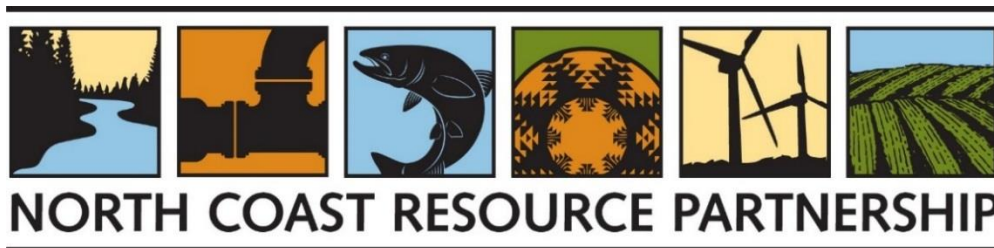


Forest Health Management Plan Template

An Annotated Guide for Wider Application in North Coast Watersheds



Created by: Eel River Recovery Project
Funded by: California Natural Resources Agency
Awarded by: North Coast Resource Partnership from the
Regional Forest and Fire Capacity Program Block Grant
October 31, 2021



Introduction

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. RPF Heather Morrison worked closely with Steve Smith of BBW Forestry and other team members to create an outline that was refined and subsequently became the basis for five FHMPs. The plans meet criteria of the Natural Resource Conservation Service's (NRCS) Environmental Quality Incentives Program (EQIP), CAL FIRE California Forest Improvement Program (CFIP) grants, and also U.S. Forest Service and American Tree Farm Association grants. This is achieved by incorporation of required elements of the pre-existing *California Cooperative Forest Management Plan* template (CAL FIRE 2020).

What follows is an explanation of how the FHMP's were created and how others can duplicate these plans in other North Coast watersheds. Only sparse information is given in this manual for the sake of brevity, however, full text versions of all previous FHMPs are available on-line and provide useful examples (www.EelRiverRecovery.org).

California Cooperative Forest Management Plan, Signature Pages, EQIP, CFIP, USFS, and ATFA

These pages require a lead California Registered Professional Forester (RPF) to attest that criteria for all the grant sources listed are met. Therefore, all those wishing to create FHMPs must have a capable RPF to fulfil this role and to collect forest inventory data or to oversee its collection. The signature pages are provided to document acceptance of this management plan by agencies and grant funders, although some minor adjustments by the RPF retained by the landowner may be needed before implementation is authorized.

Landowner Information

Landowner(s) and RPF contact information: mailing address, phone number, and email address.

Management Plan History

This section is meant to capture and previous management plans or forest data collected previously, including CFIP or EQIP grants, Non-industrial Timber Management Plans, Forest Stewardship Plans, or Conservation Activity Plans. Previous plans would be referenced and made accessible for review by grant funding agencies.

Property Facts

This section contains a legal property description of the project location, including latitude and longitude, Township and Range, and Assessor's Parcel Numbers (APN) for all properties included. Total acres of the property should be reported here and the number of forested acres, as well as whether the owner resides on the parcel(s). The general slope and aspect of the property must be described in this section and streams contained within the parcel, that border it or that are nearby. Slope should be broken down by percent on property with Flat (<5%), Gentle (<20%), and Steep (>35%) terrain. Vehicle access classes are >80% (Excellent), at least 50% (Good), at least 25% (Fair), and less than 10% (Poor). The length of surfaced and rocked roads and unimproved roads is also reported in this section. The CalWater Watershed name and number(s) are listed and it is noted whether the watershed is recognized as impaired by the U.S. Environmental Protection Agency (EPA) and State Water Resources Control Board (303d list), and for what factors. Although usually not applicable for North Coast watersheds, the U.S. Department of Agriculture Farm Tract Number should be listed, if such a classification exists. To meet CFIP requirements, property infrastructure should be captured here. 1) Structures - dwellings and out-buildings. 2) Electrical Improvements. Property wide electrical system including above and below ground powerlines and any alternative energy sources. 3) Water Improvements. Existing water system including domestic water sources, holding tanks, stock ponds, diversion source, and wells. 4) Roads: Property transportation infrastructure should be described, including stream crossings, drainage improvements and whether culvert are sized to withstand a 100 yr storm). Describe current road maintenance for erosion reduction, road surface condition, weed control, and seasonal) use.

Property History

The history section is comprised of several elements, historic maps, general area history derived from historical texts, and the known history of the property related by the land owner. Government Land Office (GLO) maps from 1860 to 1890 are generally available via download from the Library of Congress, and sometimes by counties, and they document land marks, trails and topographic features. An I-pad or GIS software can be used to import parcel shapes so their relative location on historical map is established. Local history books, such as *Pioneering on Cahto Mountain* (Mayo 1974) for the Tenmile Creek watershed, can be consulted and excerpted. Native American history of the area is available from University of California anthropologists; however, the accounts and photos of Edward S. Curtis are available on-line and provide the best recount of Native American culture and customs for the North Coast (<https://sova.si.edu/record/NAA.2010-28>). Interviewing the land owner and including their understanding the FHMP is essential, and any historic photos of property condition should be sought and included, if compelling.

Current Property Conditions

This section is the heart of the FHMP as it provides quantitative data on forest conditions, starting with total property acres and forested acres. 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 as 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 on an Avenza map, which is an available App for Smart Phones and I-pads that are necessary field equipment. The plot center will be 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 to be 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. For a complete guide to forest data collection methods, see file NCRP_FHMP_Temporary_Plot_Inventory_Procedures_V1_09_20_20.doc (Baldwin 2020).

Plot forest data need to then be transferred from field notes into Excel and then Access so data could be run through the U.S. Forest Service Forest Vegetation Simulator (FVS) growth and yield program using the Klamath Mountains (NC) Variant to yield forest inventory estimates related (Keyser 2018). 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>. The type codes are in three parts. The first letter code designates the dominant species, the number code designates the size class of that species, and the last letter code designates the percent crown closure of that species.

Although grasslands do not receive the same level of attention in planning as do forested areas, they may contribute to fire risk (D'Antonio et al. 1992) and need to be discussed. How extensive are they and where are they located on the property? Are the grasslands dominated by non-native grass species and undesirable forbs like star thistle? Are there roads crossing meadows resulting in erosion and gullies?

Forest Inventory Estimates

This section reports FVS model outputs as net volume in both millions of board feet (MBF Scribner to a 6" top) for conifers and millions of cubic feet (MCF to a 4" top) for hardwoods (Table 1). Cubic feet can be converted to cords using a ratio of 80 cubic feet/cord, or to tons using 45 lbs./cubic foot for conifers and 60 lbs./cubic foot for hardwoods. Ton values are useful if there is a local biomass market/chip log market or for calculation of carbon capture through conversion to biochar or interment as part of Hügélkultur. Cord values are useful for firewood harvest purposes can also be reported. The summary table should show property wide stocking of conifers and hardwoods with Forest Type as the first column and then acres,

number of plots, conifers in millions of board feet (MBF), hardwoods in millions of cubic feet (MCF) and hardwood cords. An example table (Table 1) from the Lower Tenmile FHMP shows the type of summary inventory data that should be displayed.

Table 1 Property-Wide Conifer and Hardwood Stocking for Tenmile FHMP area..

Type	Acres	Plots	Conifer (MBF)	Hardwood (MCF)	Hardwood (Cords)
DFR4D	37	13	219.2	2.0	25
MHC4D	159	26	476.1	67.2	840
MHW4D	59	11	92.3	40.8	510
WO4D	32	11	-	67.5	844

Growth Estimates

Another FVS output is the projected annual property-wide growth, which includes in-growth (i.e. trees that have grown from .5 inches DBH into larger classes), minus mortality. This model output for growth should be captured in a summary table with Forest Type as the first column and then acres, number of plots, conifers in millions of board feet (MBF), hardwoods in millions of cubic feet (MCF) and hardwood cords. Again a Tenmile FHMP example is below as Table 2.

Table 2 Annual Property-Wide Conifer and Hardwood Growth (2021-2030).

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

Remote Sensing Data

The *Tenmile Creek Forest Health Pilot Project* was able to access orthophoto and infrared data, as well as 2018 USGS LIDAR data. While these data are not necessary for all FHMPs, having LIDAR imagery for all sites would be optimal. LIDAR imagery can yield a highly intuitive rendering of the forest from existing data, while similarly powerful renderings derived from orthophotos require data collection and processing. 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. If LIDAR imagery is available at the outset of the project, the team can go into the project with a much better understanding of stand structure and can look for correlations of forest size and density with slope position or aspect. Frequency histograms of tree heights can also reveal things quickly, such as lack of taller and older trees, where saplings are proliferating and may be causing increased fuels, and the general size and age of all trees with the overall shape of the curve. Figure 1 shows example LIDAR data from the West Tenmile FHMP area.

If orthophoto data are collected, flights need to be after deciduous tree leaf-out. If a correlation between tree color and species were programmed to be recognized automatically to generate a tree species GIS, then widespread use of high resolution orthophoto flights could be justified. Infrared (IR) data to detect tree stress and disease should be done at more of a landscape scale from NAIS, Landsat or the Harmonized Landsat Data Sentinel.

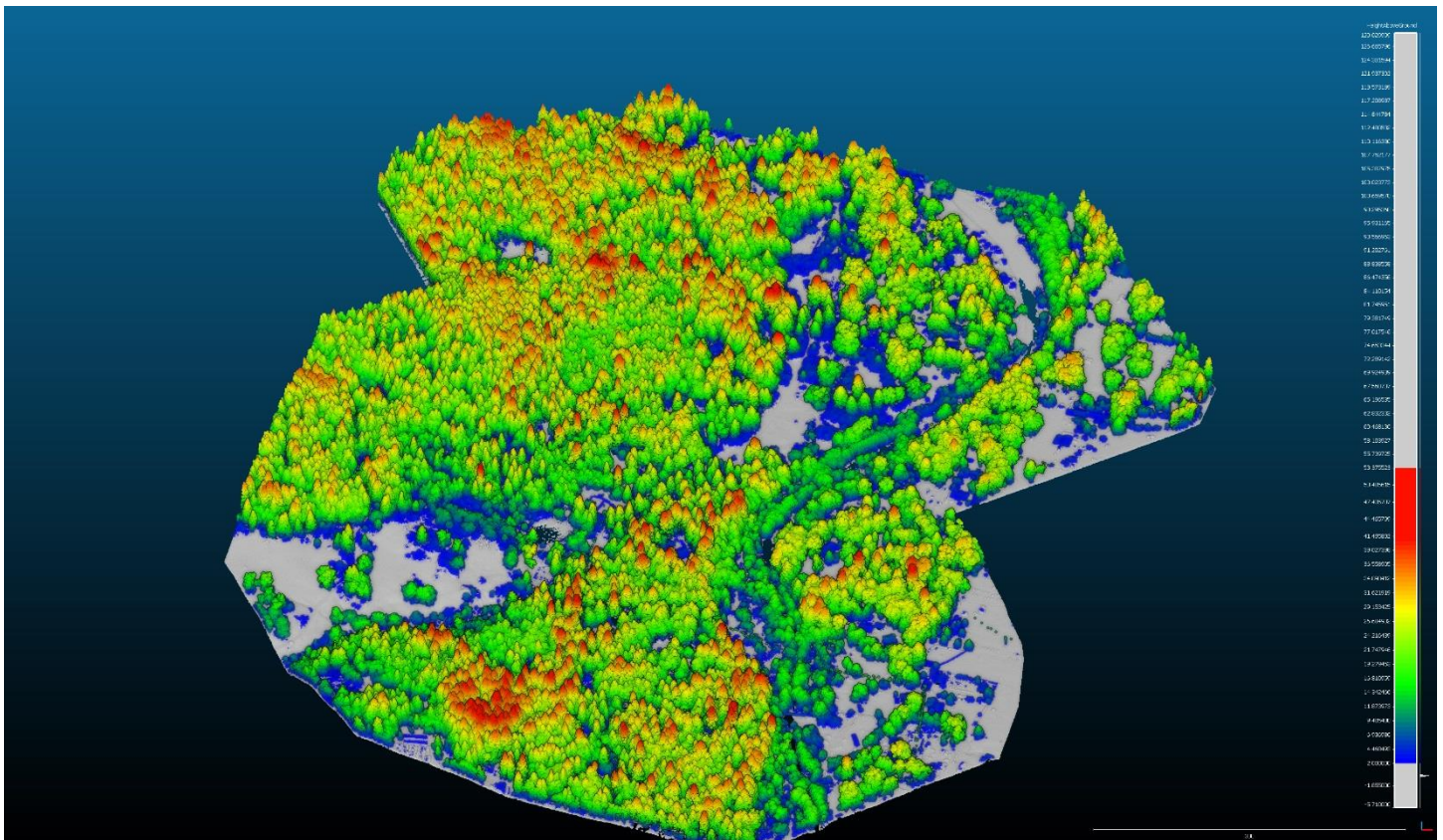


Figure 1. Tree canopy on the West Tenmile Creek properties simulated using LIDAR data and the Dalconte algorithm with taller trees showing as red highlights and grass and river bar showing as white. Image from Tim Bailey based on USGS 2018 LIDAR data.

Soils

Information on soils is critical because they govern site productivity, influencing runoff rates, susceptibility to erosion and tree growth rates. NRCS custom soil maps for parcels under study for FHMPs can be acquired from offices in North Coast counties. They are derived from local soil surveys, which for the Tenmile Creek basin was the Soil Survey of Mendocino County, California, Western Part (NRCS, BLM and UCCE 2000). Soil information can be difficult for non-soil scientists and property owners, so every effort should be made to make the information more accessible. A summary table should be provided with the Soil Complex number as identified in the local soil survey, the Complex name, the acres it covers and the percent of the parcel(s) within the FHMP. The soil type map from the custom NRCS report on a Google Earth photo backdrop should be captured and used as a plan illustration (Figure 2). The Available Water Storage (AWS) capacity of soils is one of the most important variables governing site productivity for forest growth. AWS is measured in centimeters (cm) of water held in the top 100 cm of soil and the spatial data used to make a map for the FHMP is available in Soil Survey Geographic (SSURGO) database (NRCS 2021), which requires someone trained in the use of ArcGIS software.

The level of detail conveyed on soil complexes can vary in other FHMPs, but information like the key tree and understory plant species supported, general site productivity, forest regeneration after harvests, and associated geohazards are the most important to include, in addition to AWS. A summary table for all soil types is useful for FHMP users with an interest in soils and a sample table is available as (Soil_Type_Table_FHMP_Example_LTC.xls) and parameters are the same as those in custom NRCS soil report. Parameters include the percent area the soil type covers within a complex, elevation range at which soil type is generally found, mean precipitation, mean annual temperature, frost free days, soil parent material, percent slope, depth to restrictive layer or feature, drainage rate, runoff class, depth to water table, AWS, soil water transmission rate (Ksat), and soil horizons. Note that the NRCS custom soil report had values for available water storage that were non-standard and did not supply metadata or any explanation. Therefore, AWS values were derived from SURGO data.

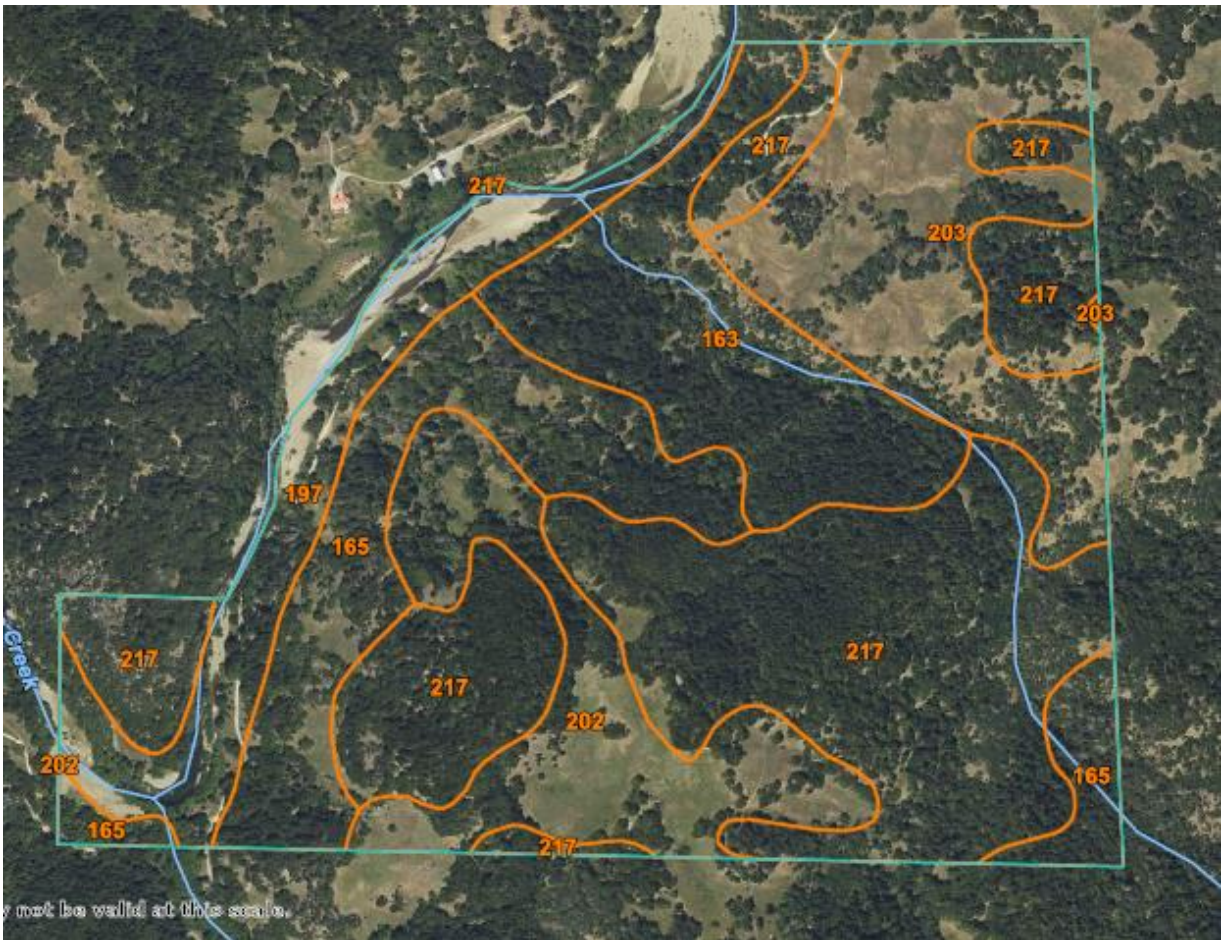


Figure 2. Lower Tenmile FHMP properties with different soil complexes on Google Earth map back ground (NRCS 2021).

Slope Stability and Erosion Hazard Risk

A map of the FHMP property showing percent slope or a map of erosion hazard rating should be included and are readily available as public GIS data to anyone with ArcGIS skills. These maps should utilize danger colors (yellow, red, orange for areas of higher slope and higher erosion risk so potential problems with operations on steep slopes are called to the attention of the land owner and anyone involved in the FHMP implementation (Figure 3). These maps are used for educational purposes, but a licensed geologist should be consulted if any management operations take place on slopes greater than 50% or with extreme risk classifications. The section in the FHMP on slope stability should make sure to mention and highlight these challenging areas, especially any steep ground immediately adjacent to stream courses or within the inner gorge area. Slope stability is also driven in part by the erodibility of soil types, so information should be referenced or restated from soils discussion.

The Erosion Hazard Risk (EHR) rating table is available as the file EHR_FHMP_NCRP.xls and derivation of values is described as follows:

Detachability: Sandy soils or those with high rock components are most resistant to being detached and eroded, with loam next and silt or clay the most highly erodible. Review soil table to determine which of the categories each type fits and then categorize detachability as High (19-30), if soils have high clay components. Loams and sandy loams would be Moderate (10-18), and sandy soils and those with high rock or gravel component rate as Low (1-9).

Permeability: NRCS surveys give an indication of the permeability of soils as the inverse of runoff (i.e. if runoff is rapid, permeability is low). Ksat is the rate of water movement through the soil and is; therefore, also an indicator of permeability and ratings from NRCS surveys should be factored into scored. Permeability is also influenced by soil texture with clay soils

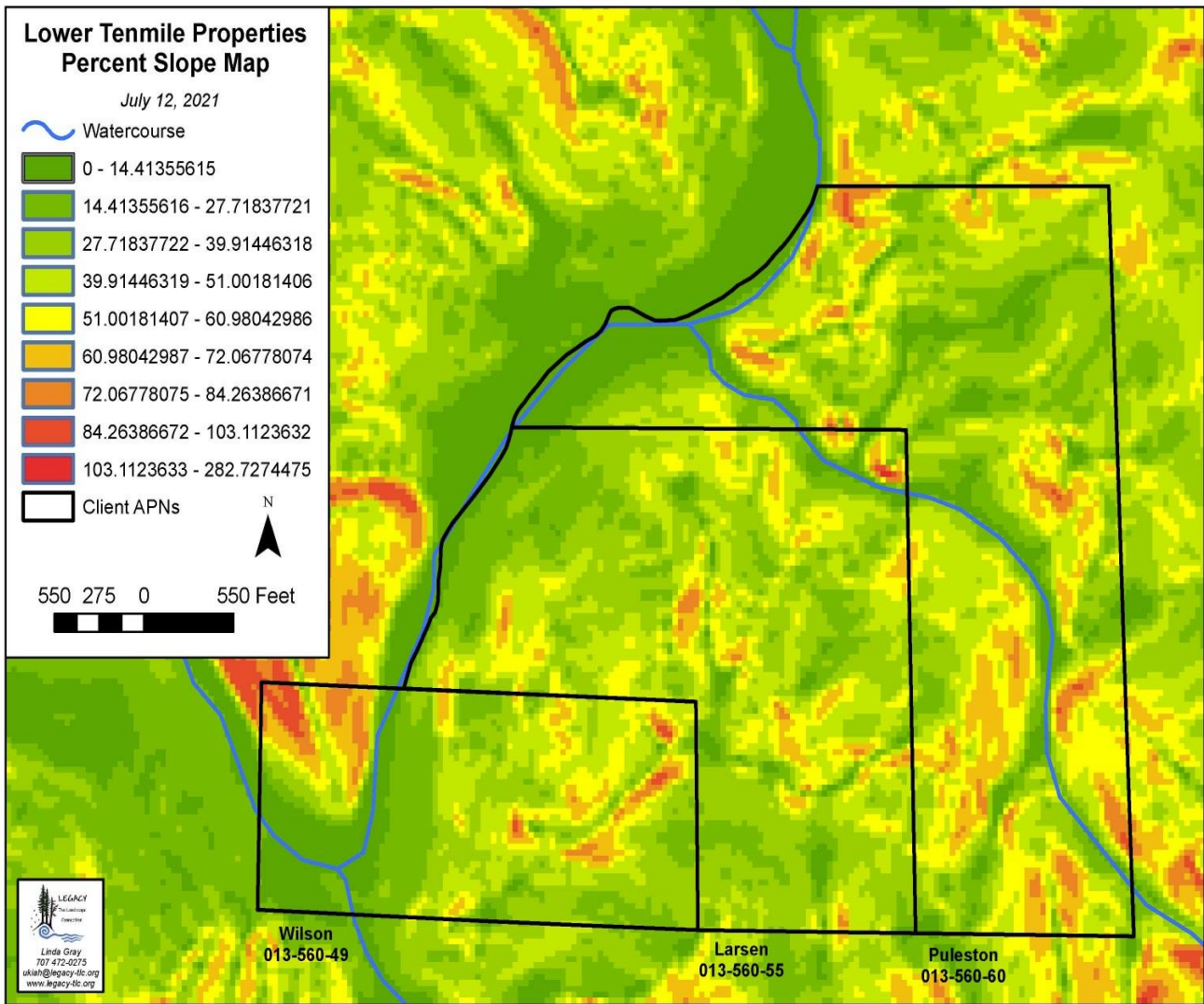


Figure 3. Percent slope map for Lower Tenmile FHMP. By Legacy the Landscape Connection.

have the lowest permeability, loam intermediate, and sandy or rocky soils are usually rapid. Review all these parameters in soils table and rate permeability as Slow (4-5), Moderate (2-3), or Rapid (1).

Depth to Restrictive Layer or Bedrock: This information is directly listed in NRCS soil tables and in soil horizon information.

Slope Rating: The percent slope for various soil types from NRCS soil tables translates directly into slope rating scores.

Percent Surface Coarse Fragments Greater Than 2 mm in Size Including Rocks or Stones: Use the soil description (i.e. gravelly loam) and rock presence in the shallow soil horizon information from soil property table to derive this score.

Protective Vegetation Cover Remaining After Disturbance: Forest health implementation is first and foremost about removing ground vegetation and seedlings and saplings that don't effect canopy cover. Also, forest health harvest of mature trees will follow the principal of thinning from below selecting smaller trees and protecting larger healthier trees of the desired species. Therefore, canopy closure should be maintained at a level to achieve Moderate or High designations with canopy cover of at least 50% and in many cases meeting the greater than 80% criteria.

Two-Year One-Hour Rainfall Intensity: These data are available at https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=ca

Add all scores to determine the overall ERH score.

Diseases

Tree disease information in the Tenmile FHMPs is from the University of California Cooperative Extension (<http://cemendocino.ucanr.edu>) and information would be the same for any other FHMPs in Mendocino County. Other counties also have UC Cooperative Extension offices and UCCE Advisors and their resources can be obtained using on-line research. The U.S. Forest Service (2019) also has a *California Forest Disease and Insect Training Manual* with pertinent information (https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev3_046410.pdf).

All tree diseases potentially present in the FHMP area should be listed and described, so the landowner can look out for them in the future. Notes on presence or absence of tree diseases in the FHMP project area that accompany plot data should be included in this section, or known tree disease outbreaks in the area. Sudden Oak Death (SOD) syndrome is the most troubling tree disease in the North Coast region and it is a serious threat to tanoaks, especially, that are a common tree and important ecologically. It is recommended that all FHMPs; therefore, have full information on plants that are susceptible to SOD or that might be carriers of the disease from UCCE and include caution about potential spread of the disease. Precautions need to be taken when implementing forest health so as to prevent spread of SOD on vehicles and especially shoes of people working on the project who do other woods work. Each FHMP should include protocols for cleaning cars and equipment prior to work daily, when implementation is taking place to prevent the introduction of any pathogen or non-native species..

Insects

Insect pest are generally more prevalent on diseased trees, but sometimes reach levels of infestation where they can attack health trees. Local University of California Cooperative Extension offices and Advisors are the best source of information on insect pests, with resources for Mendocino County watersheds available at <http://cemendocino.ucanr.edu>. Other counties also have offices and Advisors and their resources can be obtained using on-line research. The U.S.F.S. training manual on California tree diseases and forest pests is also a useful resource and available on-line at: www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev3_046410.pdf. The California State Integrated Pest Management Program (UC 2021) also has information about controlling pests without chemicals

A cautionary note on relying on literature for distribution of insect pests. Species such as the pine borer are proliferating after the recent fires in dead snags and downed logs, and may be expanding their range. Therefore, insect pests may be found in locations not yet documented by scientists. Discussion of insect pests should encourage practices that do not provide more habitat for insect pests, including harvesting logs and leaving them decked for extended periods.

Invasive Species

Although there are many non-native plant species that have been introduced to California and the North Coast region, only invasive species that alter ecosystem functions, outcompete and exclude native flora and fauna, and hybridize with native species are considered a serious threat. Several species that are widespread and have a high chance of occurrence in North Coast watersheds include: French broom (*Genista monspessulana*), Fennel (*Foeniculum vulgare*), Giant reed (*Arundo donax*), Pampasgrass (*Cortaderia* spp.), Himalayan blackberry (*Rubus armeniacus*), Periwinkle (*Vinca major*), English and Algerian ivy (*Hedera* spp.), Yellow Starthistle (*Centaurea solstitialis*), and Saltcedar (*Tamarix* spp.). More information can be acquired from the California Department of Fish and Wildlife Invasive Species division <https://wildlife.ca.gov/Conservation/Invasives> or from UCCE forest and range advisors.

Streams, Wetlands and Ponds

Stream courses and adjacent riparian zones and wetlands are the most sensitive parts of the landscape. Consequently, governmental regulatory agencies are often most concerned about impacts to these areas and the FHMP should fully describe them. The CAL FIRE stream classification systems should be utilized and explained, including a description of each water course on the property and its length. Definitions used in this management plan come from the California Forest Practice Rules.

Road/stream crossings and streamside roads often pose greater risk of erosion and these should be described and a map USGS topographic map backdrop and 1:24000 USGS stream coverage should be included in the FHMP. If the FHMP includes replacement of stream culverts, or any other projects that will substantially alter the bed, bank or channel of any size watercourse, they will require a 1600 series permit from California Department of Fish and Wildlife. The area and location of ponds should be described, whether they are seasonal or perennial, and whether water from that source is a part of FHMP area fire protection.

Rare, Threatened and Endangered Species

Lists and maps are needed for any of the following that have the potential to occur in the FHMP area: 1) Federally Rare, Threatened or Endangered under the federal Endangered Species Act (ESA); 2) California Rare, Threatened or Endangered under the California Endangered Species Act (CESA); 3) California Native Plant Society (CNPS) List 1, 2, 3 and 4 plants or vegetation communities, and 4) any that are considered as candidates for listing under CESA or ESA. Lists and maps are available from the California Natural Diversity Database (CNDDDB) (<https://wildlife.ca.gov/Data/CNDDDB>), the California Native Plant Society (CNPS) database (<https://www.cnps.org/rare-plants/cnps-inventory-of-rare-plants>) and the U.S.F.W.S. Information for Planning and Consultation (IPaC) database. The latter includes a list of potential species, critical habitat, migratory birds, or other natural resources that should be considered under Section 7 of the Endangered Species Act (see <https://ecos.fws.gov/ipac/>). The USGS quadrangles for search area should be listed. Any forest health implementation measures recommended in the FHMP should be addressed as to whether they will cause harm to rare species but also, if such actions will improve habitat for them. Whereas, most timber harvests treat presence of rare species as a constraint, FHMP activities will typically foster recovery of these species, not harm (i.e. retaining downed wood and snags where possible, restore oak woodlands, etc.).

Botanical Resources

While most of the emphasis of FHMPs is on trees, the co-adapted native plant community should also be discussed. Lists of rare plants are accessible through web addresses listed above in Rare, Threatened and Endangered Species section. Most FHMPs will recommend the re-introduction of annual low intensity fire as a maintenance tool after project implementation that will help oak woodlands and grasslands thrive and also other botanical species that are co-evolved at this location, including those that are culturally important to the Cahto Tribe. Tables containing rare plant species referenced above should also be listed here, including maps of listed plants species within a 3-mile radius of FHMP area.

Upland Wildlife

Since forest health in any FHMP area is likely to be altered from its historic condition, it may have compromised wildlife carrying capacity that will likely be improved by implementation of recommended forest health implementation. Similar to Botanical Resources Section above, tables and maps containing rare animal species should be referenced here. As noted above, opening up the forest floor can increase native plant species diversity that in turn benefits animals with which they have co-evolved. Notes should be included about protection of raptor nests not previously located prior to implementation, including no activity within 300' of the active nest during breeding season or 150' outside of breeding season and consultation with a qualified biologist.

Fish and Aquatic Species

Low gradient reaches of stream in the North Coast Region are likely to have anadromous salmon and steelhead species, and native trout that are the same as steelhead may be present but exhibit a resident life history. Pacific lamprey also is widespread, but may be less apparent because their juveniles burrow in muddy substrate. Native suckers and sculpin species may also be present as well as non-native warmwater species. Frogs and salamanders are also present in many stream locations, as well as the native western pond turtle. Some species have protected status in other areas of the State, but not on the North Coast.

CDFW fish habitat inventory reports for streams crossing the property or nearby should be referenced. These are available at: <https://nrm.dfg.ca.gov/documents/ContextDocs.aspx?cat=Fisheries--StreamInventoryReports>

Threatened or Endangered Plants and Animals

This section should make reference to any tables or maps containing lists of rare plants or animals and also maps of location of these species within a three-mile radius of the FHMP area. The Northern Spotted Owl is a species that is of concern to regulatory agencies and a map of their location, within 3-miles of the project should be included in the report. If ESA and CESA salmon, steelhead and native trout species are found within the FHMP area, address whether forest health implementation will jeopardize these species or benefit them.

Property Access and Security

A description of how to access property should be included here and the location of the nearest law enforcement agency (i.e. Northern Operations unit of the Mendocino County Sheriff's office). The full name, address and contact phone number for nearest law enforcement agency should follow.

Aesthetics

Only a brief statement is needed here, since aesthetics are likely to be improved. Thinning that removes a visual buffer between dwellings and a road is sometimes a concern for landowners.

Fire Protection

Current information about loCAL FIRE-fighting resources provided by CAL FIRE or other agencies, noting whether stations are open year-around or seasonally. Name of the fire department or agency, street address and telephone should be listed for all within a 15-mile radius of the project.

The next section should include how to be fire-safe around rural homes such as those on many FHMPs, including information on vegetation control, especially of potential ladder fuels, home hardening, cleaning roof gutters, and mowing grass to reduce fuels for fire. Planting of native bunch grasses can also reduce the threat of fire. Creating shaded fuel breaks should also be discussed to create a more defensible space by disrupting the continuity of the fuel, thereby reducing fire intensity. Possible sources of ignition for fires should also be considered in shaded fuel break design (i.e. nearby roads).

Income

This section should state any future plans for land use for commercial purposes by landowner. The effects of the commercial activities on forest health project implementation outcomes should be discussed, if there are competing interests. The FHMP is aimed at ecological restoration, and extractive commercial interest may not be compatible.

Legacy

What does the landowner see as the long-term use of the land and what is their desired future condition in the near-term and long-term? It is important that the landowners are interviewed on this subject and that notes be captured accurately and included in the FHMP.

Air Resources

The California Air Resources Board has several Air Quality Management Districts and the office of jurisdiction in the project area should be listed (<https://www.arb.ca.gov/capcoa/dismap.htm>). This should include the name of the District, address of office, telephone number and email, if available. A discussion should be included in this section on permissible burn date ranges, protocols for obtaining permits, and which other agencies need to be notified, depending on the scale of burning activity. Concerns over smoke and how to limit it should be addressed and the need to consider winter inversions that may concentrate smoke in valley areas under certain conditions. Regulations and limitations on burning should be listed and covered at least in summary.

Climate Considerations and Carbon Sequestration

The climate change benefits resulting from the proposed forest and grassland health implementation (i.e. reduced catastrophic fire) should be described here and also potential for carbon sequestration. The extent of atmospheric pollution caused by large catastrophic fires can be referenced. Generally, when forests are thinned and grasslands are rejuvenated and native species restored, and frequent low-intensity fire is used to maintain the landscape, carbon sequestration will result. Wood coming from forest health implementation projects may be turned into biochar (NRCS 2019) and interred, which can lead to long term carbon sequestration. Use of wood for Hügelkultur, where wood is buried to increase organic matter and moisture, would also result in carbon sequestration.

Carbon sequestration can be calculated for forest growth after forest health implementation by using a new module for the FVS model. FVS growth calculation is based on stand conditions after the equivalent of EQIP thinning. Problems remain for calculation of carbon capture from biochar and or use of wood in Hügelkultur because the FVS model does not generate biomass estimates or tonnage of trees less than four inches in diameter or seedlings or brush on the forest floor, all of which might be used for these purposes.

Landowner Management Objectives

This section is bullet points of management objectives that obtain forest and grassland health. These should be thoroughly discussed with landowners and be reflected in the Preferred Alternative.

Management Plan Implementation

Proposed Alternatives and Constraints:

Preferred Alternative: This section should clearly state the actions that will be taken to achieve forest and grassland health, including details about how methods may vary at different locations across the property. This discussion can include how lands were likely managed historically by Native Americans, and how more recent land use patterns have affected vegetation and resulted in current conditions. The Preferred Alternative is an array of actions to meet management goals, and most FHMPs should have positive benefits for the environment, including improved biodiversity and improved hydrology that should be emphasized. The more specific this section can be in terms of management actions, the better. Representative photos of different WHR types in this section may help reviewers better understand the proposed treatments. Use of wood resulting from the forest and grassland health implementation should be considered and discussed.

Agricultural Alternative: Under the California Environmental Quality Act, alternatives other than the Preferred Alternative must be offered. Most often, forested wildlands are not suited for typical agricultural development.

Alternative Project Location, Size or Timing: Jurisdiction of the landowner is only over their property, less treatment would not achieve the desired result, and the urgency of forest health crisis calls for immediate action.

No Project Alternative: The No Project Alternative would prevent any short-term impacts from management activities, but it creates greater risk of environmental damage in the long term as a result of catastrophic fire and increased tree diseases. Fuel loading and catastrophic fire risk would remain high. Other project benefits that would not be accrued can be mentioned here. In sum, the No Project Alternative is not consistent with the purpose of the project and does not address the need for the project.

Benefits of Preferred Alternative Implementation

Benefits from carrying out the Preferred Alternative should be described, including the following subject areas:

- *Fire protection*
- *Forest Health*
- *Grassland Health*
- *Wildlife Habitat*
- *Fish Habitat*

Economic Sustainability

How will FHMP implementation effect the property value and augment ecosystem services that accrue to the landowner but also to the environment?

Maintaining Soil Productivity

A major concern with any forest harvest, including those carried out for the purpose of improving forest health, is that they can cause soil compaction and erosion. Measures taken to mitigate such problems should be described, such as season of operation, the type of equipment used, or other relevant methods that help protect soils. If wood harvested from the FHMP area is to be used for soil rebuilding, such as the use of biochar or Hügelskultur, that should also be mentioned. Roads are often a source of erosion and any measures taken to reduce sediment from roads would be relevant here.

Required Permits:

This section should include all potential permits that might be required by the landowner to cover a wide range of land management options.

1. Burn Permits – List agencies and actions needed by landowner to do a controlled burn.
2. Lake or Streambed Alteration Agreement from the California Department of Fish and Wildlife, if road stream crossings need to be added or changed, including increasing culvert size.
3. Timber Harvest Plan or Non-Industrial Timber Management Plan could be used as a means to achieve forest health, but there are substantial costs involved in planning and there may not be enough merchantable timber to make such approaches cost-effective. None the less, these processes should be described.

Timber Harvest Exemptions should be listed here, criteria for meeting them, and whether the FHMP area might qualify for any of them. It is a good idea for landowners to periodically review (once a year) the CAL FIRE website (<http://www.fire.ca.gov>) to see if there have been any changes or additions.

Management Activity Schedule and Tracking

The table below should be used to summarize the area of the property, number of acres, treatment type, planned schedule for implementation, landowner cost share and the level of grant resources expected for implementation.

Table 3 Treatment Activities and Costs.

Management Unit	Acres	NRCS Practice Code (optional)	Treatment Activity Short Description	Dates		Cost Share Used? Type?	Net Cash Flow	
				Planned	Completed		Cost	Income
Total								

California Environmental Quality Act (CEQA) and National Environmental Protection Act (NEPA) Information

The California Environmental Quality Act needs to be discussed here as it pertains to private land management activities. Although the National Environmental Policy Act (NEPA) is mentioned in this section, it usually doesn't apply to an FHMP, but circumstances under which it might be invoked need to be mentioned. The principal concerns for CEQA would be impact on special environmental and/or cultural values, threatened or endangered species, and archaeological sites. Landowners also need to know that environmental and cultural reviews by regulatory agencies are required when a ground practice is proposed, and a permit and/or government assistance becomes part of the project.

The FHMP allows implementation in partnership with the Natural Resources Conservation Service and/or CAL FIRE that does not require CEQA review, but the environmental benefits of the project should be listed here a note taken of mitigation activities that might pertain. Other factors related to regulation, including qualifying for California Forest Practice Rules Exemptions, should be discussed here (i.e. California Oak Woodland Conservation Exemption).

Additional CEQA/NEPA Notification for Ground Disturbance Practices

Any future ground practices under the FHMP implementation using reimbursement grant funds requires a signed CAL FIRE CFIP Environmental Checklist (CEQA) or an NRCS CPA-52 (NEPA) Checklist. Along with this checklist a process of “discovery” or survey for unknown values along with a discussion of possible mitigations is required. Additionally, the checklist must be filled out by an RPF or Certified Planner. Archaeological values require an Archaeological Records Check, an entity Archaeologist review, and Native American notification for the practice area. A listing of all entities and agencies needing notification based on different types of actions and impacts needs to be listed here.

Additional Professional Assistance

This list should include contacts for the California Department of Fish and Wildlife (including on-line data and resources), the local NRCS office, CAL FIRE (including CFIP information), the local Resource Conservation District, the loCAL FIRE Safe Council, and the Forest Landowners of California (including grant availability).

Landowner Incentive Programs/Grants

All grant sources, a description of opportunities and how to apply and contacts should be listed here including

- Environmental Quality Incentives Program (EQIP) grants offered by NRCS.
- California Forest Improvement Program (CFIP) offered by CAL FIRE
- Vegetation Management Program (VMP) Also CAL FIRE
- North Bay Forest Improvement Program (Mendocino County and South to Marin)
- North Coast Resource Partnership (NCRP)
- Climate Change Initiative (CCI) by CAL FIRE and CA Wildlife Conservation Board
- Fire Prevention Grants Program also by CAL FIRE

References

All literature cited with web links, if available.

Appendix 1 – Selected Conservation Standards and Specifications

Links are OK for this section.

NRCS Standards are located in:

<http://efotg.sc.egov.usda.gov/>

CAL FIRE CFIP Guidelines are located at:

http://CAL FIRE.ca.gov/resource_mgt/resource_mgt_forestryassistance_cfip.php

Appendix 2 – Tax and Business Management

This section needs at least a brief discussion regarding the following to explain potential federal and/or state income tax liability, or potential tax credits available for some management activities: 1) Timber Yield Tax (Revenue and Tax Code Sec. 38116), 2) Property Taxes, 3) Estate Taxes, 4) needed record keeping and 5) additional resources to help provide more information on taxes related to FHMP implementation.

Appendix 3 – Past Plans, Amendments and Updates

This Appendix should include reference to any previous management plans created, including Timber Harvest Plans, and or previous work supported by CAL FIRE or NRCS.

Appendix 4 – Supporting Data

Tables should be inserted here for 1) parameters of soil complexes for the FHMP area, 2) Botanical Scoping List, and the 3) Biological Scoping List.

Appendix 5 – Confidential Addendums

Include here 1) table of CNDDDB results for species within three miles of the FHMP and maps of 2) CNDDDB results, and 3) nearby occurrences of the northern spotted owl.

Appendix 6 – Additional Maps

- 1) Vicinity Map
- 2) Nearby Parcels Map
- 3) Resource Management Unit (RMU) Map for FHMP Area

Appendix 7 – Open Burning Information

Provide Open Burning Recommendations here from CAL FIRE, including comprehensive contact list for any landowner considering use of controlled fire.

Appendix 8 – FVS Model Methods

RPF in charge of forest inventory and growth modeling should supply this information.

References

- Bell, J. and J.R. Dillworth. 1988. Log Scaling and Timber Cruising. O.S.U. Book Stores, Inc., Corvallis, OR. 124 p.
- CAL FIRE. 2020. California Cooperative Forest Management Plan. Plan Template Edition Date: December 21, 2020. CAL FIRE, Sacramento, CA. 24 p.
- California Department of Fish and Game. 1988. California Wildlife Habitat Relationship System.. <https://wildlife.ca.gov/Data/CWHR>
- D'Antonio, Carla M. and Vitousek, Peter M., Biological Invasions by Exotic Grasses, the Grass/Fire Cycle, and Global Change, Annual Rev. Ecol. System, 1992.
- Dunning, D. and L.H. Reineke. 1933. Preliminary yield tables for second-growth stands in the California pine region. Tech. Bull. 354. Washington, DC: U.S. Department of Agriculture. 24 p.
- Keyser, Chad E. comp. 2008 (Revised September 25, 2018). Klamath Mountains (NC) Variant Overview – Forest Vegetation Simulator. Internal Rep. Fort Collins, CO: U. S. Department of Agriculture, Forest Service, Forest Management Service Center. 61p.
- Mayo, K. 1974. Pioneering in the Shadow of Cahto Mountain. First Centennial Edition 1874-1974.
- National Oceanic and Atmospheric Administration, Atlas 14 Point Precipitation Frequency Estimates, https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map.html
- Natural Resource Conservation Service. 2005. National Soil Survey Handbook title 430-VI, Soil Properties and Qualities (Part 618), Available Water Capacity (618.05). USDA NRCS. Online at: <http://soils.usda.gov/technical/handbook/>
- Natural Resource Conservation Service. 2019. Conservation Practice 384: Woody Residue Treatment – Biochar Production from Woody Residue. Conservation Stewardship Program. USDS NRCS, Washington DC. 4 p.
- Natural Resource Conservation Service. 2021. SSURGO. Soil Survey Geographic Database. NRCS. Web Soil Survey. Available online at <https://websoilsurvey.nrcs.usda.gov/>. Accessed 3/30/21.
- Smithsonian Institute. 2021. Guide to the Edward S. Curtis papers and photographs, circa 1895-2001. Smithsonian Online Virtual Archives. <https://sova.si.edu/record/NAA.2010-28>
- U.S. Forest Service. 2019. California Insect and Disease Treatment Manual. USDA Forest Service, Region 5, San Francisco, CA. 229 p.
- University of California. 2021. State Integrated Pest Management Program. UC Agriculture & Natural Resources UC IPM website (<http://ipm.ucanr.edu/PMG/PESTNOTES/pn7402.html>)