution satellite imagery to create detailed maps of vegetation. Predictive computer models then simulate natural vegetation succession patterns to forecast the future vegetation conditions. Prior to the Middle Truckee River Watershed study, TNC successfully tested and implemented LCF on other projects throughout the western United States for more than a decade.
Previous applications of LCF have provided data and decision support to federal and state agencies, including the Bureau of Land Management, Department of Defense, U.S. Forest Service (USFS), and Nevada Department of Wildlife. LCF provides a level of scientific rigor that allows federal land managers to use the outputs for National Environmental Policy Act (NEPA) regulatory decision support. Additionally, LCF is optimized for resource management decisions on large landscapes of hundreds-of-thousands to several million acres. Given the size of the Middle Truckee River Watershed and that the majority of the forested acres are owned and managed by the USFS, LCF was an ideal fit for the watershed risk assessment study.

Vegetation map outputs from LCF were used with Precipitation Runoff Modeling System (PRMS) models developed for the Bureau of Reclamation's Truckee Basin Study to quantify changes in snowmelt and runoff. The Water Erosion Prediction Project (WEPP) model was used with the LCF vegetation maps to quantify soil erosion and transport. Combining these modeling processes allowed TNC to predict water quality impacts and changes in flows resulting from burned landscapes, which alter snowpack retention and water release. Coupling LCF outputs with other modeling tools resulted in a rigorous assessment of stand-replacing fire and post-fire runoff risks across the landscape, as well as identification of priority forest treatments areas.

Figure 1 (below) shows the risk of stand-replacing fires, where the unnatural intensity of fires will result in the loss of most or all trees and desirable vegetation. (Areas in red are highest risk.) Stand-replacing fires would:

- Increase risk of flooding and runoff of large amounts of sediment and debris into rivers, streams, and reservoirs. Figure 2 shows areas where sediment runoff would be greatest after a fire.
- Degrade the quality of the source-water for nearly 400,000 people and 7,000 businesses in the Reno-Sparks area that depend on the Truckee River for their drinking water.
- Destroy areas popular for outdoor recreation, which is among the region's largest economic sectors.
- Directly threaten homes, schools, businesses, and infrastructure.
- Impair air quality and increase respiratory-related health problems.





To mitigate wildfire risks, the pace and scale of forest restoration needs to be significantly increased. TNC's study confirmed that current rates of fuels reduction and prescribed fire treatments, conducted mostly by the US Forest Service with Congressional appropriations, are inadequate to modify fire behavior across this large landscape. Figure 3 (next page), also developed from the TNC study, shows priority areas where investments in forest restoration are most needed to begin bringing the forest and watershed back to health.

The path to increase the pace and scale of these treatments requires overcoming multiple challenges:

- Most of the biomass that needs to be removed from the forest is comprised of small diameter trees, for which there is currently little economic value and no market demand. Thus, forest restoration projects generally aren't profitable and often result in a net financial loss.
- The scale of restoration planning has been too small to address the size of the problem. Today's forest fires regularly burn areas of 100,000 acres or more, but planning areas typically cover only a few thousand acres.
- Most of the forested land in the Middle Truckee River Watershed is managed by the USFS, which lacks sufficient budget and staff to increase the pace and scale of restoration on its own, necessitating a coalition of stakeholders to implement forest treatment projects.
- TNC estimated bringing the system back to balance and reducing risks would cost tens of millions of dollars, over several decades.

If we are to reach a pace and scale of restoration treatments that will modify fire behavior and mitigate the risk of unnaturally large wildfires, we must find and implement solutions to these challenges. Lasting

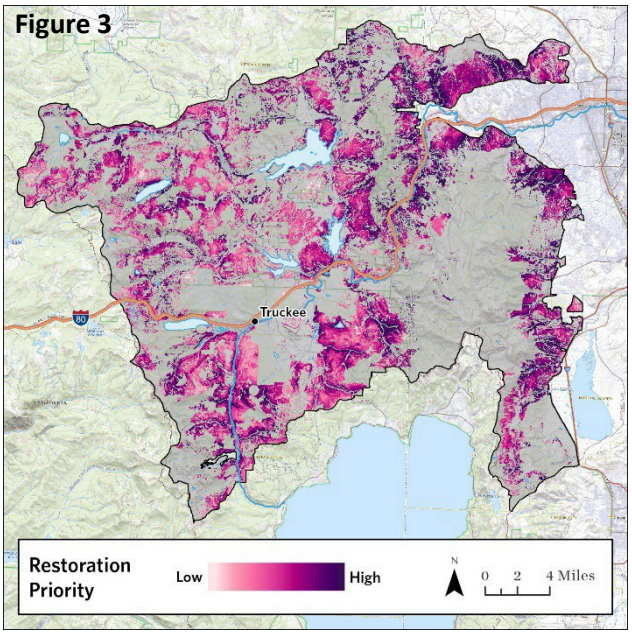


Figure 3

solutions require a multi-pronged approach, with public land managers, conservationists, scientists, leaders of business and industry, and policymakers working together in a coordinated effort. To that end, TNC partnered with the National Forest Foundation, Truckee Meadows Water Authority, USFS Tahoe National Forest (Truckee and Sierraville Ranger Districts), and the Truckee River Watershed Council to establish the Middle Truckee River Watershed Forest Partnership (MTRWFP) to fund and develop the critically needed capacities and collaborative restoration partnerships necessary for success.

The MTRWFP represents a significant step forward in restoration of the forests of the Middle Truckee and protection of the Truckee River.

For additional details about the TNC Study see Badik et al. (2022)

ForSys - Scenario planning model for multi-objective restoration and fuel management planning

ForSys is a flexible platform for exploring landscape management scenarios and optimizing decisions in terms of where and how to achieve landscape restoration and fuel management goals. The model is spatially explicit and uses multi-criteria prioritization and optimization created to rapidly design fuel treatment and restoration scenarios. ForSys modeling was a primary input driver for the Middle Truckee River Forest Health Assessment (TRWC 2020)

The program evolved from the Landscape Treatment Designer used in prior studies. The program has been used in several research and applied case studies at a range of scales (projects, forests, states, continental United States) to prioritize projects and stand treatments (see case studies).

ForSys and user guides are available upon request to the authors and mutual agreement on the intended application.

Background Information and History

The primary function of ForSys is to solve typical forest planning problems that address prioritization of stands, landscapes, and higher-level administrative units for investments, and to predict progress towards those goals. ForSys is the core analytical engine in the USFS Scenario Investment Planning Platform. The ForSys program can replicate almost any spatial treatment pattern, including treating stands to optimize fire resilient containers (Ager et al. 2013), fuel break networks (Oliveira et al. 2016) or various mixtures and variants (see figure below), including breaking up homogeneous fuelbeds. Treatments can be any management activity, including prescribed fire, thinning, habitat enhancement, streamside restoration, etc.; however, the program does not have embedded response functions – the response to management actions must be included in the input database. For instance, in an economic application, the predicted net revenue is calculated outside of ForSys and presented as choices to the model as part of a scenario that includes objectives, constraints, and treatment thresholds.

ForSys is a multicriteria spatial prioritization and optimization system created by Ager and the U.S. Forest Service (Ager 2012). The program input is a shapefile (in the Assessment, shapefile consisted of the Stewarship Atlas) that is attributed with treatment objectives (in our case Restorative Return On Investment, or RROI for 10 Resilience Pillars) and constraints (acres and cost of treatment per polygon). Two types of scenarios are generated using ForSys: 1) a non-spatially optimized scenario and 2) a spatially optimized scenario. In both cases, a set of “weights” or scalar values are multiplied by the 10 RROI values and summedtogether to generate a single objective score for each Stewardship Atlas segment.

The non-spatially optimized scenario returns a shapefile of the entire Stewardship Atlas with each segment attributed by this weighted RROI score. For the spatially-optimized scenario, a matrix of polygon adjacency is included in order to utilize the aggregation function to build projects that are composed of a set of contiguous polygons. The ForSys program uses the aggregation logic to group individual Stewardship Atlas segments together to maximize the RROI for a project, subject to constraints in project size and/or cost. Using this method, we generated a set of scenarios of projects that are designed to maximize the RROI across the 10 Resilience Pillars, based on the pillar weights

identified for the different Distinct Management Areas. Each scenario is made up of a user-defined number of projects, and each resultant project contains a set of adjacent polygons that can be treated as a single project area.

ForSys is used for short range tactical planning problems where invariant landscape conditions can be assumed, i.e., fire and forest succession are not going to significantly affect the outcome of the model run compared to prescribed management. For research and models on long-term forest restoration and fuel management by the Ager team see the LSim forest landscape management model project page.

The difference between ForSys and other fuel management planning systems (ie ArcFuels and IFTDSS) is that landscape response to treatments does not typically involve re-running burn probability or risk analysis (although ForSys will build treated binary landscapes for models like FSPro or FlamMap). Substantial research has shown the need to treat 30-50% of typical fire excluded landscapes to significantly change fire behavior – assuming anything beyond that from additional modeling under current non-stationary fire regimes is not worth the effort from a broadscale scenario planning standpoint. ForSys was built to analyze higher order constraints and inefficiencies in current restoration and fuel management programs at a range of scales and is utilized across a number of project and forcasting efforts within USFS programs and with partnering agencies.

Additional resources and information related to ForSys can be found at the USFS/U.S Department of Agriculture, Rocky Mountain Research Station.

Appendix C: Treatment Types Detailed

Prescribed Fire. Prescribed fire includes understory burning and pile or jackpot burning of fuels. Understory burning applies a surface fire that burns live and dead fuels at or near the surface of the ground, mostly by flaming combustion. Understory burning treatments are designed to consume surface and ladder fuels and mimic fire that would occur in an active fire regime. Understory burning would be used to reduce surface fuel loading and re-introduce fire. Treated areas would burn with lower flame lengths, lower fire line intensity and reduced rates of spread when exposed to wildfire, providing improved wildfire suppression opportunities and reducing likelihood of stand-replacing fire.

Pile burning removes surface fuels generated from silvicultural treatments (activity fuels) and existing fuels on the ground. Piles are made by hand or by machinery. Pile location and size would be based on existing conditions; however, piles would be preferentially placed outside sensitive areas, such as riparian areas and cultural resource sites. Piles are typically burned under fall-like conditions, in winter months, or during periods of low fire danger. Jackpot burning involves igniting piles and other concentrations of fuels and then allowing the fire to travel between piles/fuel concentrations, thereby creating a mosaic burn pattern.

Prescribed burning would be applied under an approved burn plan that details the prescription for burning and operational requirements, including parameters and conditions for weather, fuel loading, fuel and soil moistures, safety, equipment, smoke and air quality, management and staffing, and so forth.

Thinning. The proposed action includes several types of forest thinning treatments: thinning from below, variable density thinning, and protected activity center (PAC) variable density thinning. Thinning prescriptions would be accompanied by detailed marking guidelines tailored to either the mixed conifer or red fir forest type.

Thinning treatments would retain significant wildlife structures, such as cavities and platform groups of tall trees, and mid-story trees that provide canopy cover and represent high quality habitat for the California spotted owl and other species dependent on old forest conditions. Large conifer trees greater than or equal to 30 inches diameter at breast height (dbh) would be retained, except in limited situations as allowed by the Forest Plan, including proposed project-specific plan amendments.

Thinning from Below. Thinning from below focuses on removing trees from the lower canopy, thereby retaining larger overstory trees in the stand. Thinning from below in this proposal would be used where the treatment's primary focus is on removing ladder fuels and reducing stand densities while retaining overstory trees. Thinning from below would typically be used in areas where thinning focuses on removal of smaller diameter trees with the result of increasing the quadratic mean diameter (QMD) of the stand, such as in inventoried roadless areas.

Variable Density Thinning. Variable density thinning is a form of uneven-aged management designed to produce a mosaic of individual trees, clumps of trees, and small openings to enhance stand resilience to severe disturbances, create structural heterogeneity, and foster development of diverse tree species. Variable density thinning would be used when needed to reduce stand density, reduce ladder fuels, prepare stands for the safe reintroduction of fire, enhance tree species composition, increase stand structural heterogeneity, and accelerate growth of mid-seral forests toward late seral conditions (particularly in plantations).

Mastication. Mastication would treat brush, shrubs, slash, and potentially sapling-sized trees by mulching the green material into fine chip treatments. Operational machinery would utilize a tractor with a masticator attachment. This treatment would create a residual fuel bed of chips in the treated stand. Residual material is typically left to decay and provide mulch cover for soils; however, prescribed fire could be used in these stands if the risk of excessive damage to residual trees due heat damage to fine roots was below the acceptable level.

In areas of dense shrub and/or small tree cover with high fuel loads where application of prescribed fire was not feasible, a silviculturist could prescribe mastication to shred shrubs, large down woody material, increase height to live crown by removing live and dead limbs, and small trees (live and dead, generally less than 14 inches dbh) on slopes up to 35 percent.

Ground-Based Mechanical Thinning. Ground-based harvest equipment (including, but not limited to, forwarders, feller bunchers, or harvesters) would be used on slopes generally less than 30 percent. Use of ground-based mechanized equipment on slopes greater than 30 percent would require special precautions to meet soil quality standards and control erosion. Such precautions include the use of tethered operations that use a synchronized cable winch system (see glossary) and special contract provisions that require excavator type equipment to recontour and drain impacted areas.

Aerial Thinning. Aerial-based treatment methods would be used on steep slopes generally exceeding 30 percent. Tree removal methods would include aerial logging with a skyline or yoder system with one-end log suspension and/or logging with a heel boom or excavator (commonly referred to as “shovel or heel boom” logging) as well as helicopter systems. Skyline and yoder systems would operate from roads and landings. With this method material (trees) are hauled up slope to a landing using corridors. Feller bunchers could be used within skyline or yoder units to cut and bundle trees designated for removal. Feller bunchers may operate with or without tethering. Conventional logging systems that employ timber fallers would be used in situations where feller bunchers could not reasonably operate.