



USDA California Climate Hub
U.S. DEPARTMENT OF AGRICULTURE



Forest Management Handbook for Small Parcel Landowners in the Sierra Nevada and Southern Cascades

SUMMARY

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Introduction

Managing forested lands can be a difficult task for small parcel landowners in California due to a variety of technical, legal, and operational challenges. However, forest lands in the Sierra and Cascades need management attention due to the significant changes in forest conditions over the last 100 years. Many areas, particularly those that have not experienced fire for many decades, have tree densities that are three to ten times higher than 100 years ago, and are dominated by smaller trees that are more vulnerable to fire (Figs 1 and 2). Trees are dying at accelerated rates in response to drought and competition for water, forest fires are becoming larger and more intense, and changing climates forecast worsening conditions in the coming years and decades. Investing in the health of your forest today can help achieve short and long-term goals and objectives for your property.



Figure 1. Healthy multi-structured forest with large dominant trees. Photo credit: Malcolm North

The [Forest Management Handbook for Small Parcel Landowners in the Sierra Nevada and Southern Cascades](#) and its attending worksheets will help landowners build a “California Cooperative Forest Management Plan”. This management plan template meets the requirements for grants and other provisions available to small parcel landowners via agencies like the California Department of Forestry and Fire Protection (CAL FIRE), USDA Natural Resources Conservation Service (NRCS), United States Forest Service (USFS), and the American Tree Farm Association. The plan will help determine what management action(s) are appropriate for your land, how to obtain technical and financial support, and what, if any, permits may be necessary. Developing and executing an effective forest management plan may seem like a large and complex task; however, while it may certainly require some effort, it is attainable.



Figure 2. Dense forest stands common throughout the Sierra Nevada. Photo credit: Peter Stine

The complete Handbook and this six-page summary organize the forest evaluation process in a step-wise manner to assist the landowner in making decisions. The process is structured in a 4-step process: 1) establishing **management objectives**, 2) conducting a **forest condition assessment** on your property, 3) identifying the **disturbances and threats** your forest may face, and 4) evaluating a variety of **treatment options** (Figure 3). The evaluation of the information collected through this process will provide the landowner with key data needed to develop a site-specific forest management plan.

However, the initial and most critical step that all forest landowners should consider is taking immediate steps to **protect your home from wildland fire**. Create and maintain a 100-foot clearance, often referred to as “defensible space”, around your house. **This step is essential**. For more details, visit: <https://www.fire.ca.gov/programs/communications/defensible-space-prc-4291/>

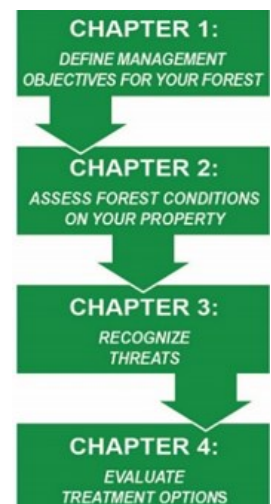


Figure 3. Four-step forest evaluation process for your property.

Step 1: Define objectives

Establishing objectives for your forest could be the single most important decision you will make for many years to come. Your forest property is likely nestled within a region with other small parcel forest landowners. What you do on your property will not only impact future conditions on your forest but could also potentially benefit your neighbors and the community more broadly. In turn what your neighbors do can also improve conditions for your property. To start, a clear definition of your objectives will prepare you to recognize threats and select suitable management tactics to achieve your objectives.

There are many objectives for owning small tracts of private forest lands, and landowners may have more than one purpose for their land. Some objectives can be compatible with others, (e.g. an objective of passing land on to heirs can match any other objective) but others may require trade-offs between objectives. The most common objectives or uses of small parcels of privately-owned forest land in the Sierra fall into five general categories (according to the National Woodland Owner Survey):

1. Recreation and Aesthetic Enjoyment
2. Timber Production
3. Minor Forest Products (e.g. firewood)
4. Other agricultural products imbedded within a forest environment (e.g. wine grapes)
5. Watershed and Ecological Processes to provide for forest health and an array of ecosystem services, such as wildlife habitat.

Defining your objectives will set you on a path toward recognizing concerns and selecting different management actions needed to achieve your objectives. Depending on your desired conditions and what you learn from the subsequent steps there are many different directions your decisions can take you.

Step 2: Assess conditions

Forests in the Sierra Nevada change gradually, but persistently, over time. If you have owned your property for even a few years, you may have witnessed tree growth, seedlings germinate and fill in openings, other trees die and fall over, and those newly created openings may have filled in with fast growing shrubs. Evaluating the condition of your forest will allow you to determine what, if any, actions may be necessary to achieve your objectives.

This process involves a careful look at your forest and the land it grows on, sometimes referred to as a *forest condition assessment*. In forests, a “stand” is a common way to describe a group of trees that are similar in terms of species composition, age classes, and growing conditions. A stand is typically between a few to more than 100 acres in size. We will use this term frequently because a stand is generally the unit for which management is designed or executed.



Figure 4. Recent drought impact on forests in the Sierra National Forest, southern Sierra Nevada. Photo credit: Craig Thompson

Step 2 (con't): Assess conditions

An initial, cursory, assessment of your forest would include the following:



1. *What is the general climate of your area* (minimum and maximum summer and winter temperatures and average annual precipitation)?



2. *Map your forest* (large scale rendering including geographic features such as ridges, roads, and creeks; delineate the distinct forest stands on your property). [Google Earth](#) renders a 3D representation of the earth's surface using satellite imagery and can be used to assist in an assessment of your forest.



3. *Physical setting in which the forest grows* (aspect, slope steepness, general soil types)



4. *Conditions of trees:*

- What trees species do you have (pines, firs, incense cedar, black oak are most common)?
- Identify the size and shape of distinct stands on your property.
- What are the dominant species of each of the stands identified?
- How many trees do you have per acre?
- What proportion of your forest has trees with canopy near ground level?
- How big (diameter at breast height or dbh) are the trees?
- Are there any seedlings coming up?
- Is there evidence of disease or insects in trees; what percentage of trees show this?
- Are there any dead standing trees? How many?
- Are there areas with few or no trees that could support trees?



5. *History of the property* (past harvests, fire, when the stands in your forest were planted)



6. *Locations of roads, fuel breaks, or "special sites" needing attention* (e.g. archeological sites)

Assessing the *future climate conditions your forest is expected to face* is also important because the changing climate could impact what kind of forest will be suitable for your property in the next few decades. We have already observed changes in vegetation conditions throughout the world in response to changing temperature and precipitation conditions so some degree of change is unavoidable. The user friendly tools at the [Cal-Adapt website](#) is a useful way to learn about climate projections for your location.

Step 3 : Recognize threats

Depending on current conditions of your forest, it may be more or less vulnerable to an array of potential threats. While it's normal for forests to experience a variety of stressors (which impose physiological strain or stress on the forest via events like drought or heatwaves) and disturbances (which force direct change in plant composition and structure through specific events like fire, mudslides or insect outbreaks), it's important to recognize when they become threats to the objectives you have for your forest property.



Figure 5. 2021 Caldor Fire in the Sierra Nevada. Photo credit: CAL FIRE

Fire is both a necessary component of and a potential major threat to a forest in the Sierra and Cascades. Periodic and low to moderate intensity fire was common in conifer forests of this region until about 100 years ago. Historically, such fire was the primary mechanism by which the forest thins itself and reduces fuels, opens the forest and makes it more resistant to further disturbances. In part due to the absence of periodic low intensity fire for many decades, many forest stands have become dense with abundant fuels (branches and needles on the ground and in the low hanging canopies of small trees). As a result, high severity fire has become the biggest present-day threat to forests in the region (Fig 5).



Figure 6. Pine beetle galleries. A common sign of mountain pine beetle attack is the presence of fine sawdust in the bark crevices along the trunk of the tree, an indicator of the beetle larvae feeding on the nutrient-rich tissue (phloem) of the tree. Photo credit: Chris Fettig

Insects occur naturally in conifer forests and only a few species pose a threat to forests. Massive increases in bark beetles can result in large-scale tree mortality (Fig 6). Such events are relatively rare but recent increases in the frequency and severity of outbreaks are clearly linked to widespread forest health problems, such as drought stress and too many trees competing for limited water.

Drought has occurred periodically in California for millennia. However, the 2012 – 2016 drought was the worst in 1,200 years and all evidence suggests that the frequency and intensity of drought in the future will increase. Extended drought and the associated stress to trees often leads to increased likelihood of tree mortality through a variety of pathways.

Pathogens in forests are typically microscopic organisms that infect trees and cause disease or even mortality. Low levels of disease are often not obvious and not necessarily a problem. However, when the disease affects many trees, it can become a threat and may require a management action.

Step 4: Evaluate treatments

Now that you have *defined your objectives*, *assessed the conditions* that currently occur in your forest, and *determined what threats* are facing your forest you can determine what treatments are most appropriate to meet your goals. A “treatment” is an action or series of actions intended to support reaching the desired condition of your forest. The main options to modify the vegetation in your forest fall into three categories; 1) mechanical and manual treatments of various kinds, 2) burning piles or using prescribed fire, and 3) planting desired species.

Mechanical and Manual treatment of vegetation includes cutting down vegetation, piling or masticating material and leaving it on site, or removal of logs and chips for commercial uses. Thinning forests and reducing density is usually done with large mechanical equipment. However, smaller scale tree and shrub removal can be accomplished by using a chain saw and other hand equipment. Mastication is the grinding and chopping of shrubs, small trees, and woody debris into smaller pieces and is usually done with machines that grind up and spread the mulched plant material over an area.



Fire can be used to combust woody debris, shrubs, litter, and other surface fuels and to remove small standing trees. *Prescribed fire* is a highly effective treatment for reducing fuels and decreasing larger-scale fire risk but it should be executed or guided by experienced people under carefully controlled conditions. You can find more guidance on using prescribed fire at the University of California, Division of Agriculture and Natural Resources' [Forest Research and Outreach website](#). Fire can also be used to *pile-burn* stacks of hand or machine cut vegetation (both small trees and shrubs). Burning these piles of fuel can safely remove them, if done in strict accordance with county or state guidelines. Extreme care should be taken when using fire treatments of any kind. Check with local authorities about when and under what conditions it is permissible to burn.



Reforestation of forests involves planting trees and shrubs and can specifically target desired tree species, spacing, and density. Reforestation efforts typically involve either natural regeneration (germination and growth of seeds from nearby trees) or planting nursery stock. These efforts often follow either a disturbance or a treatment of a stand to restore it to a desired condition. If you choose to plant seedlings consider a) planting fire tolerant species such as ponderosa pine, b) using seed stock sourced locally to ensure the seeds are adaptable to local climate conditions, and c) learning about best practices for planting trees and caring for them in the first few years. It is very important to carefully select trees and other plants that are native and appropriate for the specific area you intend to plant them, for both current and future climatic conditions. We suggest you either consult with your local NRCS, USFS, CAL FIRE, UC Cooperative Extension or Resource Conservation District (RCD) experts to help you select the most appropriate plant materials for your situation.



Regardless of which objective(s) a forest landowner is pursuing, all landowners with forest land in the Sierra Nevada and southern Cascades will have to cope with changing climate. The most likely changes expected for the Sierra Nevada region in the next few decades are warmer temperatures, longer dry seasons, and changes in precipitation in the form of less snow and more rain, depending on elevation. There are several treatments that a landowner can apply to adapt to ongoing changes, including decreasing stem density or increasing abundance of drought tolerant species.

Assemble Information into a Forest Management Plan

Although the Handbook's worksheets and directions are based on the *California Cooperative Forest Management Plan* [template](#), a forest management plan can range from a simple, informal, one-page summary of treatments you will execute independently, to a plan that meets the requirements of CAL FIRE's [Forest Improvement Program](#). What type of plan you should develop depends on 1) the complexity of your project, 2) the restoration work that needs to be addressed, 3) what, if any, permits are needed, 4) the kind of equipment and expertise needed to carry out the project, 5) the anticipated timeline for the work and its results, and 6) the funding needed to execute the work.

Regardless of its structure or complexity, forest management plans should be discussed with a resource management authority in your area (such as CAL FIRE or NRCS) or other source for technical assistance (such as UC Cooperative Extension Forest Advisor or local RCD) to provide you with feedback and further guidance. For plans that include more technical or larger scale work and or if you would like expert assistance, consider engaging professional help. One option is to hire a *Registered Professional Forester* who is licensed by the state to perform professional forest management services. The Handbook details a variety of additional sources of professional help and resources, such as the following alternative forest planning workbooks:

The National Resource Conservation Service "Conservation Planning on Your Land", <https://www.nrcs.usda.gov/wps/portal/nrcs/main/ca/technical/cp/>.

The Forest Stewardship Education Initiative, sponsored by U.C. Agriculture and Natural Resources (<https://ucanr.edu/sites/forestry/>).

This summary of the Forest Management Handbook for Small Parcel Landowners in the Sierra Nevada and Southern Cascades was produced through a partnership between the USDA California Climate Hub and the California Department of Forestry and Fire Protection (CAL FIRE). The California Climate Hub and CAL FIRE are dedicated to serving the public and their need for thorough and accurate information on managing forest lands in California. This information will enable well informed decisions by small parcel forest landowners in the Sierra Nevada region.