Regional Forest and Fire Capacity Program

Demonstration Project Regional Priority Plan Section

NORTH COAST RESOURCE PARTNERSHIP

I. Title*:* Tenmile Creek Forest Health Pilot Project

II. Abstract

The Eel River Recovery Project (ERRP) recruited forest health professionals to create a Forest Health Management Plan (FHMP) template, as well as five FHMPs for twelve landowners in the Tenmile Creek watershed. In addition to being complete guides for forest health improvement, the FHMPs qualify landowners for CFIP and EQIP grants, and all landowners engaged in this project have interest in pursuing grant funds for implementation. LIDAR and remote sensing tools piloted during the project provided useful information for FHMPs and could help us understand North Coast region forest health patterns. Extensive local outreach was conducted within the watershed to generate landowner buy-in for collaborative forest health management.

III. Problem Statement/Question Addressed

Forests and grasslands in the Tenmile Creek watershed are in poor ecological health, which results in high risk of catastrophic fire, loss of biodiversity, decreased stream baseflows, and soil erosion that causes water quality degradation. Douglas fir, and to a lesser extent Ponderosa pine, have spread widely since cessation of Native American burning and are causing the loss of oak forests. Post-World War II logging removed larger conifers, opening up light gaps that grew back thick with conifers, hardwoods, and brush species. In the late 19th Century, native grass species that were deep-rooted and perennial were replaced by European annual species that lessened meadow water storage and posed much greater fire risk. Grasslands further deteriorated with spread of star thistle. With recent severe droughts and increased air temperatures, the stage is set for catastrophic wildfire. This project sought to answer many questions: How can Tenmile Creek residents organize and implement forest health at a landscape scale in a meaningful time frame? How can neighbors be organized? How could they get the resources and the permits? How can labor be organized on the scale needed? Who has the capacity to administer millions of dollars in forest health implementation grants, if grant sources were identified?

IV. Project Goals and Objectives

- *Create a new stream-lined ecological Forest Health Plan template that can be used in this project, subsequent Tenmile Creek watershed projects, elsewhere in the Eel River basin, and on the North Coast.*
    - The primary goal of this Project was to create an expedited forest health planning process that allows implementation without requirement of additional permits or regulatory agency oversight.
- *Test technology applications by having a drone operator available to the forest ecologist to capture imagery in remote, steep areas that are difficult to access; to understand tree species diversity and community type; and to detect forest health problems.*
    - A larger goal of ERRP is to turn the Eel River watershed into a carbon sink through widespread forest health implementation. Methods were identified to calculate estimated carbon sequestration from FHMPs, if prescriptions were carried out, but the budget was insufficient to complete those estimates.

- LIDAR data and orthophoto and infrared remote sensing data were utilized to provide information for FHMPs and to evaluate their utility in planning at a landscape scale, and to calculate carbon capture. We found that LIDAR has potential for both.

- *The new Forest Health Plan template will be tested by creating plans for 12 private landowners in the Tenmile Creek watershed whose properties have significant ecological values and/or can serve as demonstration sites. Include Cahto Tribe traditional ecological knowledge (TEK).*
  - We succeeded in creating five Forest Health Management Plans (FHMPs) for landowners in the Tenmile Creek watershed that allow clients to implement forest health without more permits and that qualify them for CFIP and/or EQIP grants. The *Forest Health Management Plan Template* created allows others in North Coast watersheds to follow the same process.
  - An objective of the Project was to develop educational demonstration sites. All landowners of parcels covered by the five FHMPs have agreed to such use, and ERRP also won cooperation from owners of an additional 2000 acres that will allow similar use.
  - Restoration of native grass species and meadows is extremely important in the Tenmile Creek watershed to reduce fire risk, and also as a means of carbon sequestration through. ERRP won the cooperation of several key landowners who want to restore native grasses and are offering their land as demonstration sites, including for using frequent low-intensity fire as a management tool.
  - Contact was established with the Cahto Tribe through electronic mail and mail with Cahto Tribal Council Chair Mary Norris, through meetings and conversations with Council Member Atta Stevenson, and networking with Cahto Tribe Natural Resource staff.
- *Estimate the amount of labor necessary for each forest health project, and begin to organize human resources for the coming wave of implementation money.*
  - ERRP had contractor Vernon "Woods" Wilson contact potential forest health workers to discern whether there was a capable and interested workforce and he found high interest. ERRP also initiated contact with Laytonville High School and Mendocino Community College to stimulate interest in an articulated forest health training program.
- *Clearly recognize and define potential regulatory and permit hurdles for each plan so additional resources can be sought to meet challenges.*
- *Coordinate with and support Forest Reciprocity Group in its goal to find value-added forest health derived products and include inventory of suitable raw materials anticipated from each forest health implementation project.*
- *Continue public education in coordination with the Tenmile Creek Watershed Council by holding forest health workshops and field trips as well as using, press releases, video, electronic media, and web and social media updates to widen cooperation.*
  - ERRP worked closely with the Tenmile Creek Watershed Council (TCWC) to help them develop recognition and capacity so they can ultimately administer large-scale forest health grants. Towards that end, we informed TCWC members of our progress, invited them on field trips, assisted them with grant proposal development, and created a brochure and direct-mail piece for their use in outreach.
  - In order to educate the public about forest health problems and opportunities and increase interest and participation in forest health planning and implementation, public outreach was conducted via radio interviews (KMUD), via Zoom presentations, through

use of Facebook, streaming video (Vimeo), and dissemination of brochures and educational DVDs.

V. Project location

The five FHMPs created are listed in Table 1 and displayed in map form as Figure 1.

Table 1. FHMP locations with the area in acres and lat/lon for each location.

FHMP Sites	Acres	Latitude	Longitude
Kovner (Upper Cahto)	21.4	39.65295	-123.5339
Cahto Trail	28	39.67748	-123.488
Triple Creek Ranch	160	39.74346	-123.5054
West Tenmile Creek	28	39.71143	-123.5065
Lower Tenmile	367	39.7586	-123.576

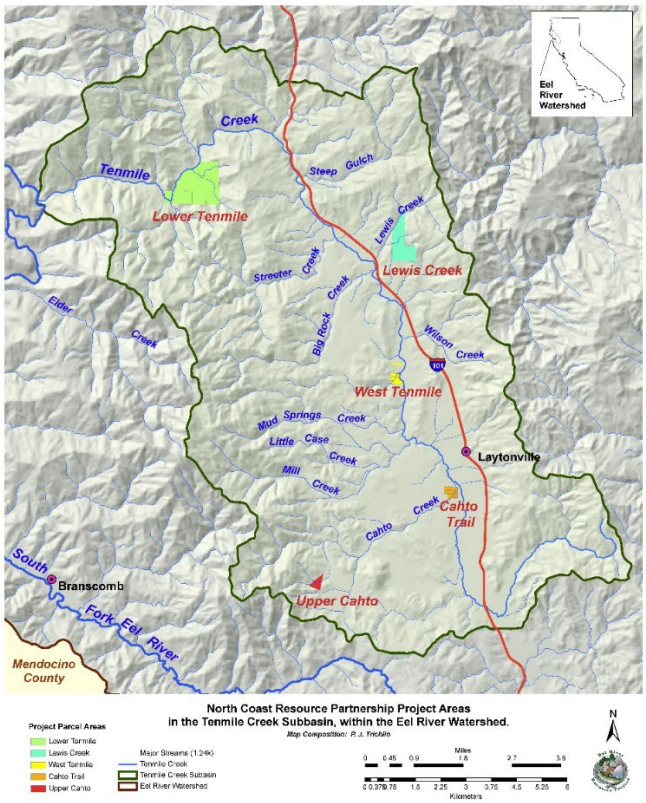


Figure 1. Location of FHMP areas within the Tenmile Creek watershed.

VI. Overview of Work Completed

The Eel River Recovery Project recruited forest health professionals, including Registered Professional Foresters (RPFs), to create a Forest Health Management Plan (FHMP) template, as well as five FHMPs for twelve landowners in the Tenmile Creek watershed in northern Mendocino County. RPFs Heather Morrison and Steve Smith of BBW Forestry worked together to create a draft template that was subsequently refined and used to create all five FHMPs. The plans meet criteria of the Natural Resources Conservation Service's (NRCS) Environmental Quality Incentives Program (EQIP) and CAL FIRE's California Forest Improvement Program (CFIP) grants. Subsequent implementation requires only archaeological review and no additional permits from other agencies, which was a major goal of the Project.

The *Forest Health Management Plan Template: An Annotated Guide for Wider Application in North Coast Watersheds* was developed to explain the methods used to create the FHMPs and, thus, it can be used to assist with forest health planning and implementation throughout the region. The key to the FHMPs is forest inventory data. One hundred and two plots were measured in all FHMP areas to better understand forest stand conditions. RPF Ken Baldwin of BBW Forestry trained Imil Ferrara and Steve Brown to collect forest inventory data. Their data were checked and found to be accurate by team leader Heather Morrison, RPF. However, because trainees could not do the plots quickly enough, an additional RPF was added to the team to speed the pace of data collection.

Plot data were transferred from field data sheets to Excel, and then Access, so data could be run through the USDA Forest Service Forest Vegetation Simulator (FVS) growth and yield program using the Klamath Mountains (NC) Variant to yield forest inventory estimates (Keyser 2018). Model outputs allow calculation of the volume, size and diversity of trees in forest stands and also provide an estimate of projected growth. Observations from foresters and technicians and from landowners all helped to shape the FHMPs.

ERRP discovered late that the FVS plot data could be used for calculation of carbon sequestration. The carbon sequestered would be calculated using growth models based on post-thinning conditions, with the amount of thinning based on EQIP forest health standards. FVS output data could then have been plugged into a newly developed FVS module for carbon sequestration calculation; however, this proved to be infeasible due to lack of sufficient funding.

ERRP funded GIS support services not covered under the NCRP grant. These were provided by Linda Gray of Legacy the Landscape Connection and long-time ERRP analyst, Dr. Paul Trichilo. They provided digital maps of slope for geohazard assessment; roads and streams to judge erosion risk; and available soil water storage capacity. All were useful for analysis and included in the FHMPs. Other maps and associated reports and tables were acquired from various sources, such as soil information from NRCS, and the location of northern spotted owls and other rare animal and plant species from the California Natural Diversity Database and the California Native Plant Society.

LIDAR imagery and summary statistics were provided by Tim Bailey of the Watershed Research & Training Center as part of the California Forest LIDAR Analytics Collaborative (CFLAC) project. These data proved highly useful and graphics and data interpretation were integrated into each FHMP.
Orthophoto and infrared (IR) data were collected by Humbots Data Analysis and also integrated into some of the FHMPs, with interpretation assistance provided by Dr. Mike Jones, UCCE Forestry Advisor. Orthophoto imagery was captured for the Kovner and Cahto Trail FHMP areas, and both Orthophoto and Infrared (IR) imagery was captured for the Lower Tenmile Creek and Triple Creek Ranch FHMP areas.

The outreach element of the Project was particularly successful. The landowners in the area covered by all five FHMPs (815 acres) have agreed to use their land as a public education forest health demonstrations sites, and all hosted field trips during the course of the Project. Two additional large landowners with substantial grassland holdings and an interest in restoring native grass species also offered their land as demonstration sites (1950 acres) after a successful native grass restoration field trip in May 2021.

Public meetings were not possible, but ERRP hosted two Eel Zoom series in spring and fall of 2021, with two presentations on forest health, including the Tenmile Creek watershed, and also on restoring native grasses. These were available live and were also streamed afterward. ERRP worked with NCRP to promote

access to the information. The ERRP Facebook page was used as a link to the Zoom series. Photos from performance of the Pilot project were also posted periodically, and then boosted to Laytonville community groups.

ERRP Tenmile Creek watershed native grass restoration field trip with landowners and experts. 5/8/21. Photo by Alex Rios.

The ERRP website was modified to included NCRP information, and videos were posted to Vimeo. Outside of the Pilot Project, ERRP helped make the KEET TV video entitled *Harmony in the Eel River Basin*, which was sponsored by PBS as part of the Age of Nature series. This video explains why returning to the use of frequent, low-intensity fire is desirable to decrease the risk of catastrophic fire. ERRP made 500 DVDs that are being distributed to the public and to the Tribal Councils of all Tribes in the Eel River watershed.

ERRP did outreach to the capable workforce in the Laytonville area through Woods Wilson, and he found great interest in participating in paid forest health work. However, there are not enough people trained to fulfill tasks such as forest inventory, so more RPFs and/or trained workers specializing in forest health are needed. ERRP found substantial interest from Mendocino Community College in having a forest health training program that articulated with Laytonville High School, but the pandemic has delayed any discussion about initiating or finding support for such a program.

The Project goal of calculating the wood available for creation of value-added products derived from forest health harvest by the Forest Reciprocity Group was abandoned because CAL FIRE said that donation of wood would not be allowed. Estimated cost of future FHMP implementation is based on the per-acre estimates provided by NRCS for EQIP grants.

VII. Budget

Grant funds awarded: $120,000 (119,959 expended)

Match funds committed: $0

VIII. Methods

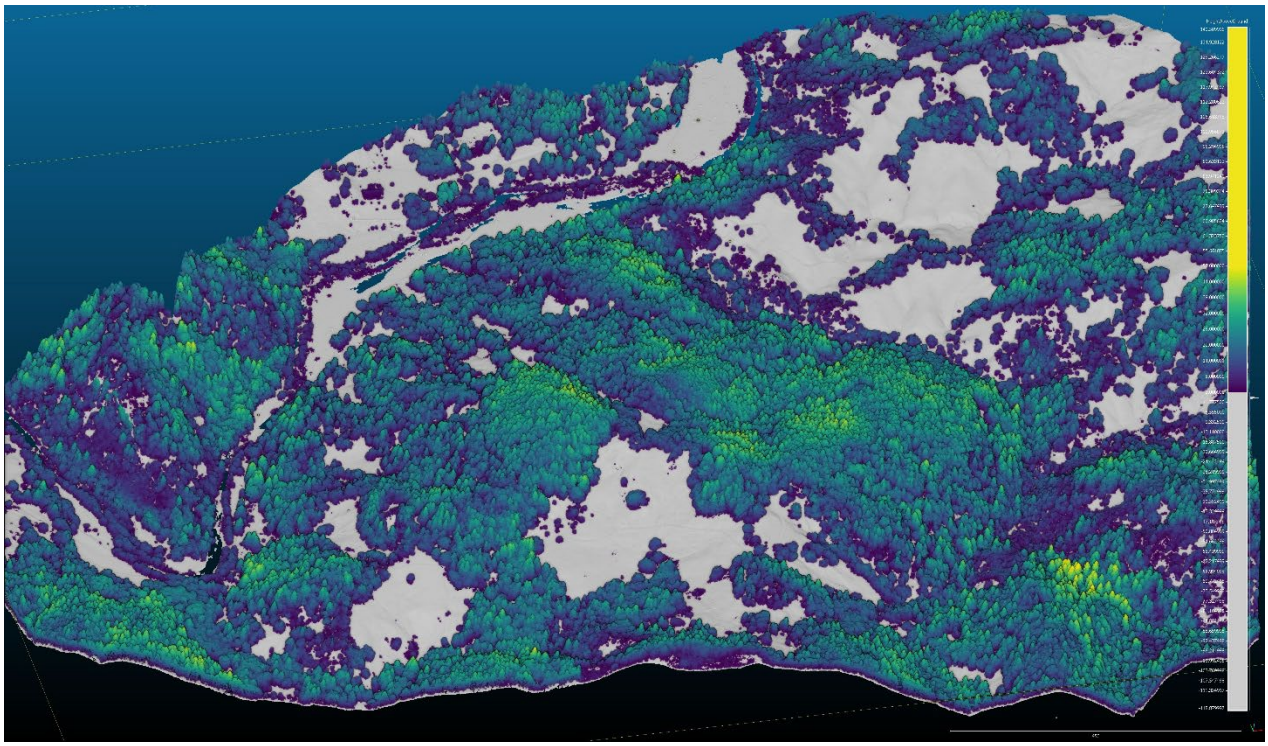
The *Forest Health Management Plan Template – An Annotated Guide for Wider Application in North Coast Watersheds* was created to explain to any forest health interested group or landowner how FHMPs can

be created for other North Coast watersheds following the methods described. This format enfolds the required elements of the pre-existing California Cooperative Forest Management Plan template, which requires assistance of an RPF and collection of standard forest inventory data.

Forest inventory data must be collected by trained personnel under the direction of or by an RPF. Data need to be collected for fixed 1/20-acre plots (26.3-foot radius) for every 3 acres of forested land according to standards and methods described in *Log Scaling and Timber Cruising* (Bell and Dilworth 1988). Plots are assigned a consecutive number on each property, which is recorded on the plot data sheet and on a placemark set at each plot center using a field mapping application (the project team used the Avenza app).. The plot center is marked with flagging with the plot number on it. All trees 5.0 inches and greater in diameter at breast height (4.5 feet above the ground on the uphill side of trees) are measured for diameter (to the nearest one-tenth of an inch), measured for total height, estimated for live crown ratio, and given a damage/disease code when appropriate. In addition, seedlings over 6 inches tall and saplings up to 4.99 inches in diameter were counted on a 1/100-acre circular plot (11.8-foot radius) using the same plot center as the 1/20-acre plot. Data are converted from field sheets to an Excel database and then into Access to feed the model.

Forest inventory data are then analyzed using the U.S. Forest Service Forest Vegetation Simulator (FVS) growth and yield program using the Klamath Mountains (NC) Variant (Keyser 2018) to yield forest inventory estimates. Forest types are determined based on the mix of species, size of trees, and density of crown closure and classified according to the California Wildlife Habitat Relationships (WHR) coding system, which can be accessed at https://wildlife.ca.gov/Data/CWHR.

LIDAR data were compiled for analysis by Tim Bailey of the California Forest LIDAR Analytics Collaborative (CFLAC) project and they are trying to acquire grants to create this capacity to support forest health planning for others on the North Coast in the near future. He processed the U.S. Geologic Survey 2018 LIDAR data using the Agile development framework to develop derivatives for forest health, similar to other projects CFLAC is supporting across the state. The first processing step is to re-project the coverage, in this case to UTM NAD 1983 Zone 10N, Meters (EPSG 26910). Model runs included 1) canopy height, 2) digital surface models, 3) digital elevation model, and 4) Entwine point tiles.



Tree canopy on the Lower Tenmile FHMP parcels simulated using LIDAR data and the Dalconte algorithm with taller trees with yellow highlights. Image from Tim Bailey based on USGS 2018 LIDAR data.

Humbots Data Analysis (Humbots DA) flew a drone to collect remote sensing data for the Project, specifically a DJI Matrice multicopter equipped with a 120-megapixel RedEdge multispectral camera. The software Map Pilot was employed to create flight plans that optimize flight paths and estimates battery life. Flights took place at an altitude of 100 meters, which allowed a safe flight above the tallest trees in the plot while also maintaining a sufficient ground resolution to easily identify the 30.48 cm square, black and white ground control points (GCPs) utilized for image geo-referencing. GCPs were placed before flights at three sites in open canopy conditions with little to no shadow. Their coordinates and elevations were recorded using an EMLID RS2 RTK GPS system.

The collected aerial photos were processed with the 3D modeling software Agisoft Metashape Pro version 1.6.2 to generate 3D point clouds from the image sets captured by the planned UAS missions. Images were calibrated in the field using a reflectance panel before and after each flight, and a top-mounted sun sensor. Using the 3D point clouds at each site, UAS images were stitched together to create an ortho-image covering the mission area. Outputs were in two formats, with the orthophotos shared as TIFF files and the point cloud data as LAZ files. Infrared data and near infrared data were delivered as TIFF files and were also provided as a Normalized Difference Vegetation Index (NDVI). IR flights need to occur after deciduous trees have regrown leaves in May or early June.

The Available Water Storage (AWS) in soils was derived using the NRCS Soil Survey Geographic database (SSURGO) and this coverage is recommended for development of all FHMPs because it is a strong driver of site productivity for forest growth. It is measured in centimeters (cm) of water held in the top 100 cm of soil.

IX. Project Findings

This Project helped to demonstrate the severity of forest and grassland health challenges in the Tenmile Creek watershed and created FHMPs to address the issues identified. Dead and dying oaks are prevalent, often suppressed beneath a conifer canopy. Native American burning that had kept oak woodlands and grasslands free of competition from fir and other vegetation stopped in about 1860. Very poor forest health conditions have resulted from the subsequent succession, similar to the findings of Keter (1995) in the North Fork Eel River watershed. Douglas fir trees over-topping and outcompeting oaks also causes a major reduction in food for wildlife due to the loss of acorns, which are the base of the food web, and can lead to a catastrophic fuel loads build-up on the forest floor.

FVS data for this Project demonstrated that most of the growth in FHMP forested areas was by Douglas fir trees. For example, the table below from the Lower Tenmile FHMP shows that fir dominated growth in stands in all WHR categories except for WO4D (white oak, 11-24" dbh, >60% canopy). Within the WHR type DFR4D (Douglas fir dominated, trees 11-24" dbh, 60% canopy closure) and MHC4D (mountain hardwood/conifer, 11-24" dbh, >60% canopy) conifer growth far exceeds that of hardwoods. Conifer growth still exceeds hardwood growth in the MHW4D (Mountain Hardwood, 11-24" dbh, >60% canopy) but only slightly. This demonstrates that oak woodlands will continue their decline without management.

Table of Projected Annual Property-Wide Conifer and Hardwood Growth (2021-2030) for Lower Tenmile Creek FHMP area.

Type	Acres	Plots	Conifer (MBF)	Hardwood (MCF)	Hardwood (Cords)
DFR4D	37	13	9.4	0.05	0.6
MHC4D	159	26	16.4	0.9	11
MHW4D	59	11	2.1	1.5	18
WO4D	32	11	-	0.7	9

Douglas fir and Ponderosa pine over-topping mature oaks. West Tenmile FHMP area. 8/22/21.

The proliferation of Douglas fir has had another major side effect: the increase in evapotranspiration that can reduce stream baseflow substantially, similar to the findings of Stubblefield et al. (2012) in the upper Mattole River watershed. Hahm et al. (2018) noted that oak trees use only a modest amount of water in

summer when compared to Douglas fir. Studies in the Tenmile Creek watershed by Thomas Gast Environmental Consultants utilizing the VELMA model (McKane et al. 2014) to compare flows and watershed impacts between the control stream Elder Creek and the altered Tenmile tributaries Streeter Creek and Big Rock Creek (ERRP 2020), arrived at a similar conclusion. Elevated evapotranspiration in the latter two watersheds had depleted their baseflow. Therefore, thinning the forest would increase flows.

Tanoak trees were historically important for acorn production for Native Americans and they were widely harvested in the late 19th Century for their bark, which was used for tanning hides (Mayo 1974). Consequently, the historical distribution of tanoak in the Tenmile Creek basin is unknown, but it has become widespread on sun-facing slopes after clear cut logging. Tanoak is being selected for retention on the Kovner property uplands for its acorn producing ability and because of the absence of other oak species. One major consideration regarding this strategy, however, is that tanoak is highly susceptible to sudden oak death syndrome and may be subject to die off, depending on the spread of the pathogen in the future.

The greatest challenge to restoring white oak and black oak forests is in areas where domination by conifers has been so prolonged that most oaks have died. Restoring oaks at these locations will be challenging, but methods were identified. Experiments carried out by Cahto Trail property owner Dennis Hogan (personal communication) found that young oaks like partial shade and protection from the hot afternoon sun, so they would be planted in light gaps and partially shaded by mature trees left after forest health thinning. He also found that planting acorns in a pile of ash encourages them to sprout and results in the growth of a high number of seedlings. However, saplings rarely survive due to deer browse; therefore, cages are necessary for protection until they have some growth above the browse line. FHMP clients all saw value in maintaining some large conifers, and large hardwoods like tanoak, madrone, and bay laurel to maintain biodiversity in areas where oaks were absent. If they wish to re-establish oaks in areas where they have disappeared, it will require a long-term effort.

While the Project did not initially focus on grassland health, the Tenmile Creek watershed has extensive grasslands due to geologic factors (Hahm et al. 2019), and several of the FHMP properties are comprised of grasslands. California grasslands were converted from deep rooted annual native grass species to being dominated by shallow rooted non-native annual species between 1859 and by 1889 as a result of livestock grazing (Barry et al. 2006). Replacement of native species increased fire risk substantially, since native grasses remained green for much of summer, while non-native annuals dry out early in spring and summer and can fuel catastrophic fire at the forest edge. Highly flammable non-native species include medusa head, cheatgrass, and bromes (Lambert et al. 2010). Also, restoration of native grass species can increase soil moisture holding capacity, helping rebuild watershed hydrology. Such activity can also play a major role in carbon sequestration because the roots of the native grasses penetrate deep into the ground (Janowiak et al. 2017). Consequently, native grass restoration became a target for all FHMPs. Frequent, low intensity fire can often be more easily used to manage grasslands than forests, if topography or roads provide points of control. The timing of controlled fire depends on the species targeted for control, such as spring burns to control star thistle.

Triple Creek Ranch grassland on 5/8/21 ERRP field trip.

X. Challenges Encountered

One goal of the Project was to see if people who were not trained RPFs could learn how to perform forest inventories. While trainees could collect high quality data, they could not attain sufficient speed (10-25 plots per day) to complete the plots needed for the five FHMPs. Therefore, another RPF was recruited to complete the needed forest inventories.

The amount of wood from forest health implementation that might be utilized by the Forest Reciprocity Group (FRG) for manufacturing value-added products was not calculated because CAL FIRE said donation of the wood would not be allowed. Mention of donation of wood to FRG was also removed from all FHMPs.

Some areas next to Indian Reservations do not have available LIDAR imagery from USGS. Data for the Cahto Trail FHMP was sourced directly from the Cahto Tribe. Humbots DA procured the use of a drone with IR capability on loan from Humboldt State University, but scheduling its use delayed the flight until late in the Project. However, data were supplied to Dr. Mike Jones for analysis and results were included in the FHMPs.

The Project called for calculation of carbon sequestration related to implementation of the FHMPs, and the FVS model can be used, if it is fed data modified to reflect forest growth after thinning equivalent to EQIP standards. The Project budget did not allow completion of estimating carbon sequestration for FHMPs at this time. Carbon may also be sequestered by transforming wood waste into biochar or directly interring it in a process called Hügelkultur. However, calculation of potential carbon sequestration in this form is hampered because FVS does not calculate volumes or weight of trees under 4” dbh, saplings, or and brush species on the forest floor.

XI. Recommendations for Application and Sharing with Others & Increasing the Pace and Scale of Forest Health

FHMP development went extremely well and the template offers a clear path for duplication in other North Coast watersheds, which can expedite implementation because they qualify recipients for CFIP and EQIP grants, and do not require additional permitting. Watershed and Fire Safe Council groups need to make residents in their area aware of the FHMP option, scope interest in developing such plans, and apply for grant funding support for cooperators. ERRP has been assisting emerging groups like the Tenmile Creek Watershed Council (TCWC) and the Mid-Eel Watershed Stewards (MEWS) with developing outreach materials, including a questionnaire and brochure suitable for direct mail. Responses to the questionnaire could quantify interest in participating in grant funded forest health planning and restoration. Data from forms would be entered into a summary database and APN numbers would show the geographic location of cooperators, which could facilitate regional planning, like the development of shaded fuel breaks. If cooperation is widespread enough, it is possible that there could be watershed-scale FHMPs, which would greatly decrease the cost of planning due to an economy of scale.

Having LIDAR imagery available prior to creating FHMPs is highly desirable because the forest stand structure can be clearly displayed, and summary data of estimated tree heights gives an overview of the age and size of trees. Furthermore, LIDAR can be used to recognize old ghost logging roads, skid trails and hillslope gullies that could be addressed during forest health implementation. Using NAIS or Harmonized Landsat (Sentinel-2) IR data is a more appropriate scale for detecting emerging forest health problems at larger geographic scales.

As noted in the FHMP Template, GIS themes such as soil Average Water Storage need to be generated to check for correlations of this factor and tree mortality and/or stress and disease. Slope maps and location of roads and stream crossings allow evaluation of potential areas of high geologic risk that might be avoided and call attention to potential problems for erosion that need to be addressed in the FHMP.

XII. Project Benefits

Significance of Project Benefits

1) Twelve very satisfied landowners who received FHMPs and are all ready to proceed if more resources for implementation are secured. Some are moving forward on their own immediately.
2) FHMPs allow forest health implementation to proceed without more permitting and only an archaeological study is required.
3) FHMP template and manual make duplication possible in other North Coast watersheds.
4) Large grassland owners engaged on May 8 field trip are ready for use of controlled burns of their properties and have long-term plans on grassland restoration.
5) Seven outreach sites at FHMP and Vassar and Varnhagen properties are available for field tours with public for outreach and education about forest and grassland health.
6) Greater awareness in the Tenmile Creek watershed as a result of ERRP outreach during the NCRP grant that will lead to more willingness to participate in forest health planning and implementation.
7) The power of LIDAR for analysis for individual FHMPs was considerable, but we also identified additional ways that it may be useful for planning and analysis at a watershed scale.
8) Learned that low altitude collection of remote sensing data such as orthophotos and IR data are useful at the FHMP scale, but that LIDAR and other pre-existing Landsat data could be used for analysis at the parcel, watershed and regional scales.
9) Identified potential relationship between soils with low Available Water Storage Capacity and manifestation of forest health problems that could be tested using Landsat IR data. If

relationship is established, then patterns in forest health problems can be identified that will help with prioritization.

10) Started community discussion on use of non-merchantable wood from forest health projects to help rebuild watershed hydrology, increase the fertility of soils, and to sequester carbon.
11) Enduring source of forest health information for the North Coast community established on ERRP website.
12) NCRP media person Alex Roa was able to capture extraordinary watershed footage and interviews of landowners and experts on May 8, 2021 grassland health field trip in Tenmile Creek watershed.

Unexpected Project Benefits

ERRP was alerted that the NCRP encouraged expansion of pilot projects to other North Coast basins, so networking with the Mattole Restoration Council began to both set the stage for transfer of FHMP technology and to learn about their pilot native grass restoration program. Hugh McGee, who leads the Mattole native grass restoration agreed to come to Tenmile Creek on a grassland field trip to share ideas. Dr. Kirsten Hill was recruited by ERRP, after being identified by Dr. Mary Power, who heads the UCB Dept of Integrative Biology, as an ideal person to work on native grass restoration at a watershed scale. Kirsten came along on the field trip and shared her wealth of knowledge. She found many different native grass species, which excited participants, and one site that had been rested from grazing was dominated by native grasses. Steve Brown is an ERRP contractor under the NCRP grant and aspires to be a regional controlled burn coordinator. During the course of the day, Steve explained how controlled burns could be used to promote grassland health, including control of star thistle. All the landowners that were to be visited on the field trip also elected to come along and shared their understanding of grassland health and how to restore it. As a result of the visits, Bob Vassar said he had an open commitment to working on grassland health on his family's 650 acres on Lower Tenmile Creek. Tony and Liz Varrhagen, who own the 1,400 acre Cahto Creek Ranch, expressed similar desires. Now there is interest in using these properties as demonstration sites and for experimentation for adaptive management. Hugh and Kristen expressed interest in planning grassland restoration at the watershed scale. Consequently, our forest health focus broadened to include restoration of native grasses. Benefits are increased forage for animals, reduced fire risk, improved hydrology and baseflows, and sequestration of carbon.

ERRP hosted a field trip with the Lower Tenmile FHMP recipients to discuss their level of satisfaction with their draft plans and to learn of potential concerns, and revised the document to reflect their input. However, two neighboring landowners stopped by to learn more and both became so excited that they expressed interest in getting similar plans. Neighbors of the Westside Tenmile FHMP have also expressed similar interest and would like FHMPs and assistance with implementation.

XIII. Next Steps

At least two of the recipients of FHMPs are already moving forward to apply for NRCS EQIP funds for implementation in the near future. ERRP has interest in pursuing additional grants to assist landowners without the capability to provide the 25% match required by EQIP and CFIP, and to obtain additional resources for developing FHMPs for potential clients that have expressed interest. Sources would include the NCRP, the North Bay Forest Improvement Program, and CAL FIRE grant programs. ERRP requested funding for development of a forest health action plan at the Tenmile Creek watershed scale, which was not included in the Project. Such a plan would still be useful for prioritizing implementation and developing a strategy for restoring native grass species and grasslands.

All the easy avenues for permitting forest health implementation involve options that do not allow sale or barter of trees harvested. Therefore, ERRP is planning articulated projects that would utilize this wood.

Theses would require separate funding and permitting. Conifer logs are ideal for rebuilding streams to increase ground water storage and improve baseflow while improving fish habitat (Doherty 2017). Wood derived from forest health could be used to create erosion control structures for gullies on nearby hillslopes that would also help restore watershed hydrology, and possibly assist with restoration of native grasses. Prior forest management has been largely extraction based, but forest health project derived wood could also be turned into biochar and buried as a soil amendment after charging in compost tea or mixing it in with compost. Interment of carbon-rich charcoal by the ton could go a long way toward making the Eel River watershed a carbon sink.

The Lower Tenmile FHMP area may be an ideal candidate for a special NRCS Conservation Stewardship Program (CSP) that allows five years for implementation, as opposed to two years typical of CFIP and EQIP. This program targets parcels of high conservation value where landowners are willing to make a long-term commitment, and Lower Tenmile FHMP landowners may qualify. The CSP also pays higher rates for forest health implementation and the longer planning period would allow for staggered implementation. Heavy fuels and brush could be removed immediately upon funding, but extraction of large diameter trees would be timed to accommodate the scheduled use of the wood, as when stream restoration projects are funded and permitted or when large-scale biochar processing is lined up. Stockpiles of unused logs are undesirable because they can be breeding grounds for insect pests.

Many landowners in the ERRP network understand the benefits of using controlled fire and are receptive to their lands being managed in this way. Cooperative energy in the Tenmile Creek watershed is high. The model of the Humboldt County Prescribed Burn Association, where people can volunteer on two controlled burns to become eligible to get their own grasslands treated, could be successful. Networking on this needs to include the Mendocino County Fire Safe Council. ERRP contractor Steve Brown is working towards certification as a local expert on controlled burns and is establishing rapport with grassland owners.

Grasslands have decreased by more than 50% since 1950. Enlarging grasslands and associated edge habitat currently occupied by encroaching firs and brush would be especially important for restoring biodiversity and reducing risk of catastrophic wildfire. ERRP has access to at least 1000 acres for adaptive management experiments for restoring native grasses. The strategy starts with identifying areas with native grasses and analyzing what it is about sites where they are growing that allow them to thrive (soil type, slope, aspect, shade, local hydrology, grazing rotation). Protect and expand these native grass areas, then look for locations using remote sensing and other analytical tools that might provide similar habitats.

As noted above, ERRP will continue to work with emerging watershed groups with an interest in forest health to help them organize and ultimately assist with bringing more resources into the Eel River watershed and to develop capacity to administer grants and organize the local labor force. Demonstration sites will be developed, and educational field trips hosted to build awareness in the community of the benefits of forest and grassland health implementation and to win cooperation for expeditious planning and implementation.

XIV. More Information

To learn more about this project, please contact Patrick Higgins (phiggins@humboldt1.com) and view the NCRP Demonstration Project Story Maps.

Zoom series and Forest Health Plans and template available for download on Home Page: https://www.eelriverrecovery.org/

Forest Health, Eel Zoom I, April 16, 2021: https://vimeo.com/540281973

Speeding North Coast Forest Health Implementation, Eel Zoom II, October 22,2021: https://vimeo.com/638335341

Grassland Restoration at a Watershed Scale, Eel Zoom II, October 29, 2021: https://vimeo.com/640983757

Various Podcasts related to Forest Health: https://soundcloud.com/eelriver-recovery-project

References

Barry, S., S. Larson, and M. George. 2006. California Native Grasslands, A Historical Perspective: A Guide for Developing Realistic Restoration Objectives. Grasslands, Winter 2006, p 7-11.

Bell, J.F., and J.R. Dilworth. 1988. Log Scaling and Timber Cruising. O.S.U. Book Stores, Inc., Corvallis, OR. 124 p.

Burcham, L.T. 1956. Historical backgrounds of range land use in California. J Range Mgmt 9:81–86.

Doherty, G. 2017. Working Together in McKee Creek: Water for Fish and People, OpenLands for You and Me. Summer/Fall Mattole Watershed News. Santuary Forest, Whitethorn, CA. 2 p.

Eel River Recovery Project. 2020. Tenmile Creek Conservation and Restoration Action Plan. Funded by the California State Coastal Conservancy Prop 1 fund. Published July 30, 2020 by ERRP, Loleta, CA 95551. 70 p.

Hahm, J., W.E. Dietrich, and T.E. Dodd. 2018. Controls on the distribution and resilience of Quercus garryana: ecophysiological evidence of oak's water-limitation tolerance. Ecosphere: May 2018, Vol. 9(5), Article e02218. 10.1002/ecs2.2218.

Hahm, W.J., D.M. Rempe, D.N. Dralle, T.E. Dawson, S.M. Lovill, A.B., Bryk, D.L. Bish, J. Schieber, and W.E. Dietrich. 2019. Lithologically controlled subsurface critical zone thickness and water storage capacity determine regional plant community composition. Water Resources Research, 55, 3028–3055. https://doi.org/10.1029/2018WR023760

Janowiak, M., W.J. Connelly, K. Dante-Wood, G.M. Domke, C. Giardina, Z. Kayler, K. Marcinkowski, , T. Ontl, C. Rodriguez-Franco, C. Swanston, C.W. Woodall, M. Buford. 2017. Considering Forest and Grassland Carbon in Land Management. USDA Forest Service General Technical Report WO-GTR-95. Washington D.C. 76 p. https://doi.org/10.2737/WO-GTR-95

Keter, T.S. 1995. 1995 Environmental History and Cultural Ecology of the North Fork Eel River Basin, California. U.S. Department of Agriculture, Forest Service, Pacific Southwest. Region 5 Publication, R5-EM -TP-002.

Keyser, Chad E. 2018). Klamath Mountains (NC) Variant Overview – Forest Vegetation Simulator. Created in 2008 and revised September 25, 2018). Internal Rep. Fort Collins, CO: U. S. Department of Agriculture, Forest Service, Forest Management Service Center. 61p.

Lambert, A.M., C.M. D'Antonio, and T.L. Dudley. 2010. Invasive Species and California Ecosystems. Fremontia, Vol. 38:2 /38:3 , April/July 2020.

Mayo, K. 1974. Pioneering in the Shadow of Cahto Mountain. First Centennial Edition 1874-1974.

McKane, R.B, A. Brookes, K. Djang, M. Stieglitz, A.G. Abdelnour, F. Pan, J.J. Halama, P. Pettus, and D. Phillps. 2014. VELMA Version 2.0 - User Manual and Technical Documentation. U.S. Environmental Protection Agency, Corvallis, OR. 180 p.