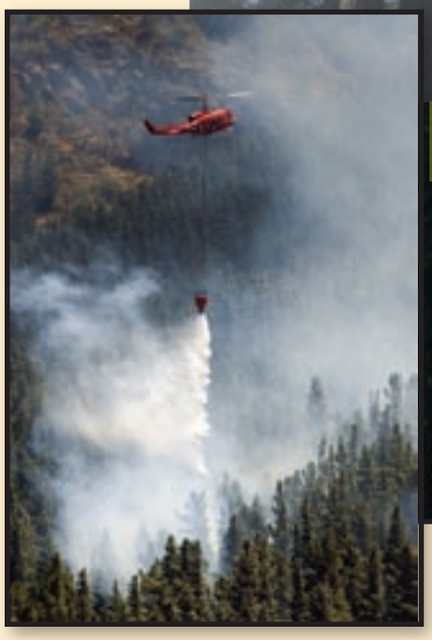
Sierra Nevada Community Conservation and Wildfire Protection Plan Guidebook

Tracy Katelman, Marko Bey, Susan Britting, and Carol Rice

July 2007



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Principal Contributors:

Tracy Katelman is the principal of ForEverGreen Forestry (*www.forevergreenforestry.com*), a consulting firm specializing in community-based fire planning, restoration forestry, and collaborative consensus building. Since 1994, she has been a California Registered Professional Forester (#2483). She is nationally recognized for her leadership in developing Community Wildfire Protection Plans. She authored the Lower Mattole Fire Plan in 2002 for the Mattole Restoration Council, a model of a public-driven planning and prioritization process for a successful community-based fuel reduction and fire safety strategy. She has since authored three more plans—Upper Mattole, Del Norte County (both in northern California), and Illinois Valley (Oregon)—and coordinated the community outreach process for the Humboldt County Master Fire Protection Plan. She was the principal author of the California Community Fire Plan Template for the California Fire Alliance and the California Fire Safe Council. Her fire experience includes serving as a firefighter with the Petrolia and Beginnings volunteer fire departments (Humboldt County). Tracy has more than twenty years of experience as an independent facilitator, where she excels at building consensus among people from various sides of resource management debates. She has a MS in Wildland Resource Science and a BS in Conservation and Resources Studies, both from UC Berkeley.

Marko Bey is co-founder of the Lomakatsi Restoration Project (*www.lomakatsi.org*) and serves as its Director of Operations, Restoration Forestry Resource Specialist, and the Ecological Stewardship Workforce Training Professional. Lomakatsi Restoration Project is a non-profit organizationformed in 1995 to develop and implement pro-active community-based ecological restoration projects throughout the Klamath–Cascade–Siskiyou ecoregions of southwestern Oregon and northwestern California. Lomakatsi achieves its goals through education, vocational training, specialized workforce development, and the utilization of restoration by-products, encouraging the recovery of ecosystems and the sustainability of communities, cultures, and economies. Since 1986 Marko has worked in the fields of conservation, silviculture, ecosystem management, and restoration forestry and ecology, with a wide range of on-the-ground expertise in watershed and riparian restoration, oak woodland restoration, reforestation, fuel reduction, federal contracting, and technical work. Marko is also the President of Lomakatsi Ecological Services Inc., a for-profit corporation formed by Lomakatsi the non-profit to employ restoration forestry crews and timber operators for the implementation of ecologically driven stewardship contracts and other restoration-based work available from federal agencies.

Susan Britting received her doctorate in biology from the University of California, Los Angeles, in 1992. Working as a consultant to non-profit organizations, her services include advising on implementation of federal and state environmental policies, analysis of management plans, habitat analysis using a geographic information system (GIS), and database development for natural resource management. Her primary area of interest is habitat planning in the Sierra Nevada, although her interests in policy development extend statewide. In 2002, she was appointed by Governor Davis to serve as a member of the California State Board of Forestry and Fire Protection.

Carol Rice leads Wildland Resource Management, Inc., a firm that has emphasized fire management—especially in the wildland-urban interface—for the past 30 years. Projects have included planning and overseeing implementation of regional fuel management plans in Central California and the Sierra, and conducting various investigations and workshops regarding fire behavior, ecology, and economics. She is a frequent lecturer regarding vegetation-fuel-fire behavior interactions and has written more than 40 technical reports and publications. She is a co-author of the book (in press) entitled *Practical Solutions for Fire in the Urban Wildland Interface*. She holds a BS in Forestry and a MS in Fire Science and Management, both from the Department of Forestry and Resource Management, University of California, Berkeley. She is Past Chair of the California-Nevada-Hawaii Fire Council and a past Officer of the Board of Directors for the International Association of Wildland Fire for six years.

Kristina Prosser graduated from Humboldt State University with a BS in Environmental Science and a Botany minor focusing on mycology. She is a Pacific Northwest native who has assisted ForEverGreen Forestry in researching this document. Other experience includes implementing salt marsh restoration for the US Fish & Wildlife Service and using photogrammetry for vegetation surveys with the USFS PNW Research station.

Kathy Glass is a writer and editor based in Northern California with a lifelong interest in forest preservation and restoration. As a landowner, she is also a steward of the forest ecosystem.

four waters has been a graphic designer for more than 20 years and the sole proprietor of four waters media (*fourwatersmedia.org*)) for the last five years. She was fortunate to move to the foothills of the central Sierra when she was very young and has been passionately in love with the Sierra mountains ever since.

Steering Committee:

- Warren Alford, Fire and Fuels Policy Coordinator, Sierra Forest Legacy
- Louis Blumberg, California Forest Initiative Director, The Nature Conservancy
- Kate Dargan, State Fire Marshal, California Department of Forestry and Fire Protection (CAL FIRE)
- Rich Fairbanks, Forest and Fire Program Associate, The Wilderness Society
- Paul Mason, Legislative Representative, Sierra Club California
- Wayne Mitchell, Assistant Deputy Director, Fire Prevention and Planning, CAL FIRE
- Gary Nakamura, Forestry Specialist, University of California (UC) Cooperative Extension
- Christine Nota, Regional Forester Assistant, US Forest Service Region 5
- Carl Skinner, Science Team Leader, US Forest Service Pacific Southwest Research Station
- Scott Stephens, Assistant Professor of Fire Science, UC Berkeley
- Craig Thomas, Director, Sierra Forest Legacy
- Jay Watson, Director, California Fire Safe Council
- Vicki Yorty, El Dorado County Fire Safe Council

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For more information on the project, please see:
www.forevergreenforestry.com/SierraConservationCWPP.html.

Sierra Nevada Community Conservation and Wildfire Protection Plan Guidebook: Table of Contents

OOPS! We accidentally refer to cross-references within the Appendices as "sections." When you see a reference to "Section 5.2," that means go to Appendix 5, subheading 5.2, which of course, is all part of Section 3. Sorry for the confusion!

I. Section One: How to Use This Guide

Welcome to the *Sierra Nevada Community Conservation and Wildfire Protection Plan Guidebook.*

This document is designed to help you create a Community Wildfire Protection Plan (CWPP) that balances fire safety with conservation values for your community in California's Sierra Nevada.

There are several existing countywide CWPPs in the Sierra Nevada. *(For a list of existing Sierra plans, see Instructions H.)* Therefore, the purpose of this guide is to assist communities of all sizes (from neighborhoods and homeowner's associations to incorporated cities or watersheds) in developing a conservation-based CWPP at the community level. If you are interested in becoming a Firewise Community (www.firewise.org/usa/), this plan can also serve as your Firewise Plan.

Fire planning and prevention are best done in balance with the conservation of the natural environment. We can make our homes fire safe and reduce the threat they cause to the wild places we love.

This Guidebook is based on the *Conservation Principles for Community Wildfire Protection in California's Sierra Nevada* (see Background A). The basic elements of those principles are:

1. **Remember the Vegetation (Native Trees and Other Plants)**
   a. Discover and monitor your forest and vegetation's dynamic changes.
   b. Act conservatively.
   c. Protect native species that share your home.
   d. Keep the oldest and biggest trees.
2. **Remember the Wildlife**
   a. Provide local wildlife a place to live.
   b. Provide access to food and water.
   c. Protect future generations of wildlife.
   d. Value the standing dead trees.
   e. Conserve rare and endangered species.
3. **Remember the Soil**
   a. Maintain the life in your soil.
   b. Ensure that your soil cover is fire-safe.
   c. Minimize erosion.
   d. Protect your soil after a fire.
4. **Remember the People**
   a. Plan your actions with your neighbors.
   b. Find experienced workers and treat them well.
   c. Work with your local fire department.

II. Guidebook Organization

This Guidebook is divided into seven sections.

This How-To document is **Section One.** It introduces the guidebook and supporting documents and describes how to use them together with relevant websites to create your own Conservation CWPP (CCWPP).

Section Two is the **Executive Summary** of your plan and process, and contains your conservation fire safety **Action Plan.** It summarizes the information you developed to create your CCWPP and Action Plan. This is a short document you can share with community members and decision-makers to implement your plan. This is the document that will likely be referred to as your CWPP.

Section Three is comprised of nine **Appendices** containing detailed information that supports the actions proposed in the Action Plan, and is sometimes included in a complete Fire Plan. Because so much information is contained in these appendices, they have been split into the separate documents

listed on the next page. They may seem overwhelming on your first review. Remember, each is a document that can be tackled on its own. The documents that contain a lot of text—such as Appendices 3 and 4—are those where we've already done most of the work for you. Take your time to review the Appendices, perhaps reading through them a couple of times. Talk within your planning committee about how you want to accomplish each task. Approached individually, these appendices and the completion of your own plan will likely be far less overwhelming.

- Appendix 1. Community Conservation and Wildfire Protection Plan Introduction
- Appendix 2. Fire Safe Planning Process
- Appendix 3. Wildfire: Current Environment and Behavior
- Appendix 4. Fire Ecology and Management of Sierra Nevada Vegetation Types
- Appendix 5. Community Features
- Appendix 6. Fire Protection Organizations
- Appendix 7. Risk Assessment: Identifying and Evaluating Assets at Risk
- Appendix 8. Meeting Your Objectives: Fire Safe Action Plan
- Appendix 9. Facilitating Fire Safety in the Long Term

Section Four is your Project Files. This is an organized list of the type of information you will develop in creating your plan. The Project Files serve to contain the records you create in this process, possibly stored in the office of your local Fire Safe Council or other sponsoring organization.

- **Project File 1 – Planning Process**
    - Community Outreach Materials
    - Community Meeting Notes
    - Public Comments Received on Draft Documents
- **Project File 2 – Community Meeting Input**
    - Outreach Survey Results
    - Community-Generated Maps
- **Project File 3 – GIS Data Layers and Mapping Information**
- **Project File 4 – Fire Protection Agency Surveys**
- **Project File 5 – Public Lands Fire Management Background Information**

Section Five is the **Reference Section**, and includes the following documents:

- **Reference A – Glossary** (definitions of terms used throughout the Guidebook)
- **Reference B – Internet Links for Further Information** (references for more detail on topics discussed throughout the Guidebook)
- **Reference C – Literature Cited** (complete references for literature cited in the Guidebook; you can customize this to fit the literature you cite in your plan)

Section Six is the **Conservation and Wildfire Background Materials**. These are background documents to help you facilitate fire safety in your community.

- **Background A – Conservation Principles for Community Wildfire Protection in California's Sierra Nevada**
- **Background B – Wildland Fire Safety at Home** (text document explaining wildfire safety and defensible space to support your fire planning and fire safety efforts)
- **Background C – Wildland Fuel Hazard Reduction** (text document that explains methodologies and prescriptions used throughout the Guidebook)
- **Background D – Fire Safety Information** (Internet links)

Section Seven is the detailed **Fire Planning Instructions**. These are background documents to help you complete your process and write your plan.

- **Instructions A – How to Organize Community Fire Safety Meetings** (instructions for planning and carrying out a community meeting)
- **Instructions B – Community Meeting Outreach Mailing and Survey** (to use in organizing your community meetings and generating community input into risks, hazards, and project priorities)
- **Instructions C – Community Meeting Mapping Instructions** (instructions for creating maps at public meetings to generate community priorities)
- **Instructions D – Creating Maps with the Fire Planning and Mapping Tools Website** (instructions for using the Fire Planning and Mapping Tools website that is referred to throughout the Guidebook for creating your maps without your own GIS)
- **Instructions E – Fire Protection Survey Form** (survey to distribute in assessing fire protection resources and needs)
- **Instructions F – Updated Project List and Plan Update Signature Page** (document and form to use when you update your plan)
- **Instructions G – Sierra Fire Safe Councils** (a list of known Fire Safe Councils in the Sierra Nevada with website addresses and phone numbers)
- **Instructions H – Sierra Community Fire Plans** (a list of known Sierra community fire plans with website addresses, and link to CAL FIRE Unit fire plans page)

III. Guidebook Types of Information and Formatting

Each of these Guidebook documents is contained in one or more Microsoft Word files. There are up to five levels of information that can be found within each document. The margins of all documents are set to be printed double-sided and inserted into a three-ring binder.

1. Guidebook Directions

> The Guidebook Directions tell you what you need to do or write for each section of your document. It includes instructions, suggestions, and places to look for the necessary information to complete your plan. This text box is an example of the Guidebook Directions format. It is in a shaded box; with 10-point Arial text (text *style*[1] name is "Sierra Guide Text"). These instructional boxes should be deleted from your plan as you complete each section.

Throughout these documents, we provide direction when you will need to further analyze information. This analysis will provide the local details necessary for your CCWPP. In most cases, analysis directions are included in the Guidebook Direction boxes, as shown above.

For example, analysis is required to create your Risk Assessment in Appendix 7 and your Action Plan in Appendix 8. We've provided as much information in those places as possible to allow you to do the analysis within your Planning Committee. You can do this if you have technical expertise on your committee. Expertise can include agency staff and registered professional foresters. If you do not have this expertise "in house," and you have resources available to hire professional assistance, consider hiring someone to help you with these types of analyses.

[1] Style: A style is a set of formatting characteristics that you can apply to text, tables, and lists in your document to quickly change their appearance. When you apply a style, you apply a whole group of formats in one simple task (from Microsoft Word Help). (All terms used throughout this Guidebook are defined in a footnote the first time they are used, and they also appear in the Glossary. Defined terms are italicized in the document text.)

2. Background Information

The Background Information is transferable to all users. You can use any part of this text in your document as your own text (with acknowledgement in your introduction that some of the text came directly from this Guidebook). Examples of this include background information on fire safety, general Sierra wildfire ecology, and wildfire behavior. This text is displayed in 11-point Times New Roman type (style name is "Sierra Text").

This is an example of the background information text and style called "Sierra Text." Most of the Guidebook text is in this format.

3. Regional Information

The Regional Information is relevant for a specific area or place. You can either cut and paste the relevant information into your CCWPP, or delete the information that is not relevant to your planning area. Examples are the vegetation type descriptions and prescriptions found in Appendix 4. You will want to include vegetation types found in your planning area and delete those types that do not occur there. The format for this text is the same as the Background Information identified above ("Sierra Text").

This is an example of the regional information text and style called "Sierra Text."

4. Fill-in-the-Blank Information

The Fill-in-the-Blank Information is for those places in the text where you will need to fill in specific information for your plan, such as the name of your plan or planning area. For example, in this sentence, you would write [your plan name] in the gray shaded box that says "[your plan name]." This text is in 11-point Times New Roman.

This is an example of a sentence where you would fill in the blank. In this case, the title of your plan is [Plan Name], was written by [plan authors], and published on [January 1, 2008].

Note: When you fill in these boxes, the text will look like the Background Information text described above. The gray boxes will show on your screen but will not show when you print. Therefore, we have put [brackets] around the form field text to help you distinguish these when you print your drafts.

These boxes are called "text form fields" in Microsoft Word. You can view the Forms tools by going to the *View* menu in Word, selecting *Toolbars*, and then selecting the *Forms* toolbar. (For more information on Form Fields, look up "About printed forms and forms for use in Word" in Word Help.)

The term "[PLACE]" or "[Planning Area]" (usually in the form field format as described above) in this document is to be replaced by the name of the locale that your plan is covering or your designated planning area (as described in Appendix 2). For example, in Cool, California, you would replace [PLACE] with "Cool."

5. Place-Specific Information

Place-Specific Information refers to the local information that you will gather. It does not generally require any analysis. Examples include identification of your existing Communities at Risk (from the list on the California Fire Alliance website), stakeholders, landowners, etc. This information will often be inserted into a table.

In most cases, the tables developed for the California Fire Alliance Simplified CWPP Template are used in this Guidebook to ensure consistency among plans throughout the Sierra. For more information on that template, see the Reference section or www.cafirealliance.org/cwpp/.

IV. Create Your Plan!

These materials have been created for you to use when writing your own CCWPP. Remember to take it one step at a time. Follow the process outlined in Appendix 2 and supported by the Reference materials. The community meeting process described in Appendix 2 will provide a structure for you to acquire most of the information needed to develop your priorities and action plan. An effective plan comes from effective collaboration amongst your planning committee members. Take the time to talk to each other, your neighbors, and other community members. It often does not matter how long it takes to create your plan. Work at the pace and scale that make the most sense with the resources you have available.

Take time to review each of the documents. Don't get overwhelmed by taking in all of the information at once. Instead, think of this Guidebook as a library of reference materials to help you write your plan. Review the information presented here in stages. Start with this document. Review Section Two to understand how your final product will look. Follow that with Appendix 1 and slowly work your way through each appendix. Use the reference materials as they are cited within the text. We've attempted to provide everything you will need to write your own plan. You can do it!

Every community fire plan is different because it reflects its own unique community character. Your plan can be as simple as the Executive Summary and Action Plan in Section Two, or it can include all of the documents in this Guidebook. You and your planning committee decide what level of detail is needed in your community.

By using this Guidebook you can prepare a CCWPP that places conservation on an equal footing with wildfire safety. The Conservation Principles, Guidebook, and Reference materials offer perspectives and information to expedite the development of a CCWPP that can conserve the natural wonders of the Sierra Nevada while reducing wildfire risks to your home and other valuable community assets.

V. Credits and Acknowledgement

This is a project of ForEverGreen Forestry (www.forevergreenforestry.com). Tracy Katelman, Registered Professional Forester #2483, was the principal author, with technical assistance from Marko Bey, Lomakatsi Ecological Services (www.lomakatsi.org), Susan Britting, PhD, and Carol Rice, Wildland Resource Management. Kristina Prosser of ForEverGreen Forestry assisted with writing and background research. Professional editing was done by Kathy Glass. Graphic design was done by four waters media (www.fourwatersmedia.com).

A **Steering Committee** provided project oversight. Steering Committee members were:

Agency

- Kate Dargan, State Fire Marshal, CA Dept. of Forestry and Fire Protection (CAL FIRE)
- Wayne Mitchell, Asst. Deputy Director, Fire Prevention and Planning, CAL FIRE
- Gary Nakamura, Forestry Specialist, University of California (UC) Cooperative Extension
- Christine Nota, Regional Forester Assistant, US Forest Service
- Jay Watson, Director, California Fire Safe Council
- Vicki Yorty, Executive Director, El Dorado County Fire Safe Council

Conservation

- Warren Alford, Fire and Fuels Policy Coordinator, Sierra Forest Legacy
- Louis Blumberg, California Forest Initiative Director, The Nature Conservancy
- Rich Fairbanks, Forest and Fire Program Associate, The Wilderness Society
- Paul Mason, Legislative Representative, Sierra Club California
- Craig Thomas, Director, Sierra Forest Legacy

Research

- Carl Skinner, Science Team Leader, US Forest Service Pacific Southwest Research Station
- Scott Stephens, Assistant Professor of Fire Science, UC Berkeley

Project Staff

- Tracy Katelman, RPF and Project Principal, ForEverGreen Forestry
- Marko Bey, Lomakatsi Ecological Services
- Susan Britting, PhD, Science and Policy Consultant
- Carol Rice, Wildland Resource Management
- Kristina Prosser, ForEverGreen Forestry

Peer Review was provided by the following individuals and others who provided anonymous review:

- Autumn Bernstein, Sierra Nevada Alliance
- Bill and Claire Cave, Auburn Lake Trails Fire Safe Council
- Jennifer Chapman, Fire Education, Prevention, and Information Specialist, National Park Service
- Ronny Coleman, Emergency Services Consulting Inc.
- Dr. David Horne, Director, California Fire Safe Council
- Jerry Hurley, Plumas County Fire Safe Council
- Jason Kirchner, Fire Communication Specialist, US Forest Service Pacific Southwest Region
- Cheryl Miller, President, Amphion, and Director, California Fire Safe Council
- Steve Quarles, Wood Durability Advisor, UC Cooperative Extension
- Kim Rodrigues, Regional Director, UC Cooperative Extension

[Your Plan Name] Community Conservation and Wildfire Protection Plan
Executive Summary and Action Plan

I. Signature Page

The [name of this CWPP] Community Wildfire Protection Plan:

- Was collaboratively developed. Interested parties and federal land management agencies managing land in the vicinity of [insert community(s) name here] have been consulted.
- Identifies and prioritizes areas for hazardous fuel reduction treatments and recommends the types and methods of treatment that will protect [insert community(s) name here].
- Recommends measures to reduce the ignitability of structures throughout the area addressed by the plan.

The following entities mutually agree with the contents of this Community Wildfire Protection Plan:

[insert a name and identify the applicable local government here– add as many lines as necessary]

[insert a name and identify the applicable local fire department here – add as many lines as necessary]

[insert Unit Chief's name here], Unit Chief
California Department of Forestry and Fire Protection (CAL FIRE)

The following stakeholders participated in the development of this CWPP and accept this as the [Plan Name or Place] Community Wildfire Protection Plan.

_____
[Name, Title]
[ ] Fire Safe Council

_____
[Name, Title]
[ ] National Forest

_____
[Name, Title]
[ ] Homeowner's Association

_____
[Name, Title]
[ ] Bureau of Land Management

_____
[Name, Title]
[ ] Volunteer Fire Department

_____
[Name, Title]
[ ] National Park

_____
[Name, Title]
[ ] Fire Department

_____
[Name, Title]
[ ] Tribe

_____
[Name, Title]
[Conservation Organization]

_____
[Name, Title]
[ ] State Park

_____
[Name, Title]
[Timber Industry]

_____
[Name, Title]
[Affiliation]

_____
[Name, Title]
[Affiliation]

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[Name, Title]
[Affiliation]

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[Name, Title]
[Affiliation]

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[Name, Title]
[Affiliation]

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[Name, Title]
[Affiliation]

_____
[Name, Title]
[Affiliation]

_____
[Name, Title]
[Affiliation]

II. Executive Summary and Action Plan Introduction

Write a short (1-2 sentences) introduction to the document here, including an introduction to the sponsoring organization.

This document summarizes the process and information developed for the [Your Plan Name] Fire Plan. Detailed information for each of these sections can be found in the relevant appendices, which are referenced for more information.

This Plan identifies wildfire risks and hazards and mitigations to reduce these in [planning area]. It also provides residents with a step-by-step guide on how to fire-safe their homes, structures, and community, and how to best contend with an impending wildfire. The appendices and reference sections contain several pages that can be copied or removed for ongoing local reference.

II.A. Plan Goals, Introduction, and Background

II.A.1. Overall Plan Purpose

List the purposes of the plan. Example purpose text is pasted below. This information is found in Appendix 1, Section 1.1 (referred to as Section 1.1 from this point forward).

The purpose of this plan is several-fold:

- To identify priority projects to reduce risks and hazards from wildfire while protecting conservation values in [planning area]. Goals are to be achieved principally through prioritization and implementation of fuel hazard reduction, community education, and fire-suppression projects and activities.
- To provide community priorities for conservation-based fuel reduction on public lands.
- To provide conservation-based fire safety educational information to residents of [planning area].
- To provide a positive balance among fire prevention, conservation, and wildlife protection.
- To provide a guidance document for future actions of the [Fire Safe Council/Sponsoring Organization] and local emergency service providers.
- To coordinate fire protection strategies across property boundaries.
- To integrate private land management goals with community needs and expectations for fire safety.
- To create ecologically sustainable biomass utilization and removal projects within [planning area].
- Finally, this document is being written as a Community Wildfire Protection Plan, in order to meet the requirements for future National Fire Plan and other government funding sources, and to provide community direction for federal lands management within the planning area.

For more information on plan purpose and goals, please see Section 1.1

II.A.2. Conservation Principles for Community Wildfire Protection in California's Sierra Nevada

This document is based on the following Conservation Principles.

1. Remember the Vegetation (Native Trees and Other Plants)

a. Discover and monitor your forest and vegetation's dynamic changes.
b. Act conservatively.
c. Protect native species that share your home.
d. Keep the oldest and biggest trees.

2. Remember the Wildlife

a. Provide local wildlife a place to live.
b. Provide access to food and water.
c. Protect future generations of wildlife.

d. Value the standing dead trees.
e. Conserve rare and endangered species.

3. Remember the Soil

a. Maintain the life in your soil.
b. Ensure that your soil cover is fire safe.
c. Minimize erosion.
d. Protect your soil after a fire.

4. Remember the People

a. Plan your actions with your neighbors.
b. Find experienced workers and treat them well.
c. Work with your local fire department.

For more information on the Conservation Principles, please see Section 1.3, and Background A.

II.A.3. Fire Safe Objectives

Summarize your objectives here. This information is found in Section 1.8.

The objectives for fire safety will drive the development of the assessment and eventual solutions. These objectives reflect the particular characteristics of [PLACE]. The overall objectives for this plan are to decrease the intensity of fire behavior and minimize ignitions, while increasing *permeability*[1] and *resiliency*[2] of landscapes—e.g. a fire-resistant landscape—to decrease damage from wildfires.

For more information on fire safe objectives, please see Section 1.8.

II.A.4. [Place] Profile

Write an introductory paragraph about your planning area. How big is it? What are the geographical boundaries and dominant features? Where is it located within the county or state? What are the major vegetation types and rivers? Are there incorporated towns? if so, list them. What is the approximate population? What are population and demographic trends? List the fire protection organizations. Briefly describe any infrastructure issues relevant to fire safety and wildfire. What is the overall land ownership pattern? What percentage is public vs. industrial vs. tribal vs. other private ownership? Who are the largest landowners/managers, both public and private? What are the significant long-term land use issues? You will detail this information in Sections 1.4, 1.6, and Appendix 5.

For more information on [Place], please see Appendix 1 and Appendix 5.

II.A.5. Communities at Risk

List the existing and proposed Communities at Risk. This information is found in Appendix 1.5.

For more information on [Place] Communities at Risk, please see Appendix 1.5.

II.B. Fire Planning Process Overview

II.B.1. Fire Planning Area Boundaries

What area does this plan cover? This information is found in Appendix 2.1.

This Fire Plan covers the entirety of [planning area], California. For purposes of this document, [planning area] was divided into [number] planning areas. These areas are described below, starting from the [northern,

[1] Permeability: In this case, a condition in which fire can spread through a community with minimal negative impact.

[2] Resiliency: The inherent ability of organisms and/or ecosystems to deal with disturbances such as fire in a way that permits or enhances healthy survival.

southern, eastern, western] extent of [planning area] and moving [northern, southern, eastern, western], and then [northern, southern, eastern, western].

For more information on planning area boundaries, please see Section 2.1.

II.B.2. Planning Process Summary

Summarize the process you described in Appendix 2. What was your public process? How many public, community, or neighborhood meetings did you hold? Over what time period? How many people attended the meetings? What other process did you use to incorporate public opinion? How many people participated in those ways?

For more information on the process and plan development, please see Section 2.2.

II.B.3. Stakeholders

List the people and organizations who actively participated in the process of developing this plan. This information is found in Section 2.3.

The following stakeholders participated in this process:

- [Federal agency]
- [State agency]
- [Local agency]
- [Fire Departments]
- [Fire Safe Council]
- [Conservation Organization]
- [Etc.]

For more information on stakeholders, please see Section 2.3.

II.C. Fire Safety and Defensible Space

When residents in the wildland-urban interface understand what steps they can take to make their homes and properties more fire safe, they are generally interested in doing it. Background B begins with a broad description of what is necessary for a fire to begin and how communities can defend themselves when faced with a wildfire. Wildfire behavior depends on *fuel,*[3] weather, and topography. Clearly, fuel is the one factor that communities have some capacity to control. This Plan focuses on how fuel can be mitigated to enhance community safety while protecting conservation values. It outlines necessary steps to ensure local fire protection efforts are successful (e.g. residence addressing, adequate roads, proper turnarounds, secondary access, water supply, etc.).

One of the most important concepts introduced in the Plan is that of defensible space. In short, this means creating a space around your residence/structure to enhance the chances of structural and human survivability. Thus, one of the priority goals of the Plan is to document the various elements that make up defensible space and to do so in clear, action-oriented terms. The Plan lists various additional ways that a community can enhance its chances of surviving a fire, including the use of fire ignition-resistant building materials and construction methods, water availability, escape plans, landscaping, and fuel hazard reduction. Recent evidence indicates that a

[3] Fuel: All burnable materials including but not limited to living or dead vegetation, structures, and chemicals that feed a fire.

structure has a greater than 80% chance of surviving a wildfire if it has adequate brush clearance and is made of ignition-resistant materials.[4]

This Plan outlines various actions that community members should take when a wildfire threatens. These include actions such as evacuation; keeping friends and family members informed of their plans and whereabouts; gas/propane shut-off; water preparation and use; closing of all interior and exterior doors; and emergency communication.

Beyond the home, fuel reduction in the wildland-urban interface is critical for fire-permeable and fire-resilient landscapes. Fuel reduction methodologies can be consistent with conservation goals to restore *fire-adapted ecosystems*.[5] In fact, they ultimately must be if they are to be effective. Fuel hazard reduction methods are described in Background C, with practices identified that are consistent with the Conservation Principles.

For more information on fire safety and fuel reduction, please see Background B, C, and D.

II.D. Wildfire Environment

It is generally believed today that fires in the Sierra Nevada landscape are less frequent and more severe compared to the patterns present before Europeans settled in the area. The absence of fire combined with historic logging practices has led to a build-up of *surface fuels*[6] and *ladder fuels*.[7] In many cases, small trees and shrubs have become a fire hazard to both the natural environment as well as to the human communities who live there.

[Place] is no exception to the increasingly common problem of loss from wildfire. Fuel loads have been accumulating to abnormal levels throughout the Sierra due to decades of fire suppression and timber harvesting. In the [timeframe], state and federal agencies responded to more than [number of fire responses documented] fires in [Place], not including fires responded to by local fire departments. One of the largest recent fires was the [wildfire name] Fire of [year], which burned a total of [number of acres burned] acres in [fire location]. Condition Class levels [one, two, and/or three] are present in [planning area.] (For an explanation of Condition Class, see Section 3.7.1.)

Appendix 4 describes the present condition of the planning area and the vegetation that occurs there and considers how wildfire might change the area. These features and conditions of the planning area are then considered in the development of management prescriptions that a) are consistent with the natural disturbance expected for each type, b) promote the Conservation Principles identified in Section 1.3, and c) improve the fire resiliency of the vegetation type.

Summarize fuel models, fire history, and condition class here. This information is found in Appendix 3. Summarize the vegetation types found in your planning area and their related fire regimes and fire ecology. This information is found in Appendix 4.

For more information on the wildfire environment, please see Appendices 3 and 4.

[4] Ethan Foote, "Wildland-Urban Interface Ignition-Resistant Building Construction Recommendations from the 2004 Community Wildfire Protection Plan Workshops, the California Fire Alliance and the California Fire Safe Council," August 2004.

[5] Fire-Adapted Ecosystem: A local mix of mature natural vegetation (ideally native species but often found in combination with exotic species) that maintains its ability to survive and regenerate, and perhaps even to thrive, with regular disturbance from wildfire. Some species may actually require fire to trigger seed maturation, such as the giant sequoia. Opportunistic species benefit from fire and the openings it can create in a woodland; this is part of their adaptation.

[6] Surface Fuels: Materials on the ground like needles or low-growing shrubs that provide the fuel for fires to spread on the ground. Surface fuels are generally considered all fuels within six feet of the ground.

[7] Ladder Fuels: Materials such as shrubs or small trees connecting the ground to the tree canopy or uppermost vegetation layer. In forests, this allows fire to climb upward into trees.

II.E. Fire Protection Organizations

Summarize existing fire agencies by the categories identified below. This information is found in Appendix 6.

In [planning area] there are [ ] local fire departments:

- [ ]
- [ ]

There are also a number of governmental fire agencies including:

- California Department of Forestry and Fire Protection, [ ] Unit, (CAL FIRE)
- US Forest Service, [ ]National Forest
- US Bureau of Land Management, [ ]
- [ ]

Summarize overall fire protection capacity. Are there any areas without first response? List the major identified needs of the fire agencies that are given in Appendix 6 (as gleaned from the surveys from Instructions E and Project File 4).

For more information on fire protection, please see Appendix 6.

II.F. [Place] Risk Assessment

II.F.1. [Place] Assets at Risk

Summarize assets at risk in a list by category as identified in Appendices 7.1.1 through 7.1.4. What conflicts did you identify in 7.1.5? Summarize those here.

For more information on assets at risk, please see Appendix 7.1.

Assets and Associated Risks Table

Insert Figure 1 from Appendix 7.2.2 here," Assets and Associated Risks" table.

Assets, Risks, and Priorities Table

Insert Figure 2 from Appendix 7.2.3 here, "Assets, Risks, and Priorities" table.

For more information on risk assessment, please see Appendix 7.2.

III. [Place] Fire Safe Action Plan

This plan identifies several actions to reduce hazards and risks from wildfire and decrease structural ignitability. The following sections and tables summarize these actions. They were identified through a collaborative public process.

III.A. Existing Projects and Actions

The following actions are already taking place in the planning area.

Compile the tables from Appendix 8.3, Figures 2-5, and insert here.

III.B. Action Plan Summary

The following actions are proposed for this Community Conservation and Wildfire Protection Plan.

Insert Figure 8 from Appendix 8.6 here.

For more information on the fire-safe action plan, please see Appendix 8.

IV. Facilitating [Place] Fire Safety in the Long Term

IV.A. Monitoring and Maintenance

Summarize your monitoring plan here. How will you follow the success (and failures) of your projects over time? Summarize the results of your Strategic Planning Matrix (from Figure 1, Section 9.1.1). Describe your plans to maintain your project over time. This information is found in Appendix 9.

For more information on monitoring and maintenance, please see Appendix 9.

IV.B. Updating This Plan

Prepare now for updating your plan over time. When your plan is done, put it in a three-ring binder. Leave room for future updates. It is recommended that at a minimum of every five years, the planning committee stakeholder groups meet to review the plan. If you have the resources, do this annually. What has changed since the last version of the plan? What needs to be revised? How can that be accomplished most simply? Remember that changes will need to be approved the same way your plan was approved (local fire, government, and CAL FIRE). Use the California Fire Alliance template in Instructions F to update your projects table and signatures.

No plan is ever permanent. This plan was written in [year] based on current conditions and best available information. The field of fire safety is rapidly changing. It is likely that new developments will occur in the coming years. Therefore, it will be important to review this plan at least every [five] years and update it as needed. Copies of this plan will be available for public review at [list locations.]

For more information on updating this plan, please see Appendix 9.

IV.C. Needed Resources

Summarize the resources you will need to successfully implement these actions and your planned steps to get the necessary resources. This information is taken from Appendix 9.

V. Acknowledgments

An extensive collaborative project such as this requires contribution, dedication, and commitment from a number of people. We would like to give a special thank you to the following people, without whom this project would have never succeeded.

You may want to write a few sentences thanking the people who played a pivotal role in the success of your plan. Fill in the following lists with the names and affiliations of the people and organizations who actively participated in your plan development. These groupings are one way to approach it; you can change the list headings to most accurately reflect your participants. In this example, the Core Planning Team consists of the people who wrote the plan and did most of the research, analysis, and public organizing. The Fire Planning Committee members are your stakeholder representatives that you identified in Section 2.3.1 and who oversaw this process. Other Partners are all of the other people who helped you with your plan, in both large and small ways, whether they be agency staff or community specialist volunteers.

The following people contributed to the successful creation of this Conservation Community Wildfire Protection Plan. We thank them for their participation.

Core Planning Team

- [Name], [Organization], [Title]
- [Name], [Organization], [Title]
- [Name], [Organization], [Title]
- [Name], [Organization], [Title]
- [Name], [Organization], [Title]
- [Name], [Organization], [Title]
- [Name], [Organization], [Title]
- [Name], [Organization], [Title]
- [Name], [Organization], [Title]
- [Name], [Organization], [Title]

Fire Planning Committee Members

- [Name], [Organization], [Title]
- [Name], [Organization], [Title]
- [Name], [Organization], [Title]
- [Name], [Organization], [Title]
- [Name], [Organization], [Title]
- [Name], [Organization], [Title]
- [Name], [Organization], [Title]
- [Name], [Organization], [Title]
- [Name], [Organization], [Title]
- [Name], [Organization], [Title]

Other Partners

- [Name], [Organization], [Title]
- [Name], [Organization], [Title]
- [Name], [Organization], [Title]
- [Name], [Organization], [Title]
- [Name], [Organization], [Title]
- [Name], [Organization], [Title]
- [Name], [Organization], [Title]
- [Name], [Organization], [Title]
- [Name], [Organization], [Title]
- [Name], [Organization], [Title]
- [Name], [Organization], [Title]
- [Name], [Organization], [Title]
- [Name], [Organization], [Title]
- [Name], [Organization], [Title]
- [Name], [Organization], [Title]
- [Name], [Organization], [Title]
- [Name], [Organization], [Title]
- [Name], [Organization], [Title]
- [Name], [Organization], [Title]
- [Name], [Organization], [Title]

This document is based on the Sierra Nevada Community Conservation and Wildfire Protection Plan Guidebook, written by Tracy Katelman, Marko Bey, Susan Britting, and Carol Rice. Some text in this document is taken directly from the Guidebook. For more information on the Guidebook, see forevergreenforestry.com/SierraConservationCWPP.html

1. [Place] Community Conservation and Wildfire Protection Plan Introduction

Write a short introduction (1-2 paragraphs) to the document here. Who is the sponsoring organization? Summarize the timeline used to complete this plan from start to finish. Who provided the resources (funding, people, etc.) to complete it?

1.1. [Plan Name] Fire Plan Purpose

List the purposes of the plan. Example purpose text is pasted below.

The purpose of this plan is several-fold:

- To identify priority projects to reduce risks and hazards from wildfire while protecting conservation values in [planning area]. Goals are to be achieved principally through prioritization and implementation of fuel hazard reduction, community education, and fire-suppression projects and activities.
- To provide community priorities for conservation-based fuel reduction on public lands.
- To provide conservation-based fire safety educational information to residents of [planning area].
- To provide a positive balance among fire prevention, conservation, and wildlife protection.
- To provide a guidance document for future actions of the [Fire Safe Council/Sponsoring Organization] and local emergency service providers.
- To coordinate fire protection strategies across property boundaries.
- To integrate private land management goals with community needs and expectations for fire safety.
- To create ecologically sustainable biomass utilization and removal projects within [planning area].
- Finally, this document is being written as a Community Wildfire Protection Plan, in order to meet the requirements for future National Fire Plan and other government funding sources, and to provide community direction for federal lands management within the planning area.

1.2. Organization of This Document

This document is based on the design of the *Sierra Nevada Community Conservation and Wildfire Protection Plan (CCWPP) Guidebook*. It contains the following sections:

Summary and Action Plan—a summary of all the following appendices and the CCWPP Action Plan.

Appendix 1, Plan Introduction—an introduction to the document, [planning area], and the [Fire Safe Council/Sponsoring Organization].

Appendix 2, [PLACE] Fire Safe Planning Process—summarizes the public process used to develop this Fire Plan.

Appendix 3, Wildfire: Current Environment and Behavior—introduces wildfire concepts and issues in [planning area].

Appendix 4, Fire Ecology and Management of Sierra Nevada Vegetation Types—summarizes the common Sierra vegetation types found in [planning area], their fire ecology, and conservation and fuel management considerations.

Appendix 5, [PLACE] Community Features—describes the social, political, and community-planning milieu; includes a discussion of land ownership and management.

Appendix 6, Fire Protection Organizations—summarizes current fire protection resources and issues in [planning area].

Appendix 7, Risk Assessment: Identifying and Evaluating Assets at Risk—summarizes assets at risk and the community risk assessment process and results.

Appendix 8, Meeting Your Objectives: [PLACE] Fire Safe Action Plan—identifies actions to reduce risks from wildfire in [planning area].

Appendix 9, Facilitating [PLACE] Fire Safety in the Long Term—outlines a monitoring strategy and long-term steps to maintain and update this plan.

There is a series of reference and background information in separate documents. These contain general information that can be used by residents.

The following Project Files contain the background information developed as part of this process. These files are located [office or other location where these files live].

Project File 1: Planning Process provides background information on the planning process, including a sample public notice, outreach materials, and a list of who received the [Plan Name] Public Draft, and the notes from the community meetings.

Project File 2: Community Meeting Input contains the maps generated at the community meetings and results of outreach surveys.

Project File 3: GIS Data Layers and Mapping Information contains a list of the GIS data sources used to create the maps located throughout the document.

Project File 4: Fire Protection Agency Surveys includes copies of the completed surveys used to assess fire suppression agencies.

Project File 5: Public Lands Fire Management Background Information contains documentation on local federal land and fire management policies, practices, and projects.

The Reference documents include:

Reference A – Glossary defines the terms used in this plan.

Reference B – Internet Links for Further Information provides references for further information on topics discussed throughout this plan.

Reference C – Literature Cited provides references for literature cited in this plan.

Background documents on conservation and wildfire include:

Background A – Conservation Principles for Community Wildfire Protection in California's Sierra Nevada.

Background B – Wildland Fire Safety at Home is a text document explaining conservation-based wildfire safety.

Background C – Wildland Fuel Hazard Reduction is a text document explaining conservation-based methodologies and prescriptions that can be used in [planning area].

Background D – Fire Safety Information is a set of Internet links for more information on fire safety.

1.3. Conservation Principles for Community Wildfire Protection in California's Sierra Nevada

This document is based on the following conservation principles.

> "Fire always has been and always will be an ecological force in the Sierra Nevada. Decades of fire suppression have changed this role, allowing stands to thicken and fuels to accumulate, especially in the foothills and lower *montane*[1] zone, where developments are increasing. We either manage fire and live with fire on our terms or let fire dictate the terms. The choice is ours."
>
> — Jan W. van Wagtendonk, *Wildfire* (2006)

Most Sierra Nevada residents choose to live here because of the natural beauty. What many of us don't realize is that living within these forests and *wildlands*[2] carries a responsibility. We need to be good stewards of the land,

[1] Montane: A mountainous region of moist cool upland slopes that occurs below the tree line and is predominantly composed of evergreen trees. It is also described as the lower vegetation belt on mountains that is composed of montane plants and animals.

[2] Wildlands: An area of land that is uncultivated and relatively free of human interference. Plants and animals exist in a natural state, thus wildlands help to maintain biodiversity and to preserve other natural values.

learning to live in balance with the natural world, of which fire is a significant part. This document summarizes what residents can do to coexist with fire in the Sierra. It will show you how to provide a positive balance among *fire prevention,*[3] conservation, and wildlife protection at your Sierra Nevada home. You've chosen to live here, and with your choice comes a stewardship responsibility.

For more information on fire safety in general, please contact your local Fire Safe Council, or go to
www.fire.ca.gov/education_homeowner.php
www.firesafecouncil.org/homeowner/index.cfm
firewise.org/resources/homeowner.htm

Some Basic Concepts to Remember for Living with Fire in the Sierra Nevada

- **Fire is a dynamic element of the Sierra.** Your property has likely burned before and will burn again. The landscape where you live today may seem "natural." In fact it has changed drastically over the last 150 years as we have attempted to manage fire. In preparing your property for fire, you can help restore it to a more ecologically appropriate state. In doing so, you will learn how to be prepared for wildfire—it is not only possible, it's smart. While it is rarely practical to completely "fire proof" your property, there are many steps you can take to survive inevitable wildfire. *For more information see*. *www.fire.ca.gov/education_content/downloads/live_w_fire.pdf*

- **One size does not fit all in terms of homeowner fire safety.** Every place is unique. Work with your local *Fire Safe Council,*[4] fire department, Cooperative *Extension Agent,*[5] *Registered Professional Forester,*[6] and/or contractors to design the appropriate *fire-safe practices*[7] and *defensible space*[8] for your property. *See www.fire.ca.gov/education_100foot.php and www.firesafecouncil.org/homeowner/index.cfm for more information.*

- **Your home exists within a larger *watershed.*[9]** It is located in the midst of a much larger landscape. Think about where your property is on the *slope*.[10] Are you on top of a ridge, where fire will easily burn toward your home? Is your slope steep or gentle? Fire moves quickly up steeper slopes, which means that you may need to treat a larger area to create your defensible space. What is below and above you? What direction, or "*aspect,"*[11] does your property face? Generally, south-facing properties are hotter and drier;

[3] Fire Prevention: Actions taken by homeowners and community members to lessen wildfires and damage caused by wildfires. Includes education, enforcement, and land management practices.

[4] Fire Safe Council: Public and private organizations that comprise a council intended to minimize the potential for wildfire damage to communities and homeowners, while also protecting the health of natural resources. Goals are achieved by distributing fire prevention materials, organizing fire safety programs, implementing fuel reduction projects, and more.

[5] Extension Agent: An employee from the government or a university who provides information to rural communities about agriculture, land management, and/or resource management. In California, the University of California Cooperative Extension (UCCE) provides this service. For more information on UCCE, see: ucanr.org/.

[6] Registered Professional Forester (RPF): A person licensed in California to manage state or private forestlands and advise landowners on management of their forests. For more information, see: www.bof.fire.ca.gov/licensing/licensing_current_docs.aspx.

[7] Fire Safe Practices: Activities such as creating defensible space, firebreaks, access to your home, fire-resistant landscapes, changes to your home in terms of material and design, etc., that make your home/property safer in wildfire situations.

[8] Defensible Space: An area around a home/structure that has been cleared of flammable materials to act as a barrier between wildfires and property, thereby decreasing the risk of damage or loss. This space is now defined as 100 feet around a structure in California.

[9] Watershed: All of the land that drains water runoff into a specific body of water. Watersheds may be referred to as drainage areas or drainage basins. Ridges of higher elevation usually form the boundaries between watersheds by directing the water to one side of the ridge or the other. The water then flows to the low point of the watershed.

[10] Slope: A percentage or degree change in elevation over a defined distance that measures the steepness of a landscape.

[11] Aspect: The direction that a slope faces—north, south, east, west, etc.

they can therefore be more susceptible to fire. Are there any natural *firebreaks*[12] around you such as streams, rivers, or rocky outcrops where a fire might naturally go out? Do wildlife use or move through your property to get to food, shelter, or water? In what watershed are you located? Do the roads in and out of your property follow ridges or rivers? Look beyond your property lines to understand the ecological perspective of your place. *See www.audubon.org/bird/at_home/Explore.html for more information.*

- **Fire can behave both predictably and unpredictably.** We can generally predict fire direction and behavior; it will go the way the wind is blowing and burn as much *fuel*[13] as is available. Predicting the exact time and place where fire will burn is less obvious. As fire moves across the landscape it can climb up into your trees. A key fire safety objective is to prevent that spread. Dead leaves and branches on the ground *(surface fuels*[14]*)* act as a *wick*[15] to move fire horizontally across the land. Shrubs, small trees, and live branches *(ladder fuels*[16]*)* can carry fire vertically into the larger trees. Too much of these surface and ladder fuels can cause the *overstory*[17] trees to burn up in what is called a "crown fire"—when fire spreads from tree to tree in the forest canopy (or tree tops). One of the main principles in creating defensible space and reducing hazardous fuel conditions is to create physical space between vegetation layers (both vertically and horizontally) so a fire cannot climb easily from the ground into the trees or to your home. *See www.for.gov.bc.ca/protect/suppression/behaviour.htm#Behaviour for more information.*
- **Timing is everything.** There are appropriate times for different actions on your property, much as there are different seasons of work in your garden. Do your defensible space and fuel reduction work well before fire season, to avoid having sparks from equipment start fires in dry vegetation. Avoid *ground-disturbing*[18] activities in your forest or wildland when the ground is too wet or when birds and animals are nesting. Don't try to do everything at once—think about your fire safety seasonally: plan your activities in the winter and spring; start clearing when the ground begins to dry (when it's not *saturated*[19]) or when there is snow on the ground; finish treatments by early summer before the vegetation is dry; do your defensible space maintenance around and inside your home in the fall; and burn your piles after the rains begin in the winter. *See celosangeles.ucdavis.edu/Natural_Resources/Wildland_Fire.htm for more information.*
- **Your house is likely a fuel source.** Many Sierra homes are located in places where a fire can start and spread into surrounding vegetation. The more you prepare your house and other structures, the less you will have to treat the surrounding vegetation. The biggest improvement you can make to reduce your fire risk is to build or remodel your house to resist the millions of tiny *embers*[20] created by *ember-attack*[21]

[12] Firebreak: A strip of land that has been cleared of vegetation to help slow or stop the spread of wildfire. It may be a road, trail, or path cleared of vegetation or other burnable materials. A firebreak could also be a stream.

[13] Fuel: All burnable materials including but not limited to living or dead vegetation, structures, and chemicals that feed a fire.

[14] Surface Fuels: Materials on the ground like needles or low-growing shrubs that provide the fuel for fires to spread on the ground. Surface fuels are generally considered all fuels within six feet of the ground.

[15] Wick: A combustible material that allows fire to travel along a confined path to larger fuel sources. An example would be a wooden fence connected to your home.

[16] Ladder Fuels: Materials such as shrubs or small trees connecting the ground to the tree canopy or uppermost vegetation layer. In forests, this allows fire to climb upward into trees.

[17] Overstory: The topmost trees in a forest which compose the upper canopy layer; compared to the understory, which is the lower woody or herbaceous layer underneath treetops.

[18] Ground-Disturbing Activities: Actions that interrupt the natural condition of the ground, such as digging and compaction from heavy equipment.

[19] Saturated: The broad meaning is "full." Saturated soil refers to the point at which the soil is so full of water that no more water can get into (be absorbed by) the soil, and therefore must run off.

[20] Embers: Small glowing or smoldering pieces of wood or other organic debris, often dispersed ahead of a fire, also known as firebrands.

from wildfires. When wildfires burn in extreme conditions they send burning firebrands (embers) ahead of them; these firebrands ignite new fires. Using *fire-resistant building materials*[22] and appropriately designed structures will give you the best chance to survive wildfire. Replace wood shake roofs with fire-resistant materials. Don't let your home be part of the problem. An interactive source of information to reduce homeowner risk in the wildland-urban interface is provided by the University of California Center for Fire Research and Outreach; it's called the Fire Information Engine Toolkit. *See firecenter.berkeley.edu/toolkit/homeowners.html for details on how this web-based program can help you make better decisions to reduce your fire risk, and the related UC Extension's Homeowner's Wildfire Mitigation Guide groups.ucanr.org/HWMG/index.cfm. Consult your local fire marshal or see firewise.org/resources/files/wildfr2.pdf for more information.*
If you are building a new home, consider slope, aspect, surrounding fuels, and your potential environmental impacts before deciding where to site your home. This may be more important than the view in the long term. Talk to your local planning department to learn about local fire-safe building regulations, or *see osfm.fire.ca.gov/WUIBS.html, or cdfdata.fire.ca.gov/pub/fireplan/fpupload/fppguidepdf99.pdf for more information about state regulations.*

- **Know your legal obligations.** Learn the legal requirements regarding defensible space and fire-safe building and construction. Discover how to balance these with the ecological needs of your place.
- **Firefighters need your help to protect your home**. Make it safe for them and their equipment to get to and from your house. Be sure they can find you with visible road and address signs. Remember that fire-safe landscaping and construction greatly improves firefighters' ability to protect your home. *For more information see principle 4C below, and www.livingwithfire.info/beforethefire/accesszone/index.php.*

Conservation Principles

Consider the Conservation Principles below in how you approach your fire safety and defensible space. It's all about balance. It is possible to have an aesthetically pleasing landscape that is fire-safe, supports local plant and animal species, and still provides you with privacy and plantings.

1. Remember the Vegetation (Native Trees and Other Plants)

a. Discover and monitor your forest and vegetation's dynamic changes.

Plan for the future of your forest. Because you are the conservation steward of your land, your work in the forest will be ongoing. Watch the wild areas on your property and learn from them as they grow and change with your stewardship. Think both in the short term (what will happen this year) and the long term (what will happen over time). Document those changes as the years go by; keep notes and records. Learn how to *monitor*[23] the ecological changes on your property and use that information for *adaptive management*[24] of your wildlands. To live with wildfire we need to take the responsibility to manage, adapt, and guide the vegetation around our homes. *For more information see www.dnr.state.mi.us/publications/pdfs/huntingwildlifehabitat/Landowners_Guide/Habitat_Mgmt/Planning/Evaluating_Land.htm.*

[21] Ember Attack: Embers blown by the wind during a firestorm that accumulate at intersections between horizontal and vertical members on the outside of your house, igniting debris and combustible materials. Embers can also enter into openings (e.g., attic vents and other wall openings), igniting debris on the inside of your home.

[22] Fire-Resistant Building Materials: Materials used in the construction of a house that are resistant to ignition when exposed to radiant heat or flames. Examples include clay tile roofs, metal roofs, and stucco siding.

[23] Monitor: To watch, keep track of, or check regularly for changes—in this case, to the environment.

[24] Adaptive Management: An approach to managing the environment/property that is based on a "learn by doing" technique that adjusts to changing conditions. Adjustments in management change over time as new information is learned.

b. Act conservatively.

We are manually recreating a more *fire-resilient landscape*.[25] In doing this, we need to apply the general concepts of the *precautionary principle*[26] while implementing *fuel treatments*[27]*:* you can always remove more trees and vegetation at a later time, but you cannot immediately replace what you have cut. The vegetation you leave is ultimately most important. Be sure that what you remove is done with careful planning and consideration to ensure that what you leave standing is healthy and *resilient.*[28] *See www.mindfully.org/Precaution/Precautionary-Principle-Common-Sense.htm for more information.*

c. Protect native species that share your home.

Look at the native vegetation around your property—or ask a local plant or forestry specialist for help—to see what different plants share your home. There may be plants that are rare. If so, protect them by providing defensible space (while keeping in mind their needs, such as shade). Find out if those plants exist in other areas within your watershed and how they are being managed there. Watch for *invasive weeds.*[29] Follow vegetation treatments with invasive weed removal. Minimize the introduction of exotic plant species near your home, especially those that can spread into adjacent wildland areas. Invasive species can change your fire hazard very quickly and be difficult to manage.

Avoid unnecessarily introducing water into your landscape, as water will generally help non-native plants out-compete native plants. *See www.cnps.org/activities/natives.htm, www.cal-ipc.org, and www.ipm.ucdavis.edu/PMG/weeds_common.html for more information.*

d. Keep the oldest and biggest trees.

Generally, most of the oldest trees in the forest are no longer present. If you have old or very large trees, create defensible space around them so they will survive wildfire. This may include raking away thick *duff*[30] at the base of the trees. Notice that these trees often have thick bark so they are generally fire-resistant (they have evolved with fire). Think about their protection in terms of building a fire in your woodstove: A big log won't start burning without a lot of smaller kindling (e.g. small trees, shrubs, branches, etc.). In your forest, make sure that the smaller kindling isn't around the bottom of your big trees, and generally the trees will make it through a wildfire on their own. In some cases, you'll need to remove smaller trees that touch the crown of the tallest trees. At the same time, you don't want to remove all of the small trees in your forest. Small trees are the next generation of large trees. Keep enough *regeneration*,[31] possibly in small patches, to provide for the future forest,

[25] Fire-Resilient Landscape: A natural landscape featuring plants that have adapted to local wildlife conditions, or a domestic outdoor space where appropriate actions have been taken to make it less vulnerable to wildfire and certainly less prone to causing one.

[26] Precautionary Principle: A concept that promotes a cautious approach to development and managing the environment when information is uncertain or unreliable. Erring on the side of caution and conservation is encouraged, along with a "Better safe than sorry" attitude.

[27] Fuel Treatment: The act of removing burnable materials to lower the risk of fires igniting and to lessen the likelihood of damage to property and communities. Treatments may include creating a defensible space, developing fuelbreaks, initiating prescribed burns, and thinning vegetation.

[28] Resilient, Resiliency: The ability of an ecosystem to return to its balanced state after a disturbance.

[29] Invasive Weeds: Undesirable plants that are not native and have been introduced to an area by humans. These plants generally have no natural enemies and are able to spread rapidly throughout the new location. Some examples include Himalayan Blackberries, English Ivy, and Scotch Broom.

[30]Duff: A layer on the forest floor that is made up of decomposing organic matter such as leaves, needles, and small branches.

[31] Regeneration: The renewal of trees or forests by planting seedlings or the direct seeding by humans, wind, birds, or animals after large disturbances like fire. "Regeneration" also refers to the young trees that were naturally seeded or planted.

while still providing adequate space between all the trees you keep standing. An additional benefit of keeping your biggest trees is that they can break up the wind as it's moving through, which can slow down fire spread. *See www.eri.nau.edu/cms/content/view/544/740/ for more information.*

2. Remember the Wildlife

a. Provide local wildlife a place to live.

Become familiar with the animals that share your property. Talk to local wildlife experts and/or bird watchers. Learn what wildlife need in terms of shelter, food, water, and reproduction. Remember that your property is their home too. Find ways to balance your land management activities with their needs, and leave some areas *untreated*[32] for the birds and wildlife using them. Protect them as you would your home by creating defensible space while still considering their needs for *cover*.[33] If you watch quietly you may see animals using those areas. *For more information, see www.fs.fed.us/psw/rsl/projects/wild/verner/psw_37.html,* and *cetuolumne.ucdavis.edu/newsletterfiles/Master_Gardener_Articles_20044858.doc*.

b. Provide access to food and water.

Protect and retain trees with nests and cavities, or where obvious wildlife feeding or nesting activities are occurring. Leave some plants that have berries or other fruit or *mast*[34] used by wildlife. Act especially carefully and leave cover around streams, *seeps*,[35] or other wet areas to keep those areas cool and wet; this will provide wildlife the protective cover they need when they are using those places or moving to and from them. Make sure all natural water supplies are clean by keeping any poisons and *sediment*[36] away from any water that could drain into them. *For more information, see www.dnr.state.mi.us/publications/pdfs/huntingwildlifehabitat/Landowners_Guide/Habitat_Mgmt/Backyard/Backyard_Intro.htm.*

c. Protect future generations of wildlife.

Find out when local species are nesting and/or breeding and avoid working in and around your wildlands during those times. Learn what kind of habitat local species might use for nesting and breeding, and be sure to protect those areas during your management activities. *See www.paws.org/about/emailnetwork/archive/wildagain/wild_2004_06_02.html and www.audubon.org/bird/at_home/SafeMisc.html for more information.*

d. Value the standing dead trees.

Standing dead trees—or *snags*[37]—are especially important for wildlife. They provide both shelter and food to many birds and other animals. However, they can also be a wildfire hazard if they are near enough to fall on your home or fall and block an evacuation road during a fire. Balance the needs of wildlife with your need for fire safety. Think about your home within the landscape; if you've got snags in the area, you don't need them next to the house. Take the time to find the most appropriate actions for your unique place. *See www.nwf.org/backyard/snags.cfm for more information*.

[32] Untreated: Not altered from a natural or original state; unprocessed, e.g. no fuel reduction or defensible space activities.

[33] Cover: Any plants or organic matter that holds soil in place or grows over and creates shade that provides wildlife with an area to reproduce and find protection from predators and weather.

[34] Mast: Nuts or fruits of trees and shrubs such as acorns, walnuts, or berries that collect on the forest floor and are a food source for animals.

[35] Seep: An area where water rises from an underground source to the surface and creates a wet area.

[36] Sediment: Particles of topsoil, sand, and minerals that come from soil erosion or decomposing plants and animals. Wind, water, and ice carry these particles; when the sediment collects in waterways it can destroy fish and wildlife habitat.

[37] Snag: A standing dead tree that has usually lost most of its branches. Snags offer essential food and cover for a host of wildlife species.

e. Conserve rare and endangered species.

One of the bonuses—and responsibilities—of living in the Sierra is living with the many rare and endangered species with which you share habitat. Find out if there are rare or endangered species in your area by talking to your local Cooperative Extension Agent or Forest Service wildlife biologist. Plan your fuel reduction actions around the needs of these species. Often by a fairly minor refinement of your activities, such as timing, technique, or extent, you can protect species while realizing your fuel reduction goals. *For more information, see www.dfg.ca.gov/hcpb/species/t_e_spp/tespp.shtm, www.dfg.ca.gov/habitats/wdp/region-sierra_nevada-cascades/overview.html*.

3. Remember the Soil

a. Maintain the life in your soil.

There is as much or more activity below the ground on your property as there is above the ground. Keep this in mind in terms of what you do above ground. Talk to your Cooperative Extension Agent or local gardeners to find out what *soil types*[38]are on your property. Some soil types can tolerate much more *disturbance*[39] than others. Minimize activities that could *compact*,[40] flood, or poison your soil. The health of your land is directly dependent on the health of your soil. As such, the soil is one of the most valuable assets of your property. *See managingwholes.com/new-topsoil.htm for more information.*

b. Ensure that your soil cover is fire safe.

Replace cover that burns easily (such as dry or dead vegetation) with cover that is less *flammable*[41] (e.g. gravel, fleshy green plants, etc.). The objective is to ensure that if and when a fire comes through, it is not so hot that it kills the life in your soil. Rather, it should move through without a lot of fuel to consume in its path. For example, a very light layer of pine needles can help with soil erosion *(see below)*, but too much can be a fuel problem. *See www.laspilitas.com/classes/fire_burn_times.html for more information.*

c. Minimize erosion.

Protect your soil by keeping it covered. Cover helps to prevent *erosion*,[42] especially on ground that is not flat; it keeps the soil in place. Don't let soil move across your property, most importantly not into streams or other natural water sources. Keep ground-disturbing activities away from *unstable*[43] areas and *riparian*[44] areas. Pay special attention on steep slopes. The steeper the slope, the faster the soil can move downhill if it's disturbed, and the faster a fire can climb uphill under the right (or wrong!) conditions. *See www.uri.edu/ce/healthylandscapes/tips/6.html and www.pfmt.org/fire/topos_effect.htm for more information.*

[38] Soil Type: Refers to the different combinations of soil particles and soil composition. Soil can vary greatly within short distances.

[39] Disturbance: Various activities that disrupt the normal state of the soil such as digging, erosion, compaction by heavy equipment, etc.

[40] Compact: To pack closely or tightly together, as in the fragments of soil being compacted from heavy equipment, thereby limiting the ability of oxygen or water to pass freely.

[41] Flammable: A quality of a substance that makes it likely to catch fire, be easily ignited, burn quickly and/or have a fast rate of spreading flames.

[42] Erosion: The removal of soil over time by weather, wind and/or water such as rain or water runoff from roads.

[43] Unstable: Land that is lacking stability, or liable to change with activity, such as in the case of step slopes or crumbly soils.

[44] Riparian: A strip of land along the bank of a natural freshwater stream, river, creek, or lake that provides vast diversity and productivity of plants and animals.

d. Protect your soil after a fire.

Soil can be most fragile after a wildfire. This is often exacerbated when winter rains come soon after a fire. The potential for erosion and loss of soil is huge with this combination of conditions. If you have experienced fire on your property, get cover onto your soil as soon as you can to prevent erosion. Remember, your soil is alive, so help it grow. *See www.ext.colostate.edu/PUBS/NATRES/06308.html* and *www.cnr.uidaho.edu/extforest/AftertheBurnFINAL.pdf for more information.*

4. Remember the People

a. Plan your actions with your neighbors.

Talk to your neighbors. Find out what they are doing on their land. Find ways to cooperate in your land management actions. Your defensible space will likely impact your neighbor's chances of surviving a wildfire and vice-versa. Talk about what to do in an emergency and how to most safely evacuate. Find out if there is a Fire Safe Council (FSC) in your community, and if so, get involved. Help make your community a Firewise community. Coordinated work amongst neighbors will have a greater impact on your individual fire safety. *For more information, see www.firesafecouncil.org, www.fire.ca.gov/about_content/downloads/Evacuation2006.pdf, and www.firewise.org.*

b. Find experienced workers and treat them well.

Forestry workers with chainsaws in hand are the actual decision-makers as to what stays or goes—what lives or dies—in your forest. If your objective is to reduce fuels while still maintaining ecological integrity and diversity on a site, your workers must have the knowledge and experience to help you achieve this. Involve the workforce in the design, planning, and monitoring of projects. Talk to your local FSC or neighbors and check references to find reputable contractors. Pay workers well and maybe even bring them chocolate chip cookies; this will achieve better ecological outcomes on the ground. Happy, respected people do the best work. *See ewp.uoregon.edu/programs.html for more information.*

c. Work with your local fire department.

Talk to your local firefighters. Find out what they need to safely get to your house and back out. Make sure that your *access roads*[45] are safe; maintain your fuel treatments along all roads, both for firefighter safety in protecting your home and your safety in case of evacuation. Let firefighters know where you live and what's on your property; invite them out to see it. Have street and address signs visible so out-of-town firefighters can find you if there is a big fire. Make sure you have a water supply they can find and use. Know where and how to turn off any fuel sources such as natural gas or propane. *See www.projecttahs.org/pdf/firedepartment.doc for more information.*

1.4. Introduction to [Place], California

Write an introductory paragraph about the place. How big is it? What are the geographical boundaries and dominant features? Where is it located within the county or state? When was it settled by Europeans? What are the major vegetation types and rivers? What percentage is public vs. industrial vs. tribal vs. other private ownership? Are there any incorporated communities? Appendix 5 will contain more detailed information on social and political community features.

See Appendix 5 for more information on [Place].

[45] Access Roads: Roads that allow entrance into and out of a property.

Figure 1. Public Land Managers in [Planning Area]

Agency	Name	Number of Acres
USDA Forest Service		
US Bureau of Land Management		
National Park		
California State Lands		
[ ] Tribe		
[ ]County		
[Local]		

Create and insert your base map from Fire Planning and Mapping Tools. *(See Instructions D for details on how to make a map.)*

→ Under Layers, select **Boundaries.** (Use the scroll bar to the right to see the entire list of available layers.)

→ To display the ownership layer, select the **visible** box to the left of the layer: **Public, Conservation and Trust Lands (05_1) - Ownership for DPA Maps.**

→ Select **Refresh Map** to show your specified layers.

Figure 2. [Planning Area] Community Base Map

Describe the population from US Census data (www.census.gov/main/www/cen2000.html). How many total people, households, families? What age groups, what is the per-capita income?

→ Select **street address** under: Enter a street address to find Census 2000 data. This can be found in the under the heading Access Data by Geography.

→ Enter the desired address in the blank fields provided and then select **Go**.

→ Select the desired geography in the list below and click **Ok**. For a detailed explanation of geographic area select **Explain Census Geography**.

→ Scroll down to the Thematic Maps section and choose the desired map. For example, choose the **Total Person: 2000** to see the population of your county or community.

Figure 3. [Planning Area] Census Map

1.5. [Place] Communities at Risk

Background information for this section and a listing of all California Communities at Risk is available at: cafirealliance.org/communities_at_risk/.

On January 4, 2001, for the purposes of the National Fire Plan, the Department of Interior (DOI) published in the *Federal Register* a "Notice of Urban-Wildland Interface (WUI) Communities Within the Vicinity of Federal Lands That Are at High Risk from Wildfire." In [planning area], [community name]was the first community to be designated as a Community At Risk. On [date], the DOI added [community names] to the list.

After the 2000 fire season, the California Department of Forestry and Fire Protection (CAL FIRE), working with the California Fire Alliance, developed a list and associated map of communities at risk from wildfire using 1990 Census and USGS Geographic Names Information System data to identify populated places, and CAL FIRE's Fire and Resource Assessment Program (FRAP) fuel hazard data. In addition to the already-mentioned communities, they designated the following as WUI Communities at Risk: [community names].[46]

Figure 4 lists all existing Communities at Risk (CAR) in [planning area]. Proposed CARs are identified in Appendix 8.

Figure 4. Communities at Risk in [Planning Area]

Community at Risk	Threat Level[47]	Federal Adjacency?[48]	Source of Designation

[46] California Fire Alliance. "Communities At Risk History." cafirealliance.org/communities_at_risk/communities_at_risk_history.

[47] The Threat Level Code designates a community's fire threat level, with 1 indicating the least threat, 3 indicating the highest threat.

[48] Lands adjacent to federal lands are indicated as such with a mark in this column.

Community at Risk	Threat Level[47]	Federal Adjacency?[48]	Source of Designation

Create and insert your Communities at Risk map from Fire Planning and Mapping Tools. *(See Instructions D for details on how to make a map.)*

→ Under Layers, select **Populated Areas.** (Use the scroll bar to the right to see the entire list of available layers.)

→ To display the Communities at Risk layer, select the **visible** box to the left of the layer: **Communities at Risk (06_1)**

→ Select **Refresh Map** to show your specified layers.

Figure 5. [Planning Area] Communities at Risk Map

1.6. [Place] Fire Protection Areas and Agencies

On land known as a Federal Responsibility Area (FRA), federal agencies have primary responsibility for fire protection. FRAs are defined based on land ownership. Federal agencies ([federal fire protection agencies]) have responsibility to provide wildland resource fire protection on all FRA lands in [planning area]. This includes the

financial responsibility of preventing and suppressing fires. To more efficiently provide protection over a more contiguous land base, the Federal agencies trade protection areas with the California Department of Forestry and Fire Protection (CAL FIRE); these lands are balanced within the state. The resulting lands are called State Direct Protection Areas or Federal Direct Protection Areas. The lands that are swapped for the purpose of efficient wildland fire protection in the State of California are reviewed every five years among the signatory parties (USFS, NPS, BLM, and CAL FIRE) to what is known as the Cooperative Fire Protection Agreement or the "4-Party Agreement."

State Responsibility Area (SRA) lands are defined based on land ownership, population density, and land use. CAL FIRE determines SRA lands per the guidelines established by the State Board of Forestry and Fire Protection. CAL FIRE has a legal responsibility to provide wildland resource fire protection on all SRA lands, including the financial responsibility of preventing and suppressing fires. Lands in incorporated cities or surrounded by federal land are excluded from SRA lands. For example, CAL FIRE does not have responsibility for densely populated areas or agricultural lands. To more efficiently provide protection over a more contiguous land base, CAL FIRE swaps protection areas with other agencies, with the resulting lands being called CAL FIRE Direct Protection Areas.

Local fire districts and urban fire departments are responsible for providing structure protection on SRA lands. They are also responsible for providing all fire protection on Local Responsibility Area (LRA) lands. LRA lands are not the responsibility of federal or state agencies.

For a map of current FRA, SRA, and LRA areas as identified by cooperating state and federal agencies, see map in Appendix 6.

The following fire protection agencies provide fire protection services to residents in the planning area. For more information on these agencies and their services, see Appendix 6.

List your fire protection agencies here. This information is found in Appendix 6.

1.7. Introduction to [Place] Fire Safe Council

For an example of text for this section, see the Del Norte Fire Safe Plan, Section 1.5, www.dnco.org/downloads/DNFSPFinal.pdf. If a Fire Safe Council is not overseeing plan development, you can write about the sponsoring organization here, or delete this section.

1.7.1. [Place] FSC Background, History, Mission

Write a little about your Fire Safe Council or the group who is leading the creation of this plan. When did it start and how? List the participating stakeholder groups. Does it have paid or volunteer staff and if so, what do they do? What area does it serve? What is the group's mission? What are its overall goals? Does the group meet regularly? Is the public invited? What is the general decision-making structure? How and where can the public find out more information about the FSC? Remember, you want this to be a living document. Avoid including information that will soon be outdated. Rather, discuss these concepts generally in ways that will persist accurately over time. See www.firesafecouncil.org for more information on starting and administering your FSC.

1.7.2. [Place] FSC Projects

Summarize the type of activities the FSC undertakes. Do you do educational, fuel reduction, fire protection, evacuation planning, and/or other projects? If so, generally describe them here. Remember that your projects will likely change over time, so avoid writing information that will soon be outdated. If you have a map of your projects (past, current, and future), insert it here.

1.7.3. [Place] FSC Strategic and/or Future Plans

Summarize the future plans of the FSC. What are your plans in the coming year? Do you have a strategic plan for the next five years or longer? If so, summarize it here. What are the major needs of the FSC and how do you intend to address them?

1.8. Fire Safety Objectives

The objectives for fire safety will drive the development of the assessment and eventual solutions. These objectives reflect the particular characteristics facing [PLACE].

Insert any specific objectives of your plan here.

Minimize Ignitions

It may seem obvious that unplanned ignitions should be minimized. Numerous ignitions place a strain on firefighting resources, which can lead to high levels of damage because of greater fire area burned.

Decrease Intensity

One factor that disposes structures to fire damage is fire intensity, or the amount of heat transferred to the structure. High-intensity fires also are most likely to produce *crown fires*[49] and *torching*.[50] Embers created from these crown fires are lofted well ahead of the fire front, creating numerous *spot fires*,[51] and they are often the cause of structures burning. The level of fire intensity greatly influences the damage to natural resources. Every ecosystem is adapted to a range of fire intensities; however, most of the Sierra Nevada is characterized by low-intensity fire. Higher-intensity fire causes a greater level of damage, such as erosion, degraded water quality, tree mortality, visual blights, and a decline in certain wildlife habitats.

Decrease Damage

Fire is part of the natural ecology of the Sierra Nevada. In contrast, wildfire damage to structures and human improvements needs to be minimized.

Increase Permeability

One ideal is to allow fire to play its natural role without loss. This describes the concept of permeability, whereby fire can spread through a community with minimal negative impact. The perfect situation will be one in which vulnerable resources are protected while fire burns under its normal regime.

Increase Resiliency

An important objective is to rebound quickly after a wildfire burns through a community. Fires of small size or limited damage support a more rapid recovery. Communities with greater preparation for wildfires (rehearsed evacuations, established communication protocols, etc.) also have greater resiliency.

[49] Crown Fire: A fire that spreads from treetop to treetop, and is characteristic of hot fires and dry conditions. Crown fires are generally more complex to control than fires on the surface.

[50] Torching: A rapid and intense burning of a single or small group of trees/shrubs, causing the upward movement of fire; a.k.a. flare-up.

[51] Spot Fire: A smaller fire outside the boundary of the main fire, started by airborne sparks or embers.

2. [Place] Fire Safe Planning Process

2.1. Planning Area Boundaries

What area does this plan cover? If it is for an incorporated area, then that area is already defined; if not, define the area. How did you divide the overall area into sub-areas? Did you use watersheds, local jurisdictions/communities, ecological types, roads and access, or a combination of these factors? Identify each of the different sub-areas with a unique name, as they will form the structure of Appendices 7 and 8.

This Fire Plan covers the entirety of [planning area], California. For purposes of this document, [planning area] was divided into [number] planning areas. These areas are described below, starting from the [northern, southern, eastern, western]extent and moving [northern, southern, eastern, western], and then [northern, southern, eastern, western].

For a map of the planning area, see Figure 2 in Appendix 1, Base Map.

2.1.1. Planning Area 1

If you want to divide your overall planning area into smaller or sub-planning areas, describe those here now. At the county scale, the planning areas could be based around community centers. For plans at the community level, the sub-planning areas could be based around neighborhoods. See the Upper Mattole Fire Plan for an example of neighborhood-level planning, mattole.org/pdf/UMFP_final.pdf. If you are only using one planning area, delete sections 2.1.1 and 2.1.2. If you have more than two planning areas, continue to number them 2.1.3., etc.

2.1.2. Planning Area 2

2.2. Process and Plan Development[1]

Describe the process used to ensure that all stakeholders participated democratically in development of this plan. How did it begin? How did you invite others to participate? What were the steps you took as a group to create this plan? What steps did you take to ensure broad-based community (public) involvement?

As discussed in Appendix 1, the [ ]Fire Safe Council began the process of the [plan name] Fire Plan with [other plan contributors]. [Discuss who wrote it here.]

2.2.1. Community Meetings

Organize a series of community meetings to gather input from your neighbors regarding existing fire hazards, risks, priorities, and potential actions. See Instructions A for how to organize a community fire safety meeting. Describe your community meeting process in this section.

Initial Meeting

An initial community meeting was held in [planning area] on [date], at [location] to introduce interested community and agency members to the [plan name] project. Speakers at that meeting included:

- *[Name]*, [Local Government]
- *[Name]*, [ ] Fire Safe Council
- *[Name]*, [Local Fire Agency]
- *[Name]*, [Federal Agency]
- *[Name]*, California Department of Forestry and Fire Protection (CAL FIRE)

[1] The community fire planning process outlined in this chapter was developed by Tracy Katelman, ForEverGreen Forestry (www.forevergreenforestry.com) and the Mattole Restoration Council (www.mattole.org). Please credit appropriately.

- *[Name]*, [Plan Coordinator or Principal Author]
  The notes from that meeting are available in Project File 1, Planning Process.

Community/Neighborhood Meetings

The following section describes the process and results from the community or neighborhood meetings. For instructions on how to organize a community meeting, see Instructions A. You can use the agenda below for running your meeting, and/or adjust it to meet your needs.

One of the goals in developing the [plan name] is to educate residents regarding fire safety and defensible space. Therefore, the planning process was designed to maximize public input. A series of [number]community meetings was held in various locations throughout [planning area]. The community meetings were held in the following locations in 200[#]. All meetings were held from [6:30 to 9:00 pm].

- [Date]– [Community or Neighborhood], [Meeting Location and Address]
- [Date]– [Community or Neighborhood], [Meeting Location and Address]
- [Date]– [Community or Neighborhood], [Meeting Location and Address]
- [Date]– [Community or Neighborhood], [Meeting Location and Address]

The following agenda was used at the community meetings.

[Plan Name] Fire Plan

Community Fire Safe Planning Meeting Agenda

1. Introductions (20 minutes)

- Everyone introduce themselves. Please state: 1) Name, 2) where you live, and 3) any experience or history you have with fire, fire suppression, or fire prevention.
- [Plan Name] Plan and Process, National Fire Plan, CWPPs
- [ ] Fire Safe Council—What does it do? How can it benefit local residents?

2. Fire safety and defensible space (50 minutes; fire agency and/or FSC representative)

Why bother? What are the benefits? What do you think it means?

- "winners and losers" (defendable/non-defendable)
- clearance around homes, landscaping
- zones concept
- building materials, UC Forest Products Lab
- access, road conditions, and fire engines
- clearance along roads
- shaded fuelbreaks
- what to do with thinned materials
- water sources
- safe zones
- what to do in case of a wildfire

3. Neighborhood fire history (10 minutes; facilitator, all)

- What are your memories and real experiences of fire here?
- How did the fire start? Where was it? What happened? How big was it? When was it? What did you do?

4. Identify values and assets at risk (10 minutes; facilitator, all)

Make a set of large maps of the planning area in advance of the meeting (at least 3'x4') and bring colored markers for people to indicate the information generated through the rest of the meeting. See mapping instructions in Instructions C for details on creating these maps.

Where are the places of most concern to you, the ones you would least want to be lost in a wildfire, such as businesses, historical areas, ecologically significant areas, etc.? Mark this information on the maps and record it on flip charts.

5. Identify high-risk and high-hazard areas (10 minutes; facilitator, all)

Where do you think a fire would start and why? Where are the areas that would be difficult to control if a fire started or reached there? In which direction have fires historically burned? Mark this information on the maps and record it on flip charts.

6. Developing projects to reduce identified risks (30 minutes; facilitator, all)

- Can we reduce the probability of ignitions? If so, how and where?
- Can we remove fuel in high fire hazard areas? If so, how and where? ID roads to brush, shaded fuelbreaks.
- Do we need more water storage in specific places? If so, where?
- Can we improve access (road/house signing, clearance)?
- Are there things you can do to improve evacuation planning?
- Are revisions of the county or municipal plan or codes necessary?
- What projects can be done without outside funds?
- Are there other priority projects, e.g. related to the local economy, education, or ecosystem recovery?

Identify projects and mark them on the map, including:

• fuel reduction work • shaded fuelbreaks • additional water storage • restoration • fire-safe development
• economic development • road improvements • education • any other relevant projects

Which of these projects is your highest priority?

> One process to identify priorities is the use of "sticky dots." Make a list of all identified projects on flip charts. Count the total number of identified projects (you can merge some if they are similar, don't remove any from the list before this vote) and divide that number by three. Give everyone this number of sticky dots (n/3) with instructions to put one dot on each of their top priority projects on the flip chart list (not to put all dots on one item). Count the total dot "votes" next to each item; those with the most dots are the top priorities.

7. [ ] Fire Safe Council (5 minutes; FSC representative, if applicable)

Provide an introduction to the local FSC and what they do. Identify how interested people can get involved.

8. Local Fire-Fighting Atlas (15 minutes)

> One of the outcomes of this planning process can be creation of a fire-fighting atlas, also known as a "map book." This atlas has local information on names of roads, location of homes, and other data important for firefighters. These map books are most useful during a large fire when out-of-town firefighters unfamiliar with your community are fighting the fire. If you decide not to collect this information, you can delete this section from the agenda.

Mark and identify on maps locations of:

• roads (with local names) • road outages/slides/problem areas • power lines • homes
• domestic animals • gates, water tanks • important outbuildings • etc.

Take copies of maps and handouts to your neighbors who could not attend the meeting to include their input.

> This is the end of the meeting agenda. Copy and paste this text into a new document and change it to meet your local needs. Then make copies to distribute at your community meetings.

2.2.2. Community Outreach

> Use this section to describe any and all outreach done as part of this fire plan. Community outreach is any attempt to discuss the plan and projects with the people who live and/or work in the planning area.

An outreach effort was made to encourage public participation in these meetings. [Name] coordinated this outreach effort. It included:

- [extensive phone calling to local residents]
- [door-to-door canvassing of higher-risk neighborhoods]
- [mailing and posting of meeting announcement flyers (see Project File 1 for copies)]
- [radio, TV, and newspaper advertisements].

Outreach Survey

Use the sample outreach mailing, survey, and map in Instructions B to solicit input from community members in identified areas.

A survey was mailed to [#] residents in areas identified as high fire hazard or risk within [planning area]. The mailing included a cover letter, survey, and the Homeowner's Checklist *(see Background D for a copy)*, as well as a map of the resident's neighborhood. [#] were returned with information similar to that gained at the community meetings from the respondents.

See Project File 1 for an example of the cover letter, survey, and map, and Project File 2 for copies of received responses.

2.2.3. Public Comment Process

In addition to the meetings that generated local data, the public was provided another opportunity to contribute to this document. An internal draft was prepared on [date] for the Planning Committee and other interested agency members. On [date], the Public Draft of the Fire Plan was published. The draft was distributed to more than [#] community members, agencies, and other entities, with several copies available for public viewing at [locations]. To view the list of recipients and a complete set of comments, see Project File 1. The public was then given until [date] to review the document and submit comments. The final plan was released on [date]. The following people made comments on the public draft.

Summarize the comments you received on your draft document in the table below.

Figure 1. Comments to Public Draft of the [Plan Name] Fire Plan

Comments submitted from (Name and Affiliation):	Date Rec'd:	Comments

2.3. Stakeholders

Describe the people and organizations who actively participated in the process of developing this plan. All property owners and residents need to be represented, including state and federal land management agencies and CAL FIRE. Include large landowners, environmental and watershed groups, industry, utilities, insurance groups, real estate companies, etc. Include community members involved in wood products utilization, such as sawmills, compost, landscaping, cogeneration, biomass, and forestry. Include representatives from local government; often local planning or emergency service staff are most appropriate. You can describe participants based on their affiliations and interests (e.g. County Planning Dept., Volunteer Fire Dept., local watershed group, etc.) and/or as individuals. Explain their level of involvement and why they were a part of this process (e.g. local school board to incorporate fire safety education in the schools). Remember, in order to get a meaningful level of participation, you first need to invite (even urge) people to become involved. You may not always be successful in getting people to come to you. Often it is necessary to first go to their homes or group meetings in order to gain their participation.

Figure 2. Stakeholder Representatives and Date Invited to Participate

The following table follows the format in the California Fire Alliance Simplified CWPP Template. Fill it in with the names, affiliations, and dates stakeholders were invited to participate in this planning process.

Agency/Stakeholder Group	Representative	Date Invited to Participate
[Local Government]	[name representative]	[date]
[Local Fire Chief]	[name representative]	[date]

[CAL FIRE Unit Chief]	[name representative]	[date]
[Forest Service]	[name representative]	[date]
[Bureau of Land Management]	[name representative]	[date]
[Park Service]	[name representative]	[date]
[Fish and Wildlife Service]	[name representative]	[date]
[Bureau of Indian Affairs]	[name representative]	[date]
[Tribal Governments]	[name representative]	[date]
[Bureau of Reclamation]	[name representative]	[date]
[Natural Resource Conservation Service]	[name representative]	[date]
[Other Federal Agencies]	[name representative]	[date]
[State Parks or Recreation]	[name representative]	[date]
[California Department of Fish and Game]	[name representative]	[date]
[Name] Resource Conservation District	[name representative]	[date]
[Department of Transportation]	[name representative]	[date]
[Emergency Management Agencies]	[name representative]	[date]
[Name] Water Districts	[name representative]	[date]
[Other State and Local Agencies]	[name representative]	[date]
[Fire Safe Councils]	[name representative]	[date]
[Landowners]	[name representative]	[date]
[Recreation Organizations]	[name representative]	[date]
[Environmental Organizations]	[name representative]	[date]
[Forest Products Interests]	[name representative]	[date]
[Chamber of Commerce]	[name representative]	[date]
[Watershed Councils]	[name representative]	[date]
[Resource Advisory Committees]	[name representative]	[date]
[Other]	[name representative]	[date]

2.3.1. Planning Committee

A Planning Committee was established to oversee development of the [Plan Name] Fire Plan and to ensure its compliance as a Community Wildfire Protection Plan. The purpose of the committee is:

- to provide oversight to the [Plan Name] Plan process,
- to meet the requirements of Community Wildfire Protection Plans (CWPP) of the National Fire Plan, and
- to ensure that the Plan meets the needs of all sectors of [planning area] in terms of fire safety and prevention.

Planning Committee members were chosen to represent all stakeholder groups in the planning area, including local government, CAL FIRE, local fire agencies, Fire Safe Council, state and federal land management agencies, tribal organizations, industry, and non-profit organizations. Oversight of the planning process by this committee ensures that the plan meets the applicable parts of the collaboration requirements of a CWPP.

[_____] FSC Fire Planning Committee Members:

- [Name], [Organization], [Title]
- [Name], [Organization], [Title]
- [Name], [Organization], [Title]
- [Name], [Organization], [Title]
- [Name], [Organization], [Title]
- [Name], [Organization], [Title]

See Section 9.3 for information regarding updating this plan.

3. Wildfire: Current Environment and Behavior[1]

Discussing the wildfire environment is a way of describing the setting for the planning area with wildfire as the focus. The environment includes the elements that influence *fire behavior*[2].

3.1. Introduction: Defining the Wildfire Problem

How wildfire will change the environment in the planning area depends on several factors including the site topography, weather, and condition and type of vegetation and other fuels. Developing an understanding of the environmental conditions in the planning area is the first step in formulating practices or actions that can best modify the environment to improve its *fire resiliency*.[3]

Summarize and define the wildfire problem in your community in 1-2 sentences. For instance, you can discuss recent large wildfires, assets that are vulnerable to wildfires, and current potential for wildfires. You can write this section after you complete the analysis associated with this appendix.

3.2. Fire Behavior Characteristics

Knowing the attributes of fire behavior is important in order to communicate the various threats from any fire and the benefits of mitigation. Flame lengths, *fire intensity*,[4] *heat output*,[5] rate of spread, residence time, and whether the fire burns on the surface or crown are all ways to describe fire behavior and to relate its resistance to *control*[6] and potential damage or positive impacts from fire. The following paragraphs describe these terms.

Surface Fires

On flat or moderate (<30% slopes) terrain in light fuels, fires usually burn as a surface fire. Surface fires may advance quickly with short or long *residence time*[7] and low to high heat output, and as such, they respond well to suppression. A manageable fire is one of the desired results of *fuel modifications.*[8]

Crown Fire Potential

Crowning activity indicates locations where fire is expected to travel into and possibly consume the crowns (or tops) of trees. Crown fires typify a fire of high intensity and exhibit high heat output and rates of spread. These attributes challenge suppression efforts. When a fire burns through tree crowns, countless *embers*[9] are produced and distributed, sometimes over long distances. These embers can start new fires *(spot fires*[10]*)*, which can each grow and confound the finest fire-suppression forces.

[1] This section was written primarily by Carol Rice, Wildland Resource Management. Please credit appropriately.

[2] Fire Behavior: The combination of fire spread, heat output, flame length intensity, etc. as the fire responds to weather, topography, types of fuels, etc.

[3] Fire Resiliency: The ability of an ecosystem to maintain its native biodiversity, ecological integrity, and natural recovery processes following a wildland fire disturbance.

[4] Fire Intensity: A measurement of the heat released in an area during a specific amount of time (btu/ft/sec). Intensity has a large influence on an ecosystems' recovery from fire.

[5] Heat Output: The total amount of heat a fire released in a specific area during the passing of the flaming front.

[6] Control: The act of managing a fire, which generally entails a completed control line around the fire.

[7] Residence Time: How long the flaming front burns in any one location.

[8] Fuel Modification: The management of fuels for fire safety. Examples include prescribed burns and creation of firebreaks.

[9] Embers: Small glowing or smoldering pieces of wood or other organic debris, often dispersed ahead of a fire, also known as firebrands

[10] Spot Fire: A smaller fire outside the boundary of the main fire (usually ahead of the direction the fire is traveling), started by airborne sparks or embers.

Crown fire initiation (or torching) occurs when *ladder fuels*[11] are present, providing a connection between the surface fuels and the crown fuels. The higher the base of the tree canopy from surface fuels, the more difficult it is for crown fires to ignite. Once in the tree canopy, crown fire spread is more likely in dense canopies and with high wind speeds.

Fire Intensity

Fire intensity describes the amount of heat that is released by flaming combustion in a specific unit of time (BTU/ft/sec[12]). This measurement captures the energy of a fire in any location; it is often confused with fire severity, which is a term describing fire effects.

Fire Severity

Fire severity describes the resulting effects of a fire, based on the amount of soil damage and tree mortality. It is determined by observing vegetation and soil conditions after a fire. The relationship between predicted fire behavior characteristics (flame length, heat per unit area, fireline intensity, etc.) and fire severity are being explored but are not yet well established. Long flame lengths, large amounts of torching, crown fire presence, high fireline intensity, and high heat per unit area are all indicators of potentially severe fires.

Flame Length

Flame length is the span of the flame from the tip to the base, irrespective of its tilt. This factor most influences the probability of structure damage and ease of fire suppression. Flame length is highly correlated with fire intensity, which can help predict fire severity. Flame lengths less than four feet are associated with fires that are more easily controlled—generally with hand crews—and are also associated with the widespread low-intensity fires prevalent prior to European settlement. In contrast, flame lengths longer than twelve feet often thwart suppression efforts and are associated with crown fires seen on the front pages of newspapers. Typically fuel management goals aim for production of flame lengths less than four feet.

Rate of Spread

The rate of spread measures how fast the *leading edge*[13] of a fire advances. A rate of spread faster than fire-line-building capacity will challenge fire suppression efforts. High spread rates also indicate the potential for quick changes in fire spread direction, which could endanger firefighters and increase the potential damages. High rates of spread in grass can exceed three hundred feet per minute. In rare crown fires, rates of spread can exceed one hundred feet per minute. A more acceptable rate of spread would be one that is slower than the line-building capacity of fire suppression forces to encircle the fire. Slow-burning fires in forested fuel types spread at a rate of two to eight feet per minute.

Residence Time

The residence time of a fire defines how long the leading edge of the fire burns in any one location. Usually grass fires are consumed quickly and have a short residence time (e.g. 30 seconds), in contrast to the residence time of fires in a deep *duff*[14] layer, which can burn for hours. Foliage and *suspended dead material*[15] are usually

[11] Ladder Fuels: Materials such as shrubs or small trees connecting the ground to the tree canopy or uppermost vegetation layer. In forests, this allows fire to climb upward into trees.

[12] BTU: British Thermal Units (heat)/feet/second.

[13] Leading Edge: The foremost part of a fire that is guiding the fire in the direction of travel.

[14] Duff: A layer on the forest floor that is made up of decomposing organic matter such as leaves, needles, and small branches.

[15] Suspended Dead Material: Typically composed of pine needles that are draped on living brush. Made up of dead fuels not in direct contact with the ground, consisting mainly of dead needles, foliage, twigs, branches, stems, bark, vines, moss, and high brush. In general these fuels easily dry out and can carry surface fires into the canopy.

consumed in less than 90 seconds. Residence time is useful in predicting tree mortality and potential for fire-induced *hydrophobic*[16] soils.

Heat Per Unit Area

Heat per unit area is defined as the total heat produced by flaming combustion in any one location. This does not include long *burn-out times*[17] and smoldering. This factor is especially important in determining soil heating and is a fairly good predictor of potential root damage and *cambium*[18] heating, all indicators of fire severity. Smoldering produces the vast majority of smoke in a fire, but most fire behavior models don't include smoldering combustion.

3.3. General Wildfire Environment Descriptions

This section is a summary of the environmental conditions in the planning area to set the context for plan readers. Much of this information is available from local natural resource agencies, university departments and/or nonprofit conservation organizations. You can include a sentence or two of introduction here if you so choose.

3.3.1. Topography

Topographic features such as slope, *aspect*,[19] and the overall form of the land have a profound effect on fire behavior. Topography directly and indirectly affects the intensity direction, and spread rate of wildfire. Fires burning in flat or gently sloping areas tend to burn more slowly and to spread in a wider ellipse than fires on steep slopes. Streams, rivers, and canyons tend to channel local *diurnal*[20] and general winds, which can accelerate the fire's speed and affect its direction, especially during *foehn*[21] winds on the west side of the Sierra Nevada. Local winds are greatly affected by topography, which "bends the wind" as it flows around or over land forms. Topography also causes daily upslope and downslope winds. The topographic features of aspect and elevation affect vegetation; solar exposure affects fuel moisture.

Provide an overall physical description of the area: Is it generally steep or flat? Convoluted or uniform? Rolling or deeply incised? What are the elevations? Are there vegetated high ridges that might spread embers long distances downward? What are the dominant aspects? Where are the areas with topographic issues (e.g. deep canyons, steep ridges, etc.) where fire will move rapidly or suppression access will be difficult?

This information is available from the US Geological Service, local natural resource and/or geology agencies, university departments, and conservation organizations. Free online topography maps are available at www.topozone.com and can be searched by place names.

Shaded relief topography can be seen and mapped along with slope steepness on the Fire Planning and Mapping Tools website. This information is likely displayed in your base map; therefore it isn't necessary to create a separate topography map.

[16] Hydrophobic: Literally meaning "water-fearing" as in a substance such as oil, which does not mix well with water. Also refers to a soil that will no longer absorb water.

[17] Burn-Out Time: The length of time in which flaming and smoldering phases occur in a given area or for the whole fire.

[18] Cambium: The growing layer of a tree, located between the bark and wood of the stem.

[19] Aspect: The direction that a slope faces (as in north, south, east, or west).

[20] Diurnal: Belonging to or active during the day.

[21] Foehn Events: A wind that blows warm, dry, and generally strong, creating extremely dry fuel and dangerous fire potential.

3.3.2. Weather

This section describes common weather conditions and weather patterns that exist at the time the most damaging fires could occur, along with routine conditions during which serious fires may burn.

Weather conditions significantly impact the potential for fire ignition, as well as rates of spread, intensity, and direction in which fires burn. Wind, temperature, and humidity are the more important weather variables used to predict fire behavior.[22] The term "fire weather"[23] refers to weather elements that influence fire ignition, behavior, and suppression.[24] These elements include temperature, relative humidity, wind speed and direction, precipitation, atmospheric stability, and aloft winds.[25] "General winds" is also an accepted term for local winds produced by broad-scale pressure gradients as shown on synoptic maps and modified by friction or topographic effects. General winds are combined with slope winds to get actual forecasted wind.

Wind is considered the most variable and difficult weather element to predict, while wind direction and velocity profoundly affect fire behavior. Wind increases the flammability of fuels by removing moisture through evaporation, by pre-heating fuels in a fire's path, and increasing spotting distances (the distance at which a spot fire might be set by a flying ember). Wind velocities and directions may vary in vertical elevation, with somewhat different impacts on fire behavior. The direction and velocity of surface winds can directly control the direction and rate at which the fire spreads. Winds that blow at least 20 feet above the ground can carry embers and firebrands downwind, causing spot fires to precede the primary front.

Annual highs in the Sierra Nevada are around 90º Fahrenheit, while lows approach 0º F. In the planning area, annual highs are around [ ]º F, while lows approach [ ]º F.

What are the general weather conditions, especially during times prone to wildfire occurrence? What is the annual precipitation? Is it generally wet in winter and dry in summer? What form does precipitation take (e.g. rain, fog, snow)? What are the average monthly temperatures and precipitation amounts? Are there areas with microclimates that increase the risk of catastrophic fire, such as areas with high winds, or hot, dry, south-facing slopes?

Information on precipitation and snow levels in California is available at cdec.water.ca.gov/snow_rain.html. For a map of weather stations by county, see www.ipm.ucdavis.edu/WEATHER/wxretrieve.html, or www.wrcc.dri.edu/summary/climsmsfo.html.

Prevailing winds in fire season (generally June through October) are out of the southwest, although infrequent foehn winds usually blow from the north to the east. Weather conditions can change rapidly as upper-level wind currents and pressure systems in the western states shift locations, and both dry and wet frontal systems move through the mountainous terrain. Frontal winds associated with low-pressure systems moving across the area can create hazardous fire conditions. Winds in advance of the frontal system can reach speeds exceeding 60 mph over ridges. The atmospheric instability dilutes and disperses smoke, but also creates torching (running crown fires are a result of strong winds) and spot fire problems (distances increase as winds increase).

Fires during foehn events—or subsiding winds—usually result in extreme fire behavior because the winds are particularly strong and dry, thus preheating fuels and predisposing them to burning with intensity. These conditions are usually worse at night, as these foehn winds combine with downslope/down-canyon diurnal winds.

When the temperature is high, relative humidity low, wind speed is high and/or originating from the east in a foehn wind, conditions are very favorable for extensive and severe wildfires. Typically the 90th or 95th percentile weather observations (i.e., weather observations that are among the most extreme–only 10% of the observations are more extreme under 90th percentile conditions) are used for planning fire hazard reduction treatments. For

[22] Husari, S., T. Nichols, N.G. Sugihara, and S.L. Stephens (2006). "Fuel Management." In: N.G. Sugihara, J. van Wagtendonk, K.E. Shaffer, J. Fites-Kaufman, and A.E. Thode, editors. *Fire in California's Ecosystems.* Berkeley: University of California Press. Pp. 444–465.

[23] Fire Weather: The various types of weather that affect how a fire ignites, behaves, and is controlled.

[24] www.rmrs.nau.edu/fourcornersforests/wildlandterms.htm

[25] Aloft Winds: Upper winds that occur in the atmosphere above the surface level, generally 2,000 feet and higher.

example, using the Lake Tahoe Region, the 90th-percentile value for fine fuel *(1-hour[26])* moisture was 5%, *10-hour fuel[27]* was 7.5%, and *100-hour fuel[28]* was 12.3% when winds blew from the southwest (the prevailing wind direction during fire season). The herbaceous fuel moisture was 67% under these frequencies. The *20-foot wind speed[29]* was 13.4 miles per hour on the most extreme 10% of the weather days.[30] In this example, if the fire season typically lasted 150 days, these values would occur on the 15 most extreme days. Normally the highest values do not occur on the same day (e.g. the hottest days may not coincide with the windiest days).

Describe the temperatures, relative humidity, wind speed, and wind direction at the *90th percentile[31]* values, as well as the most extreme values for each. The length of time available for analysis may vary between weather stations, but five years of observations should be considered a minimum.

A network of local weather stations records a variety of types of observations (e.g. temperature, relative humidity, wind speed, wind direction). The best weather data source is cdec.water.ca.gov/queryTools.html or raws.wrh.noaa.gov/cgi-bin/roman/past.cgi. A useful source on climate data for local environment is at www.wrcc.dri.edu/summary/Climsmnca.html. The National Fire Weather website at fire.boi.noaa.gov has more information on fire weather. The use of a public domain sorting program called FireFamily++ at www.fs.fed.us/fire/planning/nist/ffp_305_rn.rtf facilitates analysis of weather information.

3.3.3. Hydrology

The *hydrology[32]* of an area defines the flow of water across and through the land. Lakes, ponds, streams, wetlands, and springs are just a few examples of features that contribute to the hydrology of an area. The presence of these features tends to increase the humidity of a local site and can make it more resistant to the effects of fire. In the case of ponds and lakes, their availability as water sources for suppression is also important.

Describe rivers, creeks, and springs. Name the principal waterways. Include any specific information such as if they are wild and scenic, 303d impaired, etc.

Many streams and rivers can be mapped and identified on the Fire Planning and Mapping Tools website, using the “Hydrography, Streams NHD” layer. This information is likely displayed in your base map, so it isn’t necessary to create a separate hydrology map.

For river conditions, see www.water.ca.gov/nav.cfm?topic=Water_Conditions&subtopic=River_Conditions_and_Forecasts, and www.cnrfc.noaa.gov/, water.usgs.gov/waterwatch/?m=real&w=map&r=ca.

[26] 1-Hour Fuel: Fuels that are less than ¼ inch in diameter. These fuels will only take about an hour to lose or gain two-thirds of the equilibrium moisture content of their environment.

[27] 10-Hour Fuel: Fuels that range in diameter from ¼ inch to 1 inch, and take about ten hours to lose or gain two-thirds of the equilibrium moisture content of their environment.

[28] 100-Hour Fuel: Fuels that range from 1 inch to 3 inches and take about 100 hours to lose or gain two-thirds of the equilibrium moisture content of their environment.

[29] 20-Foot Wind Speed: The speed of wind, measured 20 feet up, in miles per hour.

[30] Information obtained from the Meyers Station near South Lake Tahoe at 6,337 feet elevation during June from 1987 to 1997 (Murphy et al., 2000).

[31] 90th Percentile: Weather observations that are among the most extreme—only 10% of the observations are more extreme under 90th percentile conditions.

[32] Hydrology: A science that deals with the waters of the Earth including movement, distribution, seasonal patterns, and conservation.

3.3.4. Vegetation and Fuels

Vegetation varies by size, height, and density, and combined with other flammable material on the site, it provides the fuel that feeds wildfire. The volume and distribution of fuels, the *moisture content*,[33] and the arrangement of fuels greatly influence resulting fire behavior.

Fuel includes anything that can burn: grass, shrubs, and trees, as well as fences, decks, furniture, cars, and houses. These can be described either as fuel models (as described in section 3.4 below), or in terms of sizes and volumes: light fuels (consisting of grass, dry leaves, and kindling-size twigs), medium fuels (shrubs and fences), or heavy fuels (logs, trees, or homes). The distribution of the volume and sizes of fuels in any one space, along with the moisture content and arrangement of fuels, greatly influence resulting fire behavior.

See Section 3.4 for a description of the planning area fuels. See Appendix 4 for more information on local vegetation types and their fire ecology.

Summarize the general vegetation types. What is their general pattern of distribution? Do you have forests: if so, what kind (e.g. mixed conifer, ponderosa pine, red fir)? Are there grasslands, chaparral and/or wetlands? Do they occur in vast areas or small patches? See Appendix 4 for a discussion of basic Sierra Nevada vegetation types. For more information about vegetation mapping, see www.dfg.ca.gov/bdb/html/vegcamp.html.

3.3.5. Wildlife

Wildlife in the Sierra Nevada includes animals, plants, insects, other invertebrates, and fish. The variety of animals in the Sierra Nevada is extensive. A recent assessment indicates the presence of about 400 animal species in the region.[34] They include amphibians (25 species), reptiles (32), birds (230), and mammals (112). In addition, there are 40 kinds of fish with 26 species represented.[35] Over 50% of the native plant species (more than 2,700 species) found in California occur in the Sierra Nevada.[36] These include 405 *endemic*[37] species, i.e., found only in the Sierra Nevada. These wildlife species all depend on the environment around them to provide the food, water, and shelter they need to survive.

Describe the wildlife in your area. What do they need for food, water, and shelter? Where are their nests, dens, or homes? When are they most active during the year?

For more information about mammals, birds, reptiles, and amphibians, see www.dfg.ca.gov/bdb/html/cawildlife.html and www.dfg.ca.gov/bdb/html/cwhr.html. For more information about plants, see www.calflora.org/. For more information about how wildfire affects specific wildlife, see www.fs.fed.us/database/feis/.

[33] Moisture Content: The dry weight of a material, such as wood or soil, compared to the wet weight of the same material. It is not unusual for live material to have a moisture content greater than 100% because it could contain more water than solid material by weight.

[34] Graber, D.M. (1996). "Status of Terrestrial Vertebrates." *Sierra Nevada Ecosystem Project, Final Report to Congress, Volume II, Assessments and Scientific Basis for Management Options.* Davis: University of California, Centers for Water and Wildland Resources.

[35] Moyle, P.B., R.M. Yoshiyama, and R.A. Knapp (1996). "Status of Fish and Fisheries." *Sierra Nevada Ecosystem Project, Final Report to Congress, Volume II, Assessments and Scientific Basis for Management Options.* Davis: University of California, Centers for Water and Wildland Resources.

[36] Shevock, J.R. (1996). "Status of Rare and Endemic Plants." *Sierra Nevada Ecosystem Project, Final Report to Congress, Volume II, Assessments and Scientific Basis for Management Options.* Davis: University of California, Centers for Water and Wildland Resources.

[37] Endemic: A plant that is native to a certain limited area and found nowhere else.

Threatened and Endangered Species

California has a large number of threatened and endangered species. While most biologists acknowledge that fire plays a role in the environment in which these species live, little is known about the relationship of these species to fire. Their response to fire of varying intensities, frequencies, and seasons is also not well understood; even less the effects of potential hazard reduction treatments on rare species. The planning and implementation of projects may be hindered because of this lack of knowledge.

What are the threatened, endangered, or rare species in the planning area? How abundant are they? What is their current legal status? Are there specific requirements known for the habitat in which they occur? Is periodic fire important to shaping these types? For more information, see www.dfg.ca.gov/bdb/html/cnddb.html and jfsp.nifc.gov/projects/01B-3-3-28/01B-3-3-28_Final_Report.pdf

3.4. Fuel: Description of Fuel Through Fuel Models

A fuel model is a standardized description of fuels available to a fire based on the amount, distribution, and continuity of vegetation and wood.[38] Fuel models distinguish between vegetation such as tall and short chaparral, tall and short grass, timber with and without an understory, and oak woodland with and without understory vegetation. They describe the structure (or arrangement) of the vegetation primarily, as well as the kinds of plants that grow in the vegetation. Fire managers use fuel models within the Fire Behavior Prediction System (FBPS) called FBPS #1, 4, 8, 9, and 10, etc. Fire behavior prediction models are useful because they forecast how fast a fire will spread, or how damaging the fire might become (in terms of fire intensity), or whether it is likely to torch in the area. Information regarding fuel volumes and fire behavior descriptions is available from the publication *How to Predict the Spread and Intensity of Forest and Range Fires*.[39]

In selecting the appropriate fuel model, it is important to consider what fuels will actually "carry the fire." The following text describes the criteria for selecting fuel models.

Fuel models describe vegetation structure, in addition to typical species composition; structure largely determines the fuel that will actually support the fire. The understory is more important than the overstory. The most significant factor is the amount and distribution of smaller-diameter fuels, because these materials generally spread wildland fires. A grassy field with oak trees that cover less than one-third of the slope would be classified as a grass fuel model because the contribution of oak leaves and branches to fire behavior may be negligible (due to the minor amount of leaf drop or the relative height at which the first branches grow above the ground). Similarly, where chaparral covers less than one-third of a conifer stand, it should be classified as a conifer stand (FBPS #8, 9, or 10). The amount and size of dead material distinguishes among the three choices of conifer fuel models. Generally, if grass covers the understory of deciduous oak woodlands, it should be categorized as a fuel model 2. If the closed canopy prohibits understory growth and leaf litter is the main fuel, it is a fuel model 8.

Another important factor in fuel models is the amount of dead biomass and the ratio of live-to-dead material in terrain with significant brush and numerous tree stands; dead biomass contributes fine fuel litter as well as carries flames more readily.

Fuel models may be delineated by several methods, from drawing polygons on maps, to field surveys and samples, to defining spectral bands on satellite imagery.

Fuel models as mapped by the USGS Landfire program may be obtained from gisdata.usgs.net/website/landfire/. This program mapped fuels and other important factors involved in fire behavior prediction.

[38] www.nps.gov/archive/seki/fire/fire_gloss.htm

[39] Rothermel, Richard C. (1983). General Technical Report INT-143, published by the USDA Forest Service Intermountain Forest and Range Experiment Station.

The following table illustrates the relationship between Sierra Nevada typical fuel models and vegetation types. The vegetation types are broad classifications of vegetation communities. These vegetation types and their fire ecology are discussed in greater detail in Appendix 4.

Figure 1. Relationship between Sierra Nevada Vegetation Types and Typical Fuel Models.

Vegetation Type	**Typical Fuel Model**[40]
Grassland and Dry Meadows	Fuel Model 1
Chaparral	Fuel Model 4
Montane Chaparral	Fuel Model 5
Foothill Woodland	Fuel Model 2, 8
Ponderosa Pine and Mixed Conifer	Fuel Model 9, 10
Upper-Elevation Fir Forests	Fuel Model 8, 10
Lodgepole-Meadow-Aspen	Fuel Model 8, 9
Sagebrush-Bitterbrush	Fuel Model 5

The following sections describe the fuel models found in the Sierra Nevada. Include those which apply to your planning area and delete those that do not.

Grasslands and Dry Meadows - FBPS Fuel Model #1

Grassland fuels (both annual and perennial) are fairly uniform and homogeneous compared to other fuel types. Grasslands generally have a light total fuel load, made entirely of fine herbaceous material that cures in the summer. This material responds to changes in humidity and is easily ignited in dry periods. It is characterized by the USDA Forest Service Fire Behavior Prediction System as:

> "Grasslands and savanna are represented along with stubble, and grass-shrub combinations where shrubs cover less than one-third of the area. Annual and perennial grasses are included in this fuel model."

Grasslands fuel type normally has under 3 tons/acre of fine fuel, and a *fuel bed height*[41] of approximately 18 inches. Fires will go out if moisture content is greater than 12%.

Grass fuels do not produce much heat, but they produce a fire that travels quickly. Thus containment is the greatest challenge in these fuel types. Grass also serves as a wick to more hazardous fuels that are apt to cause more damage. It provides an avenue for fire to travel to densely vegetated areas and build up enough of a “head of steam" to burn into those areas, or other types of fuels under conditions that would not sustain a fire by themselves.

Oak Savannah, Sagebrush and Bitterbrush - FBPS Fuel Model #2

Some examples of Fuel Model #2 include oak savannah, sagebrush and bitterbrush (when grass is abundant between shrubs), and ponderosa pine stands. The forest floor contains more *stemwood*[42] than FBPS #1 but is still dominated by either grass or needles. Fires burn more rapidly than fuel models with forest litter on the surface, but slower than grasslands. Heat output is minor, with flames usually controllable by hand crews.

The USDA Forest Service Fire Behavior Prediction system describes this fuel type as follows:

[40] There is a wide variety of fuel volume, structure, and size class distribution within vegetation types; fuel models should be determined by site-specific conditions. Fuel models can be classified by comparing photographs of fuel models with on-site conditions (Anderson 1982), by using expert opinion to translate vegetation types to fuel models, or by using a “key” provided in Rothermel (1983).
Anderson, Hal E. (1982). “Aids for determining fuel models for estimating fire behavior.” Res. Pap. INT-305. Ogden, UT. Intermountain Forest and Range Experiment Station. 26 pp.

[41] Fuel Bed Height: A measurement of the height of fuel composition from the ground surface.

[42] Stemwood: The wood of the main stem or trunk of a plant.

> "Fire Behavior is primarily through the fine herbaceous fuels, either curing or dead. These are surface fires where the herbaceous material, besides litter and dead-down stem wood from the open shrub or hardwood overstory, contribute to the fire intensity. Open shrub lands and scrub oak stands that cover one-third to two-thirds of the area may generally fit this model, but may include clumps of fuels that generate higher intensities and may produce firebrands."

Fifty percent of the fuels are comprised of material ¼ inch or smaller. A quarter of the fuels are between the size of ¼ and 1 inch diameter. An eighth of the fuels are of larger diameter, from 1 to 3 inches. A minor component is comprised of live foliage. The fuel height is approximately one foot, and the *extinction moisture*[43] is 15%, which is almost the same as grasslands.

Chaparral - FBPS Fuel Model #4

In the Sierra Nevada some examples of Fuel Model #4 include chaparral and montane chaparral (which can be classified as either FBPS #4 or #5, depending on the fuel-bed height and amount of dead material in the vegetation). Fires are not easily ignited, but when fire does travel through the stand, it almost always creates long flame lengths and rapid spread, resulting in an intense fire.

This vegetation is described as Fuel Model #4 in the Fire Behavior Prediction System:

> "Fire intensity and fast-spreading fires involve the foliage and live and dead fine woody material in the crowns of a nearly continuous secondary overstory. Stands of mature shrub, six or more feet tall, such as California mixed chaparral...are typical candidates. Besides flammable foliage, there is dead woody material in the stand that significantly contributes to the fire intensity. Height of stands qualifying for this model depends on local conditions. There may be also a deep litter layer that confounds suppression efforts."

This fuel model has a large portion of fuel as foliage in the canopy. The fuel loading by size class follows: Fine dead fuels (<¼" diameter) represent 5.01 tons per acre. Fuels which are ¼ to 1 inch diameter total 4.01 tons/acre, and fuels between 1 and 3 inches diameter total 2.0 tons per acre. Live herbaceous fuels are not a significant component in this fuel model; however, live woody fuels constitute 5.01 tons per acre of fuel. The total loading of fuel exceeds that of fuel model #9, with more than 16 tons/acre in this fuel model (#4).

Sagebrush and Bitterbrush /Montane Chaparral - FBPS Fuel Model #5

Sagebrush and bitterbrush (when shrubs are nearly continuous) and manzanita, or snowbrush-dominated chaparral stands, can be characterized as Fuel Model #5. Fires are carried in the shrub layer but are more manageable than FBPS #4 due to their lower flame lengths and slower spread rates. The USDA Forest Service Fire Behavior Prediction System describes the model as follows:

> "Fire behavior is not normally explosive. Rates of spread are quite fast, but flame lengths are low (usually under five feet) and heat output minimal. Fire is generally carried in the surface fuels that are made up of litter cast by the shrubs, and the grasses or forbs in the understory. The fires are generally not very intense because surface fuel loads are light, the shrubs are young with little dead material, and the foliage contains little volatile material."

Fuel loads are less than 5.5 tons per acre, with almost one-half in twig-sized fuels and live fuels. The FBPS notes that shrubs are not very tall, but often fuels mapped as Fuel Model #5 are up to 10 feet tall.

Oak Woodlands, Short-Needle Conifer Stands - FBPS Fuel Model #8

The surface fuels in Fuel Model #8 are either compact oak leaf litter or short-needled conifers such as Douglas fir or white fir. Ferns or wildflowers are a minor component of the forest floor. Fire intensity, flame lengths, and scorch heights are usually low in oak woodlands. Oak woodlands are characterized as follows in the Fire Behavior Prediction System:

> "Slow-burning ground fires (carried in the compact litter layer) with low flame heights are the rule, although the fire may encounter an occasional 'jackpot' or heavy fuel concentration that can

[43] Extinction Moisture: The moisture level in fuels when fires tend to stop burning.

flare up. Only under severe weather conditions involving high temperatures, low humidities, and high winds do the fuels pose fire hazards. Closed-canopy stands of short-needle conifers or hardwoods that have leafed out support fire in the compact litter layer. This layer is mainly needles, leaves, and some twigs since little undergrowth is present in the stand."

The oak woodlands fuel type likewise has a small amount of biomass: total tonnage is 5 tons/acre, 30% under ¼ inch diameter, 20% from ¼ to 1 inch diameter, and 50% from 1 to 3 inches diameter. The fuel height is 2 feet. The required moisture for extinction of a fire in this fuel type is high at 30%.

The resulting fire behavior is rather benign. Rates of fire spread are slow, approximately 2 feet/minute. Flame lengths are predicted to be 1 foot. Leisurely spread rates, combined with the relatively short flame lengths of the predicted fire behavior, demonstrate a manageable, moderate fire hazard in this fuel type.

Fuel conditions in oak woodlands vary with the slope, age, height, and canopy closure of the overstory, depth of the litter, and density of understory shrub cover. Under severe weather conditions involving high temperatures, low humidities, and high winds the fuels pose fire hazards. Ground-layer and understory fuel loads beneath dense oaks may be minimal (well under 1 ton/acre), but horizontal fuels may be continuous and ladder fuels present where the vertical distribution of foliage is continuous.

Mixed Hardwood–Conifer Forest - FBPS Fuel Model #9

In the Sierra Nevada, some examples of Fuel Model #9 include open ponderosa pine stands that have more downed stemwood, branches, and some hardwood leaves. The larger biomass from the branches promotes a longer flame length, but still a manageable fire unless winds and terrain combine to increase fire intensity.

The Fire Behavior Prediction System describes fire behavior in this fuel model as follows:

> "Fire runs through the surface litter faster than model 8 and has a higher flame height. Both long-needle conifer and hardwood stands...are typical. Fall fires in hardwoods are representative, but high winds will actually cause higher rates of spread than predicted. This is due to spotting caused by rolling and blowing leaves. Closed stands of long-needled pine like ponderosa, Jeffrey, and red pines...are grouped in this model. Concentrations of dead-down woody material will contribute to possible torching out of trees, spotting, and crowning."

Fuel loading is highly variable in space, but generally this fuel model has a preponderance of dead fuel volume in the small-diameter size class. Almost 75% of the total fuel volume (3 tons/acre) is found in the smallest size class of less than ¼ inch diameter. Fuels that are ¼ to 1 inch diameter total less than ½ ton/acre. Larger-diameter fuels, from 1 to 3 inches, total only .15 tons/acre. The fuel bed is compact, and less than 2 inches in height.

Conifer Forest with Dead, Downed Logs - FBPS Fuel Model #10

The vast majority of fuels within forests in the Sierra Nevada are characterized as Fuel Model #10. These forests have some live fuels in the surface layer, and an ample amount of dead branches and logs that fuel a more intense fire, leading to control challenges.[44] This model and resulting fire behavior are described as follows:

> "The fires burn in the surface and ground fuels with greater intensity than the other timber litter models. Dead down fuels include greater quantities of 3-inch or larger limb wood resulting from overmaturity or natural events that create a large load of dead material on the forest floor. Crowning out, spotting and torching are more frequent in this fuel situation, leading to potential fire control difficulties."

Fuel loading is variable no matter where assessments are made. However, this model is typified as having the following dead fuel loading by size class: Fine fuels (<¼ inch diameter) represents 3 tons/acre. Fuels which are ¼ to 1 inch diameter total 2 tons/acre, and fuels between 1 and 3 inches diameter total 5 tons/acre. Live herbaceous and live woody (shrubby) fuel volume totals 2 tons/acre in this fuel model. Total fuel model is 12 tons/acre.[45]

[44] Stephens, S.L. (1998). "Effects of fuels and silviculture treatments on potential fire behavior in mixed conifer forests of the Sierra Nevada, CA." *Forest Ecology and Management* 105: 21–34.

[45] Rothermel, Richard C. (1983).

Conifer Forest with Dead, Downed Logs and Slash - FBPS Fuel Model #11

Fuel Model #11 is sometimes used where there is an absence of live fuel in the forest floor of #10, Increased volumes of logs, both because of more and larger downed material, along with logging slash, create fires that have high intensity, a potential for crown fires, and severe surface fires.

The FBPS describes this fuel model and predicted fire behavior as:

> "Fires are fairly active in the slash and herbaceous material intermixed with the slash. The spacing of the rather light fuel load, shading from overstory, or the aging of the fine fuels can contribute to limiting the fire potential. Light partial cuts or thinning operations in mixed conifer stands, hardwood stands… are considered. The less-than-three-inch material fuel load is represented by no more than 10 pieces, 4 inches in diameter, along a 50-ft transect."

Figure 2 below describes the distribution of fuel volume (also called fuel loading) by size class, along with the overall height of the fuel complex (fuel bed depth). Fuel loading is measured in tons per acre (noted as T/A). It further indicates what the moisture is when fires tend to stop burning in dead fuels (Moisture of Extinction Dead Fuels). The table indicates the predicted rate of spread (ROS) in chains per hour, along with the flame length (FL) in feet per minute. A chain is 66 feet in length, so the measurement "chains per hour" is roughly equivalent to the measurement "feet per minute."

Use Figure 2 to describe the expected fire behavior based on the proportion of the plan area that contains the various fuel models. Using this table, select the flame lengths, fireline intensity, and heat per unit area, along with the rates of spread for the fuel models that occur in the planning area. It is helpful to describe the proportion of the planning area covered by the fuel types (models) with resulting fire behavior, and to highlight the locations of the most extreme fire behavior.

Figure 2. Description of Fuel Models and Fire Behavior

Fuel Model	Typical Fuel Complex	Fuel Loading (T/A) 1-H	10-H	100-H	Live	Fuel Bed Depth (ft)	Moist. of Extinction Dead Fuels (%)	ROS* ch/h	FL* (ft)
1	Short Grass	0.74	0.00	0.00	0.00	1.0	12	78	4
2	Timber	2.00	1.00	.50	.50	1.0	15	35	6
3	Tall Grass	3.01	.00	.00	.00	2.5	25	104	12
4	Chaparral	5.01	4.01	2.00	5.01	6.0	20	75	19
5	Brush	1.00	.50	.00	2.00	2.0	20	18	4
6	Dormant brush	1.50	2.50	2.00	.00	2.5	25	32	6
7	Southern rough	1.13	1.87	1.50	.37	2.5	40	20	5
8	Closed timber litter	1.50	1.00	2.50	0.00	0.2	30	2	1
9	Hardwood litter	2.92	.41	.15	.00	0.2	25	8	3
10	Timber	3.01	2.00	5.01	2.00	1.0	25	8	5
11	Light logging slash	1.50	4.51	5.51	0.00	1.0	15	6	4
12	Medium logging slash	4.01	14.03	16.53	.00	2.3	20	13	8
13	Heavy logging slash	7.01	23.04	28.05	.00	3.0	25	14	11

*ROS and FL are represented under a fine dead fuel moisture of 8%, a midflame windspeed of 5 mph and live fuel moisture, if present, of 100% (Anderson 1982).

3.5. Fire History

The fire history of an area is a description of the time, space, and cause of fires in the planning area. In fire jargon, "risk" is often associated with fire history, because this term describes the events that cause a fire to start (i.e., ignitions).

The fire history of an area is important because it illustrates the potential for future fires. Large fires often repeat themselves; thus it is useful to understand burning patterns over time. An area's fire history also portrays ignition patterns that can target effective prevention programs. For example, if there is a history of frequent fires along a well-traveled route, roadside vegetation management may be in order. Additionally, fire history discerned

through fire scars on tree rings may indicate the way fires have changed over time, both in frequency and intensity. This may point to appropriate goals for future fuel conditions.

3.5.1. Fire Caused by Natural Lightning

Lightning fires in the Sierra Nevada are common in the summer and fall months, particularly at higher elevations and on the eastern slope. Fires ignite when lightning strikes coincide with rainless, windy weather; however, lightning fires rarely occur in the spring. Lightning is closely related to elevation (and hence vegetation), more so than slope steepness and aspect (except for the east side of the Sierra, which accounts for the majority of strikes). Lightning-caused fires in the Sierra Nevada are most prevalent at 4,000 to 7,000 feet elevation, where the incidence of lightning strikes and burning conditions coincide most. There are fewer strikes at lower elevations, while above 8,000 feet, fuels are sparse and moisture typically accompanies lightning.[46] Higher-elevation vegetation types such as lodgepole pine and whitebark pine have significantly more lightning strikes but less fire because of their lower fuel volumes, which result in more benign fire behavior Red fir has a lightning strike incidence at an intermediate frequency.

3.5.2. Native American Period Fire History

Fires prior to European settlement in most of the lower-elevation grasslands, oak woodland, and conifer forest types of the Sierra Nevada were frequent, burned for months at a time, and collectively covered large areas. Although the fires were primarily low to moderate intensity, they exhibited complex patterns of severity. Fire frequency, intensity, and severity varied through time and across the landscape in response to variations in climate, number of lightning ignitions, topography, vegetation, and human cultural practices.[47, 48] E.A. Sterling wrote in 1904:

> "When white men first came into the region, they found it the established custom of the Indians to burn over the woods every fall to scare out game at the time of the annual 'drive.' Many of the larger trees are badly fire-scarred, while nearly all are more or less charred."[49]

Fire-scarred trees document fire histories before written records were established. Many researchers concur that fire frequency ranged from 5 to 25 years in the Sierra Nevada prior to European settlement. For thousands of years, the forest burned often, creating a fire-influenced pattern of vegetation dominated by more fire-tolerant species. These forests are likely to be composed of widely spaced large trees, patches of young trees, and a greater area covered by wildflowers, grasses, and hardwoods. A *fire-climax*[50] *stand structure model*[51] is much more open and park-like than a classic "old-growth" stand structure found in areas with higher annual precipitation. Fire tends to remove understory trees and shrubs, whereas an old-growth stand has a more complex and multi-layered understory.

3.5.3. European Settlement Fire History

Sterling (1904) continues:

> "With the coming of the early settlers, the general firing indulged in yearly by the Indians was broken up, although they have always remained a source of fire danger. Since the industrial

[46] van Wagtendonk, J. W. (1991). Spatial analysis of lightning strikes in Yosemite National Park. Proc. 11th Conf. Fire and Forest Meteorology 11:605-611.

[47] Sierra Nevada Ecosystem Project (SNEP). (1996a). "Fire and Fuels." Final report to Congress, Vol. I.Assessment summaries and management strategies. Wildland Resources Center Report No. 36. Davis, CA: Centers for Water and Wildland Resources, University of California; 62-71.

[48] Blackburn, Thomas C., and Kat Anderson (1993). *Before the Wilderness: Environmental Management by Native Californians*. Menlo Park, CA: Ballena Press.

[49] Sterling, E.A. (June 1904). "Report on the Forest Fire Conditions in the Lake Tahoe Region, California." Unpublished report on file at the University of California-Berkeley, Life Sciences Library.

[50] Fire Climax: The stage of vegetation that is sustained with frequent fire.

[51] Stand Structure Model: The spatial arrangement of the forest stand, describing the density and connectivity of the understory, mid-story, and overstory vegetation.

development of the region began, the most annoying and common cause of fire has been the sheepmen..., firing the brush or forest whenever it pleased them. By 1904, all but one or two small bands of sheep were driven from the region. An occasional fire is probably started by lightning, but the majority of present-day fires are the result of the careless use of fire by hunters, fishermen, and campers. The numbers of these various causes is very great. Fires near valuable property are always fought and extinguished as soon as possible. Those in more remote districts, however, are left to burn out as they will."

During European settlement logging, primarily of the largest, oldest trees, became common, with subsequent changes in forest structure and fuel volumes.

3.5.4. Recent Fire History

During the last century fire history has changed dramatically. Forest fuels have changed through more modern cultural practices of timber harvesting, mining, and grazing. Fire control in the Sierra Nevada has been extremely effective, particularly since the 1930s. Wildfire now *escapes*[52] less than 2% of the time—but those escaped fires cause the vast majority of damage.

The SNEP report[53] compared historic *fire-return intervals*[54] and present patterns, resulting in the following table.

Figure 3. Fire Return Intervals for Sierra Nevada Vegetation Types

	Fire Return Interval (years)	
	Historic (pre-1900)	**Present**
Forest Type		
Red fir	26	1,644
Mixed conifer-fir	12	644
Mixed conifer-pine	15	185
Ponderosa pine	11	192
Blue oak	8	78

Summarize your fire history here. Is it consistent with overall Sierra fire history, why or why not? When were the large fires in your planning area? Is there a pattern of ignitions? Is there any unique Native American or settlement history related to fire?

Fire history is available from the FRAP Fire Perimeters Website: frap.cdf.ca.gov/projects/fire_data/fire_perimeters/. This site displays the pattern of larger fires from 1953 to 2003. Fires larger than 300 acres on private land and larger than 10 acres on USFS lands are typically displayed. For fire history, typically fires are sorted by decades (or individual years) and/or fire size. Sometimes the number of times a parcel has burned is portrayed in the fire history maps in order to draw attention to frequently burned areas, or to those areas where fire has been absent for decades.

This website can be downloaded into a GIS program if you have that capacity. It allows the creation of maps that highlight the attributes associated with data. If not, use the Fire Planning and Mapping Tools website as described below.

Create and insert your fire history map from Fire Planning and Mapping Tools. (*See Instructions D for details on how to start your map on the website.)*

→ To show the fire history layer: click the **Fuels** layer and check **visible** next to **Fire History**. There are three choices of years to display: **(1900-1949), (1950-1999), and (2000-2005)**.

→ Choose all the layers you want to display by checking **Visible** next to the desired fire history years. Remember that too many layers could make your map hard to read.

[52] Escapes: Wildfires that cannot be contained with the first attempts at suppression.

[53] SNEP (1996a).

[54] Fire Return Interval: A period of time between fires in a specific region or area.

→ Click **Refresh Map** to have all the desired layers shown.

Figure 4. [PLACE] Fire History Map

3.6. Fire Hazard

The term "hazard" is usually used in the fire community in relation to topography and *fuel complex*[55] (the volume type, condition, arrangement, and location of fuels).[56] After several decades of successful fire-suppression efforts, the Sierra Nevada has an increasing problem of loss from wildfire. Fuel loads have increased to unnatural levels, and land-use patterns place valuable resources at risk from unnaturally intense wildfires. Fire hazard is influenced by past disturbances. The history of fire or management activities greatly alters the hazard for better or worse by changing the overall moisture of the site, as well as the volume and spatial arrangement of the fuels. This history is characterized by three fire management eras: the time before human occupation when lightning was the only ignition source, the era of Native American occupation when fire was used extensively, and the era after European Settlement when fire was largely suppressed (as discussed in the Fire History section above)."[57]

[55] Fuel Complex: The volume type, condition, arrangement, and location of fuels.

[56] Husari et al. 2006.

[57] Stephens, S.L., and N.G. Sugihara (2006). "Fire management and policy since European settlement." In: Sugihara, N.G., J. van Wagtendonk, K.E. Shaffer, J. Fites-Kaufman, and A.E. Thode, editors. *Fire in California's Ecosystems.* Berkeley: University of California Press. Pp. 431–443.

3.6.1. Hazard Assessment

To quote from the FRAP website: "CDF has developed a hazard assessment methodology for the California Fire Plan to identify and prioritize pre-fire projects that reduce the potential for large, catastrophic fires."[58] The fuel hazard ranking tells us the expected behavior of fire in severe weather (when wind speed, humidity, and temperature make conditions favorable for a catastrophic fire). The method for determining the fuel hazard ranking is based on: a) fuel model, b) slope, c) brush density, and d) tree density.

Evaluation of the fuel model and slope will result in a surface rank, which indicates the "rate of fire spread and heat per unit area associated with each unique fuel model-slope combination."[59] This describes how fast and hot a potential fire can burn in a given area. The methodology then measures how abundant ladder fuels and crown fuels are in the area. Coupled with potential fire behavior, CAL FIRE ranks the fire hazard in any location.

If an area has a very high surface rank (a very high rate of fire spread and heat per unit area), along with dense crown and ladder fuels, then it is highly probable that a fire could reach catastrophic proportions there during a severe weather condition. The area would receive a very high hazard rating. If an area has a moderate surface rank (a low rate of fire spread and heat per unit area) and has very little crown and ladder fuel, then there is a low probability of a catastrophic fire occurring there and it would receive a moderate hazard rating.

This information helps CAL FIRE and other agencies determine what kind of fire might be expected in different areas. "CDF pre-fire engineers verify these [hazard] rankings and use this fuel hazard assessment in conjunction with three additional Fire Plan assessments (weather, assets at risk, and level of service)."[60]

Create and insert your fire hazard map from Fire Planning and Mapping Tools. (*See Instructions D for details on how to start your map on the website.)*

To create your Fire Hazard Map, use the Fuel Rank (Q81_DET05_2) layer. This layer indicates moderate, high, and very high fuel rankings based on inputs such as fuel, slope, brush density (ladder), and tree density (crown cover).

→ To display the fire hazard layer: click on the **Fuels** layer and check **visible** next to Fuel Rank (Q81_DET05_2)**.**

→ Click on **Refresh Map** to have all desired layers shown.

See frap.cdf.ca.gov/data/fire_data/fuel_rank/index.html for more information on fire hazards.

The following map displays fire hazards for the planning area.

Figure 5. [PLACE] Fire Hazard Map

[58] California Department of Forestry and Fire Protection (2005). CDF Fire and Resource Assessment Program (FRAP). "Hazards Maps and Data." frap.cdf.ca.gov/data/fire_data/hazard/mainframes.html.

[59] California Department of Forestry and Fire Protection. Fire and Resource Assessment Program, "Fuel Ranks Maps and Data." frap.cdf.ca.gov/data/fire_data/fuel_rank/index.html.

[60] California Department of Forestry and Fire Protection. Fire and Resource Assessment Program, "Fuel Ranks Maps and Data."

3.7. Fire Regime

The fire regime is an objective measurement of fire's natural occurrence in the landscape, which is not necessarily the current condition or appearance. The fire regime includes the season, frequency, intensity, and spatial distribution of fires. There is quite a wide variability of "natural" intervals, intensities, and seasons, but some generalities can be made. Each vegetation type will have its own fire regime. A standardized set of five fire regimes has been generally accepted nationwide.[61],[62]

The five natural (historical) fire regimes are classified based on average number of years between fires (fire frequency) combined with the severity (amount of overstory replacement) of the fire on the dominant overstory vegetation. These five regimes include:

I: 0 to 35-year frequency and low (surface fires most common) to mixed severity (less than 75% of the dominant overstory vegetation replaced);

II: 0 to 35-year frequency and high (stand replacement) severity (greater than 75% of the dominant overstory vegetation replaced);

III: 35- to 100+-year frequency and mixed severity (less than 75% of the dominant overstory vegetation replaced);

IV: 35- to 100+-year frequency and high (stand replacement) severity (greater than 75% of the dominant overstory vegetation replaced);

V: 200+-year frequency and high (stand replacement) severity.

As scale of application becomes finer, these five classes may be defined with more detail, or any one class may be split into finer categories.

[61] Hardy, K.M., C.C. Schmidt, J.M. Menakis, and N.R. Samson (2001). "Spatial data for national fire planning and fuel management." *International Journal of Wildland Fire* 10: 353–372.

[62] Hann, W.J., and D.L. Bunnell (2001). "Fire and land management planning and implementation across multiple scales." *Int. J. Wildland Fire* 10: 389–403.

The Fire Regime on the Fire Planning and Mapping Tools website is based on the written fire history of the area. While this is useful for large-scale planning, fire regime can also be categorized through knowledge of the characteristics of pre-European settlement fire occurrence. Discovering the appropriate fire regime is a larger undertaking done by researching the history as recorded by fire scars on trees or by conducting a literature search of the relationships of fire to the various vegetation types in the area. In the absence of more site-specific information, the Fire Planning and Mapping Tools website can be used to describe the general Fire Regime.

Create and insert your Fire Regime map from Fire Planning and Mapping Tools. *(See Instructions D for details on how to start your map on the website.)*

→ To display the fire regime layer: click on the **Fuels** layer, and check **visible** next to **Fire Regime (FIRE_REG03_2).**

→ Click on **Refresh Map** to have all desired layers shown.

3.7.1. Fire Condition Class

The difference in fire regime between pre- and post-European settlement is described by the condition class. This is a subjective measurement, but mapping of the fire regime condition class has been done nationwide and is widely accepted. Usually where the condition class indicates that fire has been absent for an unnaturally long time, the hazard and potential damages are high to both the environment and human improvements in the area.

Three condition classes are described for each fire regime. Condition class is based on a relative measure describing the degree of departure from the historical natural fire regime. This departure results in changes to one or more of the following ecological components: vegetation characteristics (species composition, structural stages, stand age, canopy closure, and mosaic pattern); fuel composition; fire frequency, severity, and pattern; and other associated disturbances (e.g. insect and disease mortality, grazing, and drought). There are no wildland vegetation and fuel conditions or wildland fire situations that do not fit within one of the three classes.

The three classes are based on low (FRCC[63] 1), moderate (FRCC 2), and high (FRCC 3) departure from the central tendency of the natural (historical) regime. "Low departure is considered to be within the natural (historical) range of variability, while moderate and high departures are outside."[64] Areas considered at a high or moderate departure from the natural regime are experiencing dramatic increases in fire behavior, intensity, severity, and fire size.[65]

The greater the departure from the natural fire regime, the greater the variations to ecological components and the higher the risk of losing *key ecosystem components.*[66] For example, FRCC 3 classification means that fire regimes have been greatly altered from their natural range (i.e., from 3-10 years between fires prior to European settlement to 50-70 years since), and likewise, vegetation characteristics have been dramatically altered from their natural range. For example, an area may have experienced a fire regime of small, frequent, low-intensity fires prior to European settlement. Because fire suppression has been successful, only one fire has burned the area in the past 100 years. The fuels have become so voluminous that fire behavior is predicted to be intense, with the potential to kill trees that have survived other fires over the centuries The fuels have also become more uniform, creating conditions that facilitate fire spread and result in a large fire. Therefore, the risk of losing key ecosystem components is high. As another example, FRCC 2 classification means that fire regimes have been moderately altered from their natural range, resulting in vegetation characteristics that have been moderately altered. The risk is also moderate.

[63] Fire Regime Condition Class website (October 2006), Definition, www.frcc.gov.

[64] National Wildfire Coordinating Group. "Fire Regime Condition Class Definition. " (June 2003) www.nwcg.gov/teams/wfewt/message/FrccDefinitions.pdf

[65] Fire Regime Condition Class website, Definition, (October 2006), www.frcc.gov

[66] Key Ecosystem Component: An important piece of an ecosystem such as soil, native species, or mature/rare habitats, which are essential to the stability of an ecosystem.

The virtual exclusion of widespread low- to moderate-severity fire has affected the *structure*[67] and *composition*[68] of most Sierra Nevada vegetation types, especially in low- to middle-elevation forests. Conifer stands generally have become denser, mainly in small- and medium-size classes of shade-tolerant and *fire-sensitive*[69] tree species. Fuels have become more continuous vertically, contributing to more spatially homogeneous forests. Selective cutting of large *overstory trees*[70] and the relatively warm and moist climate during much of the twentieth century may have enhanced conditions for establishment of tree seedlings.

SNEP (1996) notes:

> "The increased density of young trees together with increased fuels from fire suppression and tree mortality has created conditions favorable to more intense and severe fires. Moreover, severe fires are more likely to be large because they are more difficult to suppress, although data on large fires in the Sierra indicate that current fire sizes vary greatly among national forests. While we cannot be sure whether more absolute area has burned in severe fires in the twentieth century than in pre-contact times, it is clear that within those areas that do burn, a greater proportion of fire is high-severity than in the past."[71]

Condition class does not relate directly to fire hazard but is designed to better predict the effects from a fire, specifically, fire-related risks to ecosystems. The documentation for this layer in the Fire Planning and Mapping Tools website is paraphrased as follows.

> "Current expected fires are compared to historic fire regimes with respect to fire frequency, size and patchiness, and effects on key ecosystem elements and processes. Classes are assigned based on current vegetation type and structure, an understanding of its pre-settlement fire regime, as well as the current conditions regarding expected fire frequency and potential fire behavior."

Fuel management projects can restore the vegetation type and structure through prescribed fire and/or other types of management techniques in a spatial distribution that can mimic the effect of natural fire regimes. Thus fuel management can move a condition class to one more closely resembling pre-European settlement, regardless of recent fire history.

The condition class in the planning area is [FRCC 1, 2, or 3], based on a natural fire regime of [I, II, III, IV, or V] and a fire history showing an interval of [number] years. The following map shows Condition Classes for the planning area.

Create and insert your condition class map from Fire Planning and Mapping Tools. *(See Instructions D for details on how to start your map on the website.)*

→ To display the condition class layer: click on the **Fuels** layer, and check **visible** next to **Condition Class (CON_CLASS03_2)**.

→ Click on **Refresh Map** to have all desired layers shown.

Another source, the USGS Landfire Mapping Program (www.landfire.gov), has mapped the Fire Regime Condition Class throughout the Sierra Nevada. This product can be downloaded from gisdata.usgs.net/website/landfire/. According to their website: "LANDFIRE, also known as the Landscape Fire and Resource Management Planning Tools Project, is a five-year, multi-partner project producing consistent and comprehensive maps and data describing vegetation, wildland fuel, and fire regimes across the United States. LANDFIRE data products include layers of vegetation composition and structure, surface and canopy fuel characteristics, historical fire regimes, and ecosystem status. LANDFIRE national methodologies are based on

[67] Structure: The composition of a forest or vegetation type, specifically looking at the density, cover, size or diameter, and arrangement.

[68] Composition: The percentage of each species that comprise a given area.

[69] Fire-Sensitive: A species of tree that is more susceptible to fire damage. Sensitivity may be due to thin bark or easily ignitable foliage.

[70] Overstory Trees: Tress that form the uppermost layer of the canopy in a forest.

[71] SNEP (1996a).

the latest science and extensive field-referenced databases. LANDFIRE data products are designed to facilitate national- and regional-level strategic planning and reporting of wildland fire management activities. Data products are created at a 30-meter grid spatial resolution raster data set. LANDFIRE national data products are produced at scales that may be useful for prioritizing and planning hazardous fuel reduction and ecosystem restoration projects."

Figure 6. [PLACE] Condition Class Map

3.8. Fire Threat

"Fire threat can be used to estimate the potential for impacts on various assets and values susceptible to fire. Impacts are more likely to occur and/or be of increased severity for the higher threat classes. Fire Threat is derived from a combination of fire frequency (how often an area burns) and expected fire behavior under severe weather conditions. Fire frequency is derived from 50 years of fire history data. Fire behavior is derived from fuels and terrain data. These data inputs are also catalogued within CERES and available via the CDF-FRAP web site. Detailed documentation is under development and will be posted on the FRAP web site."[72]

To determine whether fire threat is applicable to your community, you can use the CAL FIRE methodology by simply accessing the **FTHRT04_1** layer of the FPMT website.

→ To display the fire threat layer: click on the **Fuels** layer and check **visible** next to **Fire Threat (FTHRT04_1).**

→ Click on **Refresh Map** to have all desired layers shown.

Create and insert your fire threat map from Fire Planning and Mapping Tools. (*See Instructions D for details on how to start your map on the website.)*

[72] California Department of Forestry and Fire Protection. (2005) Fire and Resource Assessment Program. "Metadata Record: Fire Threat." frap.cdf.ca.gov/data/frapgismaps/output/fthreat_map.txt .

This is another option for creating this map from CAL FIRE data:

The analysis method developed by CAL FIRE suggests that areas with higher fire frequency have a higher potential threat. Areas with high fire frequency could take advantage of this methodology; areas with lower fire frequency can justify action with the potential for economic loss when the next, overdue fire occurs. The anticipated fire hazard should be overlaid with areas of high economic or ecological vulnerability to justify action as a substitute for fire frequency.

If you chose a methodology other than CAL FIRE's, you would use the layers describing the various assets at risk on the FPMT (e.g. water supply, scenic views) to describe the vulnerability of the planning area. The hazard layer Fuel Rank (Q81_DET05_2), described in Section 3.6.1 above should also be used. Using a GIS program outside the FPMT, the assets at risk and the hazard can be used in a weighted analysis. The combination of the values and weights will provide another perspective on fire threat.

To determine Fire Threat based on CAL FIRE's assets at risk and fuel rank, you will need to:

Step 1: Download the data (only one data layer needed – Q81_DET05_2) for your area of interest from the FPMT.

Step 2: Determine which assets at risk you would like to use (Water Supply, Water Storage, Timber, Structures, Soil Erosion, Scenic Viewsheds, Recreation, Range, Non-game Wildlife, Infrastructure, Hydroelectric Power, Historic Buildings, Fire-Flood Watersheds, and Air Quality).

Step 3: Determine weight (relative importance) for each asset at risk.

Step 4: Prepare layer(s) for weighted analysis.

Step 5: Perform additive analysis, for example (Air Quality Rank *.20) + (Soil Erosion Rank * .80) + Fuel Rank.

Step 6: Reclassify resultant output into the following fire threat values:

Threat Value	Description
-1	LITTLE OR NO THREAT
1	MODERATE THREAT
2	HIGH THREAT
3	VERY HIGH THREAT
4	EXTREME THREAT

Instructions for each step outlined above are detailed here. Keep in mind that your analysis will differ depending on your organization's fire and GIS expertise. The steps detailed below are just a guideline.

STEP 1:

→ To display the fire hazard (fuel rank) or any of the assets at risk: click on the **Fuels** layer and check **visible** next to the Fuel Rank (Q81_DET05_2) layer**.** Next, click on the **Planning Assessment**, **Total Asset Score**, or **Assets at Risk** layers and check **Visible** next to the appropriate layers, e.g. Water Supply (Q81_DET05_2), or Structures (WUI) (Q81_DET05_2) **.**

→ Click on **Refresh Map** to have all desired layers shown.

→ To download the shapefile (GIS layer), click on **Download** on the list of options on the left of the screen.

→ In the pop-up box listing all the layers that will be downloaded: click on **Extract**.

→ Another window will open listing your prepared zipped file (containing all shapefiles) as well as the metadata for each layer. Click on the appropriate links and save the file(s) on your hard drive.

→ Extract (unzip) the files on your hard drive.

NOTE: You do not need to download more than one file. The attributes contained in the shapefile Q81_DET05_2 has all surface fuel rankings.

STEP 2:

→ Determine the assets at risk that your organization is interested in using for this weighted analysis. You may want to confer with your local fire personnel to garner the expertise needed to determine which assets are at most risk from fire in your planning area.

STEP 3:

→ Determine the relative importance of each asset at risk for your planning purposes. Each asset has already been assigned a rank by CAL FIRE (1, 2 or 3 for Low, Medium or High). Your fire personnel will have to determine the "weight" each asset will have in the overall analysis.

STEP 4:

→ Your GIS personnel may need to prepare your shapefile for analysis, depending on GIS methods used.

STEP 5:

→ A simple way to determine fire threat is to add up the rankings for each asset at risk (of your choosing) and the fuel hazard rank. The higher the number, the higher the fire threat. A more nuanced approach is to "weight" each contributing factor. For example, (Air Quality Rank *.20) + (Soil Erosion Rank * .80) + (Fuel Rank). Using your organization's GIS and fire expertise, a weighted analysis can be derived and performed to determine fire threat using factors specific to your planning area.

STEP 6:

→ Depending on the number of assets used and the weights assigned, the resulting values may have a wide range. Again, relying on your organization's fire and GIS expertise, you will then need to reclassify those resulting values into a meaningful scale. To remain consistent, your resulting values for fire threat should be reclassified into the following:

Threat Value	Description
-1	LITTLE OR NO THREAT
1	MODERATE THREAT
2	HIGH THREAT
3	VERY HIGH THREAT

The following map displays fire threats for the planning area.

Figure 7. [PLACE]Fire Threat Map

3.9. Changing Fuels in the Wildland Urban Interface

The above information and assessments provide a context and history of the changing fire environment. Many recognize that the changing fire environment, along with increasing urbanization and human use of the Sierra Nevada, have created conditions where human life and property, as well as key ecosystem components, are at increasing risk from the effects of high-intensity wildfires.[73]

Before the mid-1800s, fires generally were frequent and mostly of low to moderate intensity, from lower-elevation blue oak woodlands through upper-montane red fir forests.[74] Fire exclusion, logging, grazing, forest clearing, and urbanization have combined to alter fire regimes that are now quite different from their historical character. These modified fire regimes have corresponding modified ecosystems, often with increases in vegetation density and accumulation of forest litter and duff that support a larger proportion of high-intensity fires than occurred under historical conditions.[75] The problems were created over a long time, and they will not likely be solved rapidly. The use of shaded fuelbreaks and other community fuel reduction efforts along the interface can reduce these fire risks.[76] Hence, this plan outlines actions to do just this.

[73] Biswell (1989); California Spotted Owl Federal Advisory Committee (1997); SNEP (1996a).

[74] Skinner and Chang 1996.

[75] Skinner and Chang 1996.

[76] Husari et al. 2006.

4. Fire Ecology and Management of Sierra Nevada Vegetation Types[1]

The role of fire is often seen as a *disturbance factor,*[2] but more recently fire has been acknowledged as a natural and often necessary process. Fire, like rain and sunshine, has shaped the patterns of vegetation on the landscape for eons, determining in part the species composition, *spatial distribution,*[3] age, and physical structure of plants. The process of fire has profoundly influenced most Sierra Nevada *ecosystems.*[4,5] In the Sierra Nevada foothills and mountains, fire is a dominating factor in the *disturbance regime*[6] and has been key in the evolution of *plant communities.*[7]

Most of the plant communities within this region are considered fire-adapted. Research scientists have found that many common plants have very specific *fire-adapted*[8] traits such as thick bark and fire-stimulated flowering, sprouting, seed release and/or germination. Fire also affects the amount of duff and litter that accumulates on the ground; the density of trees, shrubs, and other plants; and the cycling of nutrients to soil and plants.

It is generally believed today that fires in the Sierra Nevada landscape are less frequent and more severe compared to the patterns present before Europeans settled the area.[9] The absence of fire in combination with logging and other land management practices has led to a build-up of surface and ladder fuels, particularly in ecosystems that once experienced frequent low- to moderate-intensity fire regimes.[10] Currently in many places in the Sierra Nevada, small trees and shrubs have become a fire hazard to the natural environment as well as the human inhabitants.

Response of Vegetation Types to Fire

The following vegetation types are found in the planning area. For each type, the role of fire in shaping the assemblage of plants, the nature of the fire regime, and the common vegetative adaptations to fire are discussed.[11,12] These features are then considered in the development of management prescriptions that a) are

[1] This section was written primarily by Marko Bey, Lomakatsi Ecological Services., and Susan Britting, PhD. Please credit appropriately.

[2] Disturbance Factor: The aspects that influence changes to the environment, both human-caused and natural occurrences, such as logging or development, and fire, wind, or floods.

[3] Spatial Distribution: The manner in which plants are arranged throughout an area.

[4] Ecosystem: A community of organisms including plants, animals, and fungi and the non-living aspects of the physical environment that make up a specific area. Examples of ecosystem types include a pond or a forest.

[5] van Wagtendonk, J., and J. Fites-Kaufman (2006). "Sierra Nevada bioregion." In: Sugihara, N.G., J. van Wagtendonk, K.E. Shaffer, J. Fites-Kaufman, and A.E. Thode, editors (2006). *Fire in California's Ecosystems.* Berkeley: University of California Press. Pp 264–294.

[6] Disturbance Regime: The characteristic and usually historical pattern of disruptions to the environment (such as fire or flood or drought, for example) in a given area.

[7] Plant Community: A group of plants that are interrelated and occupy a given area.

[8] Fire-Adapted: The ability of organisms or ecosystems to make long-term genetic change for the most advantageous response to fire-prone environments.

[9] Mckelvey, Kevin, S. et al. (1996). "An Overview of Fire in the Sierra Nevada." In: *Sierra Nevada Ecosystem Project, A Final Report to Congress, Volume II, Assessments and Scientific Basis for Management Options.* Davis: University of California, Centers for Water and Wildland Resources.

[10] Sierra Nevada Ecosystem Project (SNEP). (1996a). "Fire and Fuels." Final report to Congress, Vol. I.Assessment summaries and management strategies. Wildland Resources Center Report No. 36. Davis, CA: Centers for Water and Wildland Resources, University of California; 62-71.

[11] Much of the information contained in these sections was summarized from; Skinner, C.N., and C. Chang (1996). "Fire Regimes, past and present." *Sierra Nevada Ecosystem Project, Final Report to Congress, Volume II, Assessments and Scientific Basis for Management Options.* Davis: University of California, Centers for Water and Wildland Resources., and; Chang, C. (1996). "Ecosystem responses to fire and variations in fire regimes." *Sierra Nevada Ecosystem Project, Final Report to Congress, Volume II, Assessments and Scientific Basis for Management Options.* Davis: University of California, Centers for Water and Wildland Resources., as well as vegetation models used in wildland fire planning

consistent with the natural role of fire expected for each type, b) promote the Conservation Principles identified in Section 1.3, and c) improve the fire resiliency of the vegetation type.

Among the vegetation types, fire regimes and plant adaptations are quite varied. The role that fire plays in each type however, has some common themes. For example, fire burns the vegetation and releases nutrients to the soil and air that can be recycled into new plants or used by surviving plants. Vegetative removal by burning creates space or openings that encourage the regrowth or reseeding of plants, allowing the stand to renew itself. Fire also has historically been able to *fragment*[13] the vegetation and provide for a diversity of *age classes*[14] and species. However, fires today generally burn larger areas, making the age classes more uniform in larger patches. In addition to these general benefits and consequences of periodic fire, fire plays a unique role in shaping each vegetation type, as the sections below illustrate.

The following sections describe a number of major vegetation types that are commonly found in the Sierra Nevada foothills and mountains. Choose the vegetation types that are found in your planning area and include those in this section (delete the vegetation types not found in your planning area). You will need to renumber the following sections if you delete any non-relevant vegetation types for your planning area.

4.1. Grassland

At lower elevations in the Sierra Nevada, large expanses of grassland are often interspersed with stands of chaparral and oak woodland. (At higher elevations, areas dominated by grass and grass-like plants are generally classified as wet or dry meadows. Meadows are covered in a separate section below.) Historically, perennial grasses were common. Today, however, grasslands are dominated by non-native annual grasses that arrived with the introduction of livestock grazing following European settlement; some of these species are useful as livestock forage. Other introduced grasses (e.g. ripgut brome, *Bromus diandrus*) and plants (e.g. star thistle, *Centaurea solstitialis*) are not useful as forage and have invaded many native grasslands.

4.1.1. Grassland Role of Fire

Fire in a grassland system serves to reduce the amount of accumulated dead plant material. This is important for annual grass species, as they often do not sprout well unless some of the plant material has been removed and the bare soil exposed for seed germination. Perennials generally respond well to fire, as an overabundance of thatch inhibits the spread and reproduction of these long-lived plants.

4.1.2. Grassland Fire Regime

Grassland fires tend to be of moderate intensity and burn only briefly in a given area, with a low heat output and low severity because of the limited amount of *biomass.*[15] Historically, fire size was likely highly variable, ranging from dozens to thousands of acres. Prior to European settlement and in localized areas with the absence of burning by native Californians, fire occurred every ten to thirty years and sometimes at longer intervals. Burning initiated by natives and early settlers occurred in some areas as frequently as every one to three years.

(www.landfire.gov/models_EW.php); also Rice, C. (1983). "A literature review of the fire relationship of antelope bitterbrush." In: Tiedemann, Arthur R., and Kendall L. Johnson, compilers. *Proceedings: Research and Management of Bitterbrush and Cliffrose in Western North America;* April 13–15, 1982, conference, Salt Lake City, UT. Gen. Tech. Report INT-152. (1982). (Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station), pp. 256–265.

[12] Sugihara, N.G., J. van Wagtendonk, K.E. Shaffer, J. Fites-Kaufman, and A.E. Thode, editors (2006). *Fire in California's Ecosystems.* Berkeley: University of California Press.

[13] Fragment: Used as a verb, the transformation of forests or vegetation into one or more patches of smaller size than the original area. Can also refer to one of the patches.

[14] Age Classes: The range in age of vegetation such as trees, forests, or stands; generally placed into 20-year age groups.

[15] Biomass: The total weight of living matter in a given ecosystem. May also be defined as the total weight of plant debris that can be burned as a fuel.

4.1.3. Grassland Plant Adaptations to Fire

The rapid and early seed germination of many annual grasses is well suited to a fire regime that results in most of the aboveground material being burned. Because grass fires burn quickly over an area, the heat rarely penetrates deep into the soil, leaving the seed bank viable. The rootstock and underground *rhizomes*[16] of perennial grasses often survive brief fires. These living, underground plant parts are then able to resprout quickly following the next rains.

4.1.4. Grassland Conservation and Fuel Modification Objectives

Similar to meadows, prairies, and savannahs, grasslands contribute to regional diversity and should be maintained. Of all the vegetation types, grasslands have the smallest percentage remaining today since European settlement. Grasslands have generally been plowed or developed, or they have become chaparral or woodlands. The majority of grasslands have been converted from native perennial grasses and forbs that carry shorter flame lengths, to tall annual non-native grasses that produce longer flame lengths and faster spread rates. This change increases the potential dangers of wildfire in California grasslands.

Short-term fuel-reduction objectives for managing grasslands are to manage them in early to mid summer by methods of "*weed eating,"*[17] cutting, or mowing prior to the beginning of fire season. Long-term objectives are to convert back to native grasses (from exotic annuals) through fall or spring *broadcast burning*[18] followed by native seed sowing. This is a very time-consuming task requiring meticulously scheduled seasonal activities. If grass conversion is not the focus, then careful, very temporary, selective, rotational livestock grazing can mitigate annual grass heights, reducing grassy fuels. Timing of fuel treatments is important in grasses. Selectively mow alien annuals in the spring before seed set to retain and promote native perennials, as well as to enhance fire safety. Convert annual grasses to perennials; the greater proportion of perennials, the more benign the fire effects. Perennial grasses tend to shorten the ignition season and dampen fire intensity and spread.

Fuel-reduction efforts at the edges and within neighboring woodlands and shrublands will be an important activity for fire behavior modification plans. Similar to meadows, grasslands can serve as natural fuelbreaks and fire suppression *anchor points.*[19]

4.1.5. Grassland Fuel Modification Treatment Prescription

- Mow, graze, or "weed eat" annual grasses in early to mid summer, prior to the plants going to seed. Before cutting grass, identify healthy patches of native grasses and forbs, as well as any wildlife nests, in order to protect and buffer these locations, *Discing*[20] should be avoided because it promotes alien invasive plants and surface soil erosion.
- In a large grassland area, prioritize grass cutting of 100-200 feet between grass and woodland/shrubland edges in order to create a grass fuelbreak. Where grazing is desired in a strip pattern, spread molasses in the area where grazing is to be concentrated.
- Treat fuels along edges and within neighboring woodlands or shrublands in an effort to separate grass and woody plant connections. *(See fuel treatment prescriptions below for whatever vegetation community borders the grassland.)*

[16] Rhizome: An underground stem that has the ability to send out roots and shoots. Grasses and irises are two plants that exhibit rhizomes.

[17] Weed Eater: A hand-held tool that utilizes a gas or electric motor and a rotating nylon string or metal blade to cut down vegetation.

[18] Broadcast Burning: A controlled burn, where the fire is intentionally ignited and allowed to proceed over a designated area within well-defined boundaries for the reduction of fuel hazard after logging, for site preparation before planting and/or for ecosystem restoration.

[19] Anchor Point: The point at which firefighters begin fireline construction, usually blocked from the spreading fire to protect firefighters from harm.

[20] Discing: Cultivating or roto-tilling the soil.

- Following the treatment of fuels within neighboring woodlands and shrublands, carefully consider broadcast burning in defined *strip patch*[21] portions of the grasslands. This will refresh the *seed bank*[22] of wildflowers and other plants that typically only thrive after fire. These fire-following species have an unknown length of time in which the seeds are viable; returning fire to the site provides an additional ecological benefit. (Prescribed fire experts should be consulted and hired for this activity.) Following burning, native grass seeds can be sowed into mineral-rich ashes at varied seeding rates, depending on the vitality of the seed source. When acquiring native grass seed from either a nursery or federal agency it is good to determine how old the seed is; be sure to find grass seed best suited for your specific area and elevation. Older grass seed will have less vitality than more recently harvested seed. It is best to keep grass seed stored in a cool place, preferably refrigerated or stored in a cooler at around 35°F. Successful establishment of native grass will require visual monitoring of the seeding response. Apply a variety of seeding rates in different burn locations, including both heavier (more seed spread) and lighter (less seed spread). Label these treatment areas with rebar and flagging to monitor effectiveness. Keep a journal of these details to assist future efforts. Consult local botanical experts for appropriate ratios and genetic sources.

4.2. Foothill and Montane Chaparral

Most shrub communities in the Sierra Nevada are referred to as chaparral. Chaparral often occurs on hot, dry slopes and on sites with less productive soil. Chaparral can also dominate areas where the vegetation has been recently cleared, e.g. by fire or timber harvest. Foothill chaparral occurs up to an elevation of 2,000 to 3,000 feet and includes shrubs such as toyon *(Heteromeles arbutifolia)*, white-leaf manzanita *(Arctostaphylus viscida)*, buck brush *(Ceanothus cuneatus)*, and chamise *(Adenostoma fasciculatum)*. Montane chaparral occurs at elevations above 3,000 feet and includes shrubs such as green-leaf manzanita (*Arctostaphlyus patula*), pinemat manzanita *(Ceanothus nevadensis)*, and deer brush *(Ceanothus integerrimus)*.

4.2.1. Chaparral Role of Fire

Chaparral has been described as a fire-adapted ecosystem; it benefits from fire. Some chaparral requires fire for its regeneration and to reduce competition. In the absence of fire, montane chaparral particularly tends to become a coniferous forest as tree seedlings grow up through the shrub layer. In foothill chaparral, the absence of fire can result in dense, tall stands of shrubs that have a low diversity of both shrub and herbaceous species. This situation is a high fire hazard and has less ecological value than a high diversity of younger shrubs.

4.2.2. Chaparral Fire Regime

Regardless of whether chaparral occurs in the foothill or montane regions, tall, old, mature chaparral generally produces high-intensity fires. Wildfires in chaparral communities often are stand-replacing events; fires burn sufficiently hot to consume all of the aboveground plant material.

In the past, frequent fire in chaparral communities led to *fragmentation*,[23] thereby reducing the continuity of the vegetation.[24] Generally, where plant cover is discontinuous in chaparral landscapes, fires were characterized as medium-sized, burning at varied intensities. Infrequent fire has led to dense and continuous stands of chaparral which burn in a unique pattern, and those fires that escape can lead to enormous high-intensity conflagrations. Fires in chaparral today generally are larger, less scattered, and more uniform than those in pre-settlement times.

Chaparral fires generally occur in summer and fall, depending on the dryness of the year and site. The time between episodes of fire—the fire return interval—in chaparral is highly variable, ranging from ten to more than one hundred years.

[21] Strip Patch: In prescribed burning, a narrow section or area where the fuel is burnt while the surrounding area is left untreated.

[22] Seed Bank: A repository of dormant seeds buried in the soil.

[23] Fragmentation: The transformation of forests or vegetation into one or more patches of smaller size which can occur by natural means such as fire, disease, etc., or by management practices such as timber harvesting.

[24] Biswell, Harold H. (1989). Prescribed Burning in California Wildlands, Vegetation Management. Berkeley: University of California Press, London. 255 pp.

4.2.3. Chaparral Plant Adaptations to Fire

Chaparral plant communities have developed important adaptations for fire survival and regrowth. Sprouting from the underground rootstock and the stimulation of seed germination are examples of such adaptations. Some shrub species that usually reproduce by seeds are able to resprout from rootstock after fire; these plants are called *facultative sprouters.*[25] Other shrub species either only regrow from seeds *(obligate seeders*[26]*)* or from rootstock *(obligate sprouters*[27]*).*

Herbaceous plants in chaparral, which are often "fire followers," usually only become conspicuous during initial post-fire years. The seeds of many herbaceous plants remain dormant in the soil until germination is triggered directly or indirectly by fire. Examples of fire-related stimuli include heating of seeds for a particular amount of time or to a certain temperature in order to scar the seed coat to allow germination and sunlight. Smoke can cause seed germination in some species, whereas it is lethal to other species.

4.2.4. Chaparral Conservation and Fuel Modification Objectives

Chaparral plant communities in the Sierra Nevada comprise an extremely important niche of regional biodiversity, supporting more than seventy species of native plants, providing nesting habitat for neo-tropical birds, and food for bears and other wildlife from the abundant flower and berry *crops.*[28]

Prior to the implementation of fire-suppression policies, chaparral was an abundant native plant community where stand-replacing fire was the historic natural fire regime. Because of high-intensity fire intervals of twenty to forty years in chaparral, and its common presence within *WUI*[29] communities, it is important that fuel mitigation strategies are combined with the conservation and protection of this important, under-appreciated vegetation community. Fuel reduction objectives will not only increase community wildfire protection, they will refresh the chaparral stand. Objectives are to retain and protect portions of this valuable habitat while still creatively reducing and modifying fire behavior through *mosaic thinning*[30] prescriptions. In addition to meeting fuel reduction objectives, both the retention and reduction of chaparral patches will support wildlife habitat enhancement by restoring a wide variety of plant communities to their *natural range of conditions.*[31] Reinvigorating and maintaining chaparral will be advantageous to species dependent upon this habitat.

Avoid cutting obligate-seeding chaparral species. While these plants generally have a long life in the seed bank, they will not continue to be present in the stand and produce more seeds when cut. Look around and avoid cutting species that are infrequent or unusual. If there is only one or two of a type of plant in the area, retain those specimens to maintain the present species diversity.

Mosaic or *patch-retention thinning*[32] focuses on separating *fuel continuity*[33] by incorporating fuelbreaks in strategic locations where fire-suppression efforts have a higher chance of effectiveness. Higher levels of chaparral

[25] Facultative Sprouter: A species of plant that can resprout after a fire from the rootstock, although this may not be its usual method of reproduction in the absence of fire. The ability to resprout may be dependent on the intensity of the fire.

[26] Obligate Seeder: A plant that reseeds itself after fire as a means of recovery and regeneration.

[27] Obligate Sprouter: A plant that resprouts after fires as a means of recovery and regeneration.

[28] Crop: The amount of fruits a group of plants yields in one growing season.

[29] WUI: Wildland Urban Interface, the area where wildlands and communities converge, often assumed to be at high risk of wildfire.

[30] Mosaic Thinning: A style of vegetative thinning that creates openings and patches of vegetation to increase the potential variety of habitat types.

[31] Natural Range of Conditions: The normal assortment of circumstances under which an organism or group can survive.

[32] Patch-Retention Thinning: A silvicultural thinning practice where patches of trees and vegetation are retained in a given area while other parts of the treatment area are thinned (selectively cut) at intermediate levels.

[33] Fuel Continuity: The amount of continuous fuel materials in a fire's path that allows the fire to extend in a horizontal and/or vertical direction.

reduction will be concentrated along main roads, key ridges, secondary logging roads, *spurs*,[34] and other strategic areas within treatment boundaries. This will modify fire behavior and achieve increased community safety.

On steep and mid slopes where chaparral patches can be isolated, efforts will focus on retaining *thickets*.[35] Planning treatments for chaparral reduction or retention will take into consideration fuel conditions, fuel profile areas to be created, biomass utilization potential and accessibility, as well as the direct end-result objectives for each site-specific location.

Wherever possible, use prescribed fire in chaparral to refresh the species that require fire to perpetuate. Involve agencies, consultants and/or land-owning resource managers within the community (neighbors) to help plan, prepare, and implement the burn.

For information on spacing between shrubs and shrub islands, see Figure 2, Plant Spacing Guidelines, in Background B.

4.2.5. Chaparral Fuel Modification Treatment Prescription

Treatment Preparation and Layout

Prior to beginning fuel reduction work in chaparral plant communities, it is vitally important that the treatment area is pre-designated and flagged. Since chaparral tends to be contiguous and dense, it is easy to "over cut" and greatly reduce the vegetative cover. Remembering the Conservation Principle "you can always take more, but you can't put back what you have cut" is a key guiding concept for treatments in chaparral.

Begin the *layout*[36] by selecting the strategic areas to clear chaparral and create openings. These areas are not always necessary to delineate with flagging. Select patches with a high proportion of obligate seeders to retain. Although the encroachment of pine and oak is a product of fire suppression, if trees are established and vigorous, protect some by performing the *"drip-line thinning"*[37] technique described in Background C. Continue the layout by selecting the trees to keep and clearing chaparral around them. Planning and layout of fuel treatments in chaparral prior to beginning work will ensure that portions of this diverse habitat are conserved.

Following identification of "cut areas," identify *leave-patches*.[38] These can be of varying sizes based on the site. Make leave-patches bigger at first; their size can be reduced later if needed. When selecting leave-patches, identify natural features that would benefit from retaining vegetation. For example, select leave-patches on steeper areas, or areas where there are healthy and abundant native plant groupings, wildlife habitat zones, along ravines, etc. It is important to read the landscape.

For laying out chaparral fuel treatments, determine a leave-patch color, e.g. green. Laying out a treatment in this plant community will require crawling around on hands and knees; therefore, it is best if two people work together designating the leave-patches. Patches may range in lengths between ten to thirty feet; flag in a random circumference while communicating with the flagging partner regarding what direction to move. Hang 16-inch strips of flagging every ten to fifteen feet so it is clearly visible to whoever will be treating the site later. This leave-patch flagging will identify a "no-cut, no-entry boundary" in which all of the material both dead and alive will be retained.

Thinning

- Implement mosaic thinning to reduce the abundance of some chaparral while conserving portions of this valuable habitat. Such thinning creates a diversity of habitat types beneficial to wildlife by creating islands,

[34] Spur: A road branching off the main road to provide access to a designated area.

[35] Thicket: A thick area of brush containing close-growing plants. Provides habitat to wildlife but may be difficult for humans to pass through.

[36] Layout: In this case, defining and designating forest operations for a specific location.

[37] Drip-Line Thinning: Clearing ladder fuels under the drip-line circumference of a leave tree. *See Background C for more detailed information.*

[38] Leave-Patches: Swaths or clusters of trees or other vegetation that have been selected to remain standing in an area of fuel treatment.

corridors, thickets, and open understory shrub and herbaceous communities of random shapes, sizes, and occurrences.

- In chaparral fields, patches will be created to enhance structural habitat diversity and to separate fuel continuity. Impenetrable and contiguously dense chaparral will be separated and thinned to create isolated islands, grouping fuels into clumps. Partial chaparral reduction will be created via random mosaics—or strip patches with the long axis oriented along contours—using a variety of spacing between strip patches of ten to thirty feet. Strip patches should be offset from one another so as not to lie directly up and down the slope (to lower fuel connectivity and erosion potential).
- Retain old-growth chaparral individuals by leaving surrounding chaparral intact as a support structure and leave-patch. Within many chaparral zones, old-growth, tree-form-sized manzanita will be present. Sometimes these individuals exceed thirty feet in height. When shrub removal around these trees is too heavy, they can break in half from exposure to weather events such as high winds or snow. Careful consideration should be made to protect these individual locations.
- Larger pines and oaks that have developed within the chaparral community will be *released*[39] by thinning *excessive stems*,[40] chaparral, and small trees from under *drip lines.*[41] (It's referred to as a drip line because rainfall generally drips from the leaves and branches at this point, creating a circular line around the tree.) Encroaching chaparral will be thinned back in a ten-foot radius beyond the larger pine and oak drip lines. Special emphasis on pine and oak enhancement will occur during thinning treatments. When thinning or shrub removal is conducted around sun-loving pines, thinning emphasis is placed on the south and west, because pines thrive in open forest stands with abundant sun exposure. Younger pines and oaks under eight inches *DBH*[42] should be cut to prevent increased encroachment on native chaparral.
- Clumps and groupings of trees will be retained where appropriate. Thinning will occur in a ten-foot radius beyond the drip lines of the outer clump trees. Smaller stems beyond the clumps, and in between and around tree groupings, will be thinned to fifteen by fifteen feet spacing, to break up fuel connectivity between groups of trees in an effort to maintain structural diversity. Forked trees (another element of structural diversity) will be retained for wildlife. Leave-trees will be *limbed up*[43] to ten feet from the ground.
- In locations outside chaparral leave-patches, smaller patches of *tip-sprouting*[44] shrub species (e.g. deer brush *[Ceanothus integerrimus]* and buck brush *[Ceanothus cuneatus])* can be isolated from other fuels and cut at chest level (three to four feet from the ground) for the benefit of fresh wildlife browse. To vary this treatment, some root-sprouting shrubs (e.g. oceanspray, *[Holodiscus discolor]*, mock orange *[Philadelphus lewisii]*, and California hazel *[Corylus californica]*) can be cut to the ground to encourage diversity through regeneration. Prior to implementing this treatment, research what tip-sprouting or stump-sprouting species grow on the site. Treatment ratios may vary depending on the ratio of sprouting shrubs. Mosaic treatments are recommended.
- Throughout the chaparral, areas of trees may need thinning to achieve fuel reduction goals. When thinning in tree stands—particularly conifers—a *variable density treatment*[45] approach is recommended. Mosaic thinning

[39] Release: To use thinning techniques to free a tree or group of trees from competition for nutrients, sunlight, and water by eliminating the competing small trees and shrubs.

[40] Excessive Stems: Stems (tree or shrub main trunks) in high density.

[41] Drip Line: The boundary of a tree's canopy, generally estimated by the extent of the tree's outermost limbs and the circular moisture line formed when rainfall drips from the limb tips.

[42] DBH: Diameter at Breast Height, a measurement of a tree's diameter at the level of an adult chest (approximately 4.5 feet above the ground.)

[43] Limb Up: To remove the lower branches from a woody plant to create a defined space between the forest floor and the canopy.

[44] Tip-Sprout: The ability of a shrub to resprout from a cut limb.

[45] Variable Density Treatment: Silvicultural thinning practice where some portions of a stand are left lightly or completely unthinned ("skips"), providing areas with high stem density, heavy shade, and freedom from disturbance; while other parts of the stand are heavily cut ("gaps"), including removal of some dominant trees to provide more light for subdominant trees and

pertains to areas of brush that are thinned into patches, while variable density or uneven-aged thinning is more specific to forest stands where representatives of all species and age classes will be retained throughout the treatment areas. This is done in a fashion that still meets fuel reduction objectives.

- Smaller snags, less than ten inches DBH, will be cut and left as downed wood. Larger snags will be left standing for wildlife habitat. In areas where snags are not abundant, smaller snags may also be retained.

Slash Treatment

Slash[46] accumulated from fuel treatments in chaparral will be abundant; the disposal of this material will need to be performed carefully. Regardless of what methods are used for slash treatment, it is important that a portion of the cut material be left on site and placed across the slopes of the treatment area for erosion control and soil productivity. Preferred materials for scattering on the slopes are the main chaparral trunks greater than four inches in diameter. The fine (smaller) branches are best removed. These main trunks should make contact with the ground and be left as intact as possible, four to ten feet long. Manzanita trunks are generally smaller in diameter; they can be combined by lying them along the contour of the slope, where they are placed together (either on top of or below each other) to make ground contact. Lay them as close together as possible. Within a year they will sink into the ground and be naturally anchored. By combining four to six smaller-diameter pieces you can increase their total diameter, replicating a log. Wood placement should be done randomly in openings or at the edge of leave-patches. The goal is to have coarse woody material present on the site without creating a fuel problem. This lopping and scattering of the thinned chaparral throughout the site will not significantly reduce fuel hazards, therefore the majority of the cut material will need to be chipped, utilized for biomass, or burned.

Prior to planning treatments and utilization strategies it is best to take into consideration each specific treatment location and to estimate both the ecological and economic implications of your biomass and slash disposal strategies. Slash disposal may have greater impact than the initial treatment. An example is steep areas with lengthy yarding distances. Plan slash treatments in a site-specific manner. Even within a twenty-acre property, three different slash treatment methods may be used.

Burning

Following *initial-entry*[47] chaparral fuel treatments, burning slash may be the most economical treatment option, if planned and executed properly. In areas further away from roads, burning is often the main method.

Swamper burning[48] is generally the preferred method of burning initial-treatment chaparral slash. It is a prescribed fire method in which fuels are gradually and continually added (over the course of a day) to a hand or machine pile. Pay attention to weather conditions when initiating the swamper-burning method. When possible, burn during or following rain. Chaparral fuels burn very hot and send a strong *convection column*[49] toward the surrounding leave-trees or patches. This is the preferred method to deal with chaparral slash because material can be gradually added to the pile (thereby providing more control over burn operations). Since chaparral patches contain a good mixture of dead fuels, prepare burn operations by building small ignition piles with dead materials. Stack smaller fine fuels together (mixing both dead and live). Stack half the pile two feet high then cover the pile with *slash paper.*[50] Complete the task by piling the remaining slash on top of the pile. (Use slash paper instead of plastic; it burns clean and is better for the environment. Slash paper can be purchased at forestry outfit suppliers.)

understory plants. Intermediate levels of thinning are also applied in a typical variable-density prescription. This practice is also known as “free thinning.”

[46] Slash: The wood debris left on the ground after pruning, thinning, or brushing—may include branches, bark, chips, or logs.

[47] Initial Entry: The first stage of vegetation and tree thinning performed in a fuel reduction treatment.

[48] Swamper Burning: A method of prescribed fire where fuel is added gradually and continually to a burning pile over the course of a day.

[49] Convection Column: Heat generated from a fire into a column that rises into the air at varying heights, depending on the size of the burn.

[50] Slash Paper: Paper used to cover slash piles before ignition with the intention of keeping the slash dry or allowing it to dry. Paper is more environmentally appropriate than plastic.

An effective method is to burn several piles at once, working in a rotating fashion from pile to pile. After adding slash to one pile, move to the next one, then return to the first pile where the fuels will have been consumed and it is time to add more slash. This method mitigates the convection columns, so as not to damage the remaining vegetation by scorching it.

Following burning operations, when the fires are *dead out,*[51] native grass suited to the site can be sowed into the mineral-rich ashes of the burn spots. This follow-up method will encourage herbaceous understory growth and help prevent non-native grasses from invading and taking over the site.

Broadcast burning can be conducted in chaparral stands following initial entry, when the grass is green and foliar moisture is still low (in the late fall). As with the grasslands, involve agencies, local landowners, resource managers, and private industry to plan and carry out the burn.

For more detailed instructions regarding burning, see Background C.2.1.

Chipping and Biomass Utilization

Two other ways to dispose of slash are chipping and biomass utilization. Both can be expensive, depending on the *site-specific*[52] location of your treatment area. For example, if you are working in the middle of a steep slope, far away from road access, it's likely that the most economical way to deal with slash is to burn it. The added expense of either *machine yarding*[53] materials or hand-carrying them long distances to process can be significant. In areas closest to main roads, secondary logging roads, or skid trails, the removal of biomass can be cost-effective if planned correctly. Choose areas within fifty feet of a road or landing, preferably on a downhill drag; hand-carrying upslope is extremely time-consuming and should be avoided for obvious reasons. Where material must be dragged, consider that the dragging process "sweeps" the ground of all material, particularly in the haul routes. Because hand labor is usually used on the steepest slopes, the bare earth that this sweeping produces can be a concern. There will be a tradeoff between erosion potential and future germination of local native plants. The site will need to be re-covered with chips, other small material from the site, or with commercial erosion-control products. Chips should not exceed one inch in depth along the surface. Try to limit the areas subjected to sweeping by designating a few haul routes. In general, areas that are not economically feasible for chipping and biomass utilization are usually areas where ecological impacts would increase from activities due to the difficulties of material extraction. For example, removing biomass or chipping away from roads will require an increase in ground-based machinery use in the forest where the potential of damaging soils or the residual forest stand is more likely to occur. In areas that have limited access or are located at mid-slope or on steeper locations, it can be very expensive (both ecologically and economically) to remove or chip treatment slash.

Grazing

Grazing with goats is sometimes used to reduce fire hazard and to remove weeds (since they eat them). Goats are best used in areas that do not have a large number of plants to be retained since all plants (other than large trees) will likely be damaged or killed unless protected. Grazing under contract with a large herd of goats is a possibility for larger acreages; or one to three goats can be grazed on smaller parcels. In this situation, alternate locations should be arranged for additional grazing when they have eaten all undesirable plants on the site. Goats can be placed on any steepness of slope and can generally graze any shape or size of parcel. However, care should be taken with steep slopes because goats can denude the site and cause significant erosion.

4.3. Foothill Woodland

Gray pine *(Pinus sabiniana)* and numerous species of oak such as blue oak *(Quercus douglasii),* interior live oak *(Q. wislizenii),* and black oak *(Q. kelloggii)* dominate the woodlands in the foothill zone. The oak and other tree species found in foothill woodlands often extend up into higher elevations along riparian areas. Foothill woodlands are characterized by a range of tree densities and canopy cover from very sparse (ten percent of the

[51] Dead Out: When a fire has completely burned out or been entirely extinguished.

[52] Site-Specific: A specific unit of land marked as a designated area.

[53] Yarding: A technique for moving felled trees, limbs, and brush by hauling them to the road with a cable and tractor.

area covered by tree canopy) to dense (one hundred percent cover). A variety of herbaceous plants and shrubs grow in the understory and between the trees here, such as poison oak *(Rhus diversiloba),* California buckeye *(Aesculus californica),* and toyon *(Heteromeles arbutifolia).* Grass often is co-mingled with shrubs, especially in sparse and deciduous oak stands.

4.3.1. Foothill Woodland Role of Fire

Periodic fire in foothill woodlands can reduce the competition for water and nutrients by killing shrubs and small trees found in the pine and oak understory. Periodic fire creates openings in dense stands to allow the sprouting and growth of new oaks and other tree species (e.g. gray pine).

4.3.2. Foothill Woodland Fire Regime

Historically, fires in these woodlands were frequent, usually low to moderate with occasional high-intensity areas. Woodland understory strongly influences the intensity of the burn. Those dominated by grass and herbaceous plants tend to burn less intensely than those dominated by shrubs. Historically, perennial plants dominated the herbaceous understory. Today shorter-lived annuals dominate, primarily introduced grasses. Annual grasses may promote an earlier onset to burning season because they dry and cure earlier than perennials.

Only a few studies have examined the time between foothill woodland fires. Prior to European settlement, fire return intervals ranged from 8 to 49 years. The shorter fire-return intervals were noted where site conditions were drier and warmer.

4.3.3. Foothill Woodland Plant Adaptations to Fire

Tree response to fire in the foothill woodland is varied. Bark thickness, tree structure, and sprouting response each affect the ability of a given species to resist or recover from fire. Canyon live oak and interior live oak have thin bark, and their tops are more sensitive to heat damage from fire. These live oaks, however, can vigorously resprout from their stumps following fire. Blue oak and black oak have thicker bark and hence are better able to resist the damaging effects of fire. These species also vigorously resprout from rootstock following fire. Seed stored in the soil is another source for regrowth for all oaks. Shrubs and grasses in the understory have similar adaptations as those discussed in the chaparral and grassland sections above.

4.3.4. Foothill Woodland Conservation and Fuel Modification Objectives

Oak woodlands and savannahs provide habitat for more than two hundred animal species including 35 species of insects and butterflies. Oak trees provide shade, fertile organic matter, perches for large birds, forage for larger animals, and nesting cavities that together increase wildlife diversity. Understory native plant diversity is abundant within an intact woodland ecosystem.

Objectives for fuel treatments within oak stands are to reduce excessive shrubs and encroaching smaller conifers, and in some cases to carefully and selectively thin the oaks. Oaks can be thinned when the stands are very dense, there are numerous smaller oaks crowding larger leave-trees (e.g. a larger oak or pine) and/or there are several side sprouts around a dominant stem.

Fuel reduction activities within the foothill woodland zone can be a significant proactive step not only to reduce fire hazard and increase community wildfire safety, but also to aid in the process of ecological recovery for these valuable vanishing ecosystems.

4.3.5. Foothill Woodland Fuel Modification Treatment Prescription

Understory Thinning

- Remove understory shrubs and small trees under drip lines. Prune lower branches of trees to a height of eight feet, where the canopy is dense and closed.

- In closed-canopy woodland habitats, select productive shrub habitat and understory vegetation as isolated *retention patches*[54] under multi-stemmed oaks. Diversify this mosaic thinning treatment by reducing shrubs and *thinning from below*[55] other closed-canopy areas.
- Incorporate a variety of treatments based on strategic fuel modification locations. For example, if working near a skid road that can serve as an area where firefighters can suppress fire or set a *backfire*,[56] thin the understory more thoroughly. If on a mid slope or more distant corner of the property away from roads, consider retaining more patches of multi-stemmed oaks and brush as one large clump for the benefit of wildlife habitat.

Thinning

- Consider the necessity to thin within the canopy of oak woodlands where there are many small trees or sprouts as described in 4.3.5 above. However, if the canopy is closed or nearly so, thinning may encourage undesirable understory growth, necessitating more frequent maintenance. If you decide to thin the canopy, be conservative and use the *Precautionary Principle*.[57] You can always thin more later but you can't put back what you've taken, especially where oak regeneration is problematic.
- Favored leave-trees in decreasing order of preference will be black oak, blue oak, canyon live oak, interior live oak, and gray pine. Large trees and vigorous oaks with full crowns will be the main targets to be protected, retained, and released. Release by clearing encroaching conifers, shade-tolerant species (e.g. Douglas fir and incense cedar), and shrubs from below the drip line of desired leave-trees.
- Reducing oak density will follow the removal of less desirable species and should be performed carefully. Ecological fuel treatments will typically remove twenty percent of the oaks under eight inches DBH for a given treatment area. Spacing in between oaks can vary while still effectively reducing overall fuel hazards.
- Within oak stands that have a diversity of size and age classes, select the healthiest trees to leave. Thin smaller oaks under eight inches DBH from beneath the drip line of the larger leave-trees. The practice of *mixed-structural thinning*[58] can be accomplished by a diversified treatment where clumps of oaks are retained as a group, and fuels are reduced by thinning outside these groups beyond their drip lines. This practice combines the selection of individual oaks and clumps to be released. Both groups and individual trees are retained.
- Retain as much canopy closure as possible in *ephemeral*[59] and *perennial*[60] stream gulches.
- All oak species will sprout from the stump after being cut. This can result in an even greater fuel hazard because they form multi-stemmed brush patches requiring frequent maintenance. To minimize this, focus your actions on removing dead oak sprouts and stems under five inches DBH, cutting up to twenty percent of the oak density. Portions of *stump sprouting*[61] areas from the previously cut oaks will benefit wildlife by

[54] Retention Patch: A clump of vegetation that has been isolated from contiguous fuels and retained for wildlife habitat and/or native plant species diversity.

[55] Thinning From Below: Silvicultural practice where smaller understory trees are selectively removed below overstory trees. This method is also called "low thinning."

[56] Backfire: A technique used in certain locations to direct fire spread against the wind while doing prescribed burns.

[57] Precautionary Principle: A concept that promotes a cautious approach to development and managing the environment when information is uncertain or unreliable. Erring on the side of caution and conservation is encouraged, along with a "Better safe than sorry" attitude.

[58] Mixed-Structural Thinning: Practice of selectively eliminating multi-stemmed species to achieve a variety of densities where either one stem is retained or groupings of stems are retained.

[59] Ephemeral: Meaning short duration or life, as in an ephemeral stream that only exists after a rainstorm or during the rainy season.

[60] Perennial: In reference to water, a stream that holds water year-round during a typical year. May have some flux in a drought year.

[61] Stump Sprout: The ability of a tree to resprout from its cut stump.

creating fresh nutritious browse. The over-cutting of oaks should always be avoided. Areas designated for wildlife browse should be placed under gaps in the tree canopy.

- Often closed-canopy, multi-stemmed, even-aged woodlands are diverse biological strongholds for understory plant communities. Therefore, thinning within these oak groups can be detrimental to these native plant communities. This can cause a decline in productive native vegetation, which can lead to the introduction of noxious and invasive species. In certain locations select and maintain (i.e., don't cut) the closed-woodland habitat type within the treatment area by isolating these clusters and *thinning away contiguous fuels*[62] around the outside perimeter of your chosen patch. Similar to chaparral treatments, this can be performed by encircling these locations and creating a mini fuelbreak around them.
- Maintain the important diversity created by openings and edges within woodland zones. This is where oak groves transition into grassy openings, also called *ecotone edges.*[63] As a result of fire suppression, many of these valuable openings are being closed in by the encroachment of shrubs and, to a lesser extent, conifers. Hardy shrub species will take hold and over time eliminate these valuable ecological niches. Prescriptions for these areas will be site-specific based on slope and aspect. However, aggressive vegetation reduction for these sites will both maintain them and create a natural fuelbreak. Such sites can serve as a location for *prescribed fire*[64] ignition for the long-term maintenance of fuel hazards in neighboring oak groves, as well as anchor points for fire-suppression activities.
- Considerations should be made to protect oak seedlings within a stand. Young oaks are a valuable resource for expanding the oak stand and replacing older trees. In many areas, regeneration is extremely limited due to grazing and other disturbances. As with any ecological fuel prescription, retaining a diversity of ages will support the long-term health of the stand. Maintain vertical discontinuity by reducing ladder fuels while retaining seedlings.
- Snags are not as abundant in oak woodlands as they are in conifer forests. Therefore special emphasis should be placed on retaining a diversity of age classes of standing dead oaks (snags) for wildlife habitat. *Cavities*[65] present in oak snags serve as long-term habitat for many wildlife species. Retain a diversity of snag ages and sizes during treatments. Additionally, incorporate snag creation into treatments. In those areas where snags are less abundant, cut oaks ten to fifteen feet above ground to create valuable snag habitat. Select conifers for snag creation by *girdling.*[66]
- Reduce ladder fuels by *high-pruning*[67] branches eight feet above the woodland floor. Reduce excessive ground fuels and surface fuels. Remove all dead branches smaller than three inches DBH Do not remove limbs greater than three inches DBH. Trees less than twenty-four feet high should be pruned up from the ground for one-third the total height. This treatment will reduce the possibility of fire spreading into tree crowns. In young trees, prune branches on the lower one-third of the tree. (E.g. if a tree is ten feet, prune the lower three to four feet and keep the understory plant material to less than one foot in height. As the tree grows up to twenty-four feet, it can achieve the eight-foot distance from the ground, and the understory plant material can reach two and one-half feet high.) This is possible only where high-frequency maintenance is probable.

[62] Thinning Away Contiguous Fuels: The practice of cutting back fuel loads from the edge of a desired leave-tree or patch in an effort to separate fuel connectivity.

[63] Ecotone Edge: The boundary between two or more ecosystems. The change in ecosystems may be due to elevation, soil type, disturbance, or other factors.

[64] Prescribed Fire: A forest management practice that uses fire to improve habitat or reduce hazardous fuels. A plan for the prescribed burn must be written out and approved, and specific requirements must be met before commencing burning.

[65] Cavities: Holes or openings, usually in a decayed area of a tree, where birds and animals may live.

[66] Girdling: A technique used to kill trees by cutting through the cambium and sapwood layer around the circumference of the tree. The flow of water and nutrients is broken and the tree eventually dies.

[67] High Pruning: Cutting of both dead and live branches ten to fifteen feet from the base of the tree (height to live crown). This is done on larger trees to separate the fuel connectivity from the ground to the crown of a tree.

Slash Treatment

Burning

- Follow initial entry into foothill woodland zones with a combination of swamper burning or hand pile burning, where slash is gathered into piles located in open areas and burned. *(See "Burning" in Chaparral section above, or Background C.2.1 for more details)*. Following this reduction of initial treatment slash, broadcast burning is an extremely beneficial tool for the long-term management of woodlands.
- In combination with burning, the practice of lopping and scattering slash at different locations (away from the burning) throughout the treatment area can facilitate the construction of wildlife piles. Create a wildlife pile by using slash from the fuel treatment and stacking it into a pile at a density of two per acre. Best locations for wildlife piles are within natural pits caused by tree blowdown, along *nurse logs*,[68] or at the edge of retained vegetation patches. Wildlife piles can be made of various sizes, (ranging from ankle or knee height to five feet high), keeping in mind fuel reduction objectives.
- Follow burning with the sowing of native grasses in the mineral-rich ashes and disturbed soils in order to reduce colonization by non-native species and restore herbaceous understory.

4.4. Ponderosa Pine and Mixed Conifer

Ponderosa pine and mixed-conifer forest types contain a variety of conifer species, including ponderosa pine *(Pinus ponderosa)*, incense cedar *(Calocedrus decurrens)*, white fir *(Abies concolor)*, sugar pine *(Pinus lambertiana)*, Douglas fir *(Pseudotsuga menziesii)*, black and canyon live oaks *(Q. kelloggi* and *Q. wislizenii)*, and herbaceous and shrub species intermixed. As one moves up in elevation and toward the crest of the Sierra Nevada, foothill woodland generally transitions into ponderosa pine and then into mixed-conifer forest.

4.4.1. Ponderosa Pine and Mixed Conifer Role of Fire

Fire in this forest type is particularly important for maintaining species composition. Pine species are generally *shade-intolerant*.[69] Therefore, fire that creates gaps or openings in the vegetation can support their germination and growth. With early logging practices that removed the large, fire-resistant tree species (e.g. pine), and the general exclusion of fire from Sierra Nevada forests in the last 75 to 100 years, shade-tolerant tree species (e.g. white fir) have become far more abundant, reducing pine's historic role in this ecosystem. This has often resulted in overly dense stands of trees. Some conifer species (e.g. ponderosa pine) also germinate best when there are low amounts of litter and duff; periodic fire keeps these levels low enough to support germination. Fire kills understory trees and top-kills shrubs, simplifying the structure to consist of a tree overstory with a herbaceous understory.

4.4.2. Ponderosa Pine and Mixed Conifer Fire Regime

These forest types are often characterized by a historic regime of frequent fires that were low to moderate intensity. Exceptions to this have been noted where topographic position, vegetation, and other site factors led to more severe fires. A great deal of variation in fire intensity and effect has been noted among similar sites, even within a single fire. Historically, few fires exceeded ten thousand acres in size, whereas such large fires are now more common in the Sierra Nevada.

Fire return intervals for these types range from two to forty years, with median values ranging from five to twenty years. Variability in fire return intervals is linked to the species composition of the stand and landscape location (i.e., types dominated by pine, as well as hotter and drier sites, often have shorter fire return intervals).

4.4.3. Ponderosa Pine and Mixed Conifer Plant Adaptations to Fire

Ponderosa pine is especially well adapted to periodic fire. Adaptations for seedlings include the rapid development of thick insulating bark, deep taproots, and high moisture content of living needles. Similarly,

[68] Nurse Log: A tree that has fallen, died, and started to decompose. The decaying log is rich in moisture and nutrients and provides a germination spot for plants, as well as habitat for insects.

[69] Shade Tolerant: Attribute of a species that is able to grow and mature normally in and/or prefers shaded areas.

mature trees have thick bark, deep roots, and *crown structures*[70] that are less vulnerable to flames. This pine is also more tolerant of *crown scorch*[71] than other conifer species such as incense cedar, white fir, and Douglas fir.[72] Ponderosa pine also has an effective wound response in which resin is produced to seal off any wounds that are made in the bark.

Other conifers resist fire to varying degrees depending on the thickness of their bark. The bark of mature sugar pine, Jeffrey pine, Douglas fir, and incense cedar is thick and fire-resistant. In contrast, the bark of white fir is considerably thinner and poorly protects the growing portions of the tree that are just under the bark.

4.4.4. Ponderosa Pine and Mixed Conifer Conservation and Fuel Modification Objectives

Treatment activities within ponderosa pine and mixed conifer stands will result in the reduction of tree density and volume of understory and mid-story fuels. It will also work toward the restoration of natural plant composition and structure. Recruitment of old-growth forest stands is another recommended objective for long-term fire safety and ecosystem health. One of the main objectives for the long-term maintenance and health of this forest type is the reintroduction of low- to moderate-intensity fire. Brown, Agee, and Franklin (2004) state:

> A forest that is fire-resilient has characteristics that limit fire intensity and increase the resistance of the forest to mortality. The first principle is to manage surface fuels to limit flame length…The second principle is to make it more difficult for canopy torching to occur by increasing the height to flammable crown fuels...The third principle is to decrease crown density by thinning overstory trees, making tree-to-tree crowning less probable. This will not be necessary on all sites and will be effective only if linked to the application of the first two principles.[73]

4.4.5. Ponderosa Pine and Mixed Conifer Fuel Modification Treatment Prescription

Thinning

- Treatment emphasis will focus on thinning from below in an effort to reduce and separate both vertical and horizontal fuel layer continuity.
- Canopy thinning is recommended only if the fire hazard cannot be reduced adequately through treating the surface and ladder fuels. Understory thinning is the preferred treatment.[74, 75]
- Favored trees to leave in decreasing order of preference are: black oak, sugar pine, ponderosa pine, Jeffery pine, tanoak, canyon live oak, incense cedar, Pacific madrone, Douglas fir, and white fir. Thinning treatments will focus on the retention of species diversity, making allowances for favoring species best suited for a given location.
- Create overall structural characteristics (arrangement of live and dead fuels) appropriate for restoration of the historical fire regime of frequent, low- to moderate-intensity forest *underburns.*[76] This structure includes an overstory with low fuel volumes and a sparse understory with patches of interspersed even-aged young trees, shrubs, and native perennial grasses. This structure will facilitate maintenance by future low-intensity fires by creating gaps where fuel connectivity (both horizontal and vertical) is low.

[70] Crown Structure: The structure or arrangement of the uppermost branches and foliage of a tree.

[71] Crown Scorch: When a fire or a convection column burns a portion or the entire crown of a tree.

[72] Stephens S.L., and M.A. Finney (2002). "Prescribed fire mortality of Sierra Nevada mixed conifer tree species: effects of crown damage and forest floor combustions." *Forest Ecology and Management* 162: 261–271.

[73] Brown, Richard T., James K. Agee, and Jerry Franklin (2004). "Forest Restoration and Fire: Principles in the Context of Place." *Conservation Biology* 18(4): pp. 903–912.

[74] Stephens, S.L. (1998). "Effects of fuels and silviculture treatments on potential fire behavior in mixed conifer forests of the Sierra Nevada, CA." *Forest Ecology and Management* 105: pp. 21–34.

[75] Stephens, S.L., and J.J. Moghaddas (2005a). "Experimental fuel treatment impacts on forest structure, potential fire behavior, and predicted tree mortality in a mixed conifer forest." *Forest Ecology and Management* 215: pp. 21–36.

[76] Underburn: A prescribed fire method where burning is conducted in the understory of the forest below the dominant trees.

- Pine and oak leave-trees will be released by thinning small trees and brush ten feet out from drip lines. Emphasis will be placed on thinning on the southern and western exposures because pines thrive in open forests stands with abundant sun.
- Variable density treatment is a thinning practice to create diversity in a forest stand, leaving portions of the stand unthinned, with other areas thinned more thoroughly. It can be implemented within mixed-conifer forest types by reducing both understory and crown density within the stand. Separate fuel continuity through the creation of *repeating skips and gaps*[77] of varying sizes and shapes. Treatments will emphasize the retention of randomly spaced tree groupings by identifying the largest trees for old-growth recruitment, moisture retention, and wildlife habitat. Release around the drip lines of groupings and some individual trees by thinning excessive stems, pole-sized trees, and shrubs. The objectives are to release individual trees, limit competition, reduce fuel loads around groupings (clumps) of trees, and enhance site structural diversity.[78]
- To reduce the possibility of beetle infestation, consider not cutting pines until the fall. Beetles are attracted to the scent of fresh-cut pine and could infest the stand. You can mark the pines to be cut when implementing your fuel treatments earlier in the year, then return between October to May to remove pines and their slash, as beetles tend to be dormant during this period. *See www.fire.ca.gov/rsrc-mgt_pestmanagement_socalbeetle.php for more information on beetle infestations in California.*
- In areas with no overstory, small conifer saplings and poles will be thinned to fifteen by fifteen feet between live trees. In more open, arid, savannah-type locations, pine and oak should be favored. In some openings, shrub species may be favored or complete vegetation removal may occur to create variable density.
- Retain all age and *size classes*[79] of all native species for *vertical and horizontal structural diversity*[80] throughout the landscape, but not within the same stand. However, thin around the edges of multi-canopied, vertically structured tree groupings of varying sizes to separate them from other fuels.
- Retain seedlings and saplings of favored species to replace future trees that will die.
- Retain a wide variety of age, size, and *decay classes*[81] including dead and dying vegetation, consistent with fire hazard reduction goals. Retain some deformed trees (e.g. *pistol butts,*[82] forked tops, trees with a low percentage of live crown, etc.) for genetic diversity and wildlife habitat.[83]
- Create or maintain light conditions (sun, shade, or *dappled light*[84]) that are site-specific to species currently less common to the site. Prevalence of native species tends to discourage weedy exotic or native *generalist*[85] species and favors native endangered or threatened wildlife and plants. *Sensitive species*[86] likely require very

[77] Repeating Skips and Gaps: The forest structure throughout a treatment area following a variable density treatment where some areas are retained and not thinned (skips) and other portions of the stand are heavily harvested (gaps). The range of size of the skips and gaps are from a few hundred square feet to up to an acre where site conditions dictate.

[78] Stephens, S.L., and P.Z. Fule (2005). "Western pine forests with continuing frequent fire regimes: Possible reference sites for management." *Journal of Forestry* 103(7): pp. 357–362.

[79] Size Class: The division of trees by the size of their diameter, sometimes split into three categories—seedlings, pole, and saw timber—or by diameter in inches.

[80] Vertical and Horizontal Structure Diversity: Describes the configuration of trees within a forest stand that create a variation of structure where trees stand straight up and down (vertical) or grow at an angle (horizontal).

[81] Decay Classes: Decomposing wood is categorized based on the level of decomposition, broken into five classes.

[82] Pistol Butts: Trees within a forest stand that have a crooked sweep beginning at the base of the tree, then growing straight toward the sky. A "pistol butt" tree indicates erosive soil movement on the slopes of a particular area.

[83] Stephens, S.L., and D.L. Fry, E. Franco-Vizcaino, M.M. Collins, and J.J. Moghaddas (2007). "Coarse woody debris and canopy cover in an old-growth Jeffrey pine–mixed conifer forest from the Sierra San Pedro Martir, Mexico." *Forest Ecology and Management* 240: pp. 87–95.

[84] Dappled Light: When the forest canopy has small openings where filtered sunrays project through the tree tops onto the forest floor.

[85] Generalist: A species with the ability to utilize a wide variety of resources and tolerate various environmental situations.

[86] Sensitive Species: A plant or animal species that can tolerate a small range of resources and environmental situations. These species raise concerns about population numbers and may be recognized locally as rare.

specific habitat *niches*[87] and are hence generally uncommon, rare, or threatened. Conservative species have restricted distribution on a particular site, but the site could support more individuals. Generalist species are those that are already everywhere on the site.

- Retain vegetation with evidence of wildlife use (e.g. bird or woodrat nests, burrows, cavities, and hollows, etc.). Retain *sheltered connectivity*[88] and major game trails between selected tree and vegetation patches. Retain lichen and moss species diversity, including some mistletoe-infected trees and live trees with heart rot *(conks*[89]*)*. Retain large *downed woody debris*[90] for moisture retention, *mycorrhizal*[91] inoculation sites, and wildlife habitat. Retain or create large snags for wildlife.[92]
- Leave *green islands*[93]*or patches* of tree or shrub thickets (e.g. *doghair*[94] conifer patches) for wildlife habitat. Retain an average of one patch per acre no greater than twenty by twenty feet. Protect green islands by reducing fuels around it.
- Retain as much canopy closure as possible in ephemeral and perennial stream gulches.
- Enhance productive understory shrub and herbaceous vegetation by thinning conifers to allow dappled sunlight. Retain ten to thirty percent of understory shrub cover as scattered and isolated patches.
- When thinning in scattered stands of oak and madrone clumps, thin clumps to leave the largest, healthiest stem. Those stems that you have cut will then create fresh, nutritious shoots for wildlife browse.
- Thin and/or remove *codominant*[95] white fir and Douglas fir in order to release dominant pines or oaks (possibly for *merchantable*[96] materials). If these trees cannot be economically utilized, leave them on site to serve as downed wood for wildlife habitat. Remove all material less than three inches DBH.

Slash Treatment

- Avoid any treatment that involves lop and scatter of slash under the tree canopy.
- Avoid lop and scatter of pine limbs and tops over two inches diameter so pine beetles will not enter downed, freshly cut treatment slash. It is best to avoid lop and scatter in pine sites to prevent beetle infestations. If cut materials must sit over the summer and are greater than two inches diameter, put into piles and cover with clear plastic to control beetle populations.
- Ensure surface fuels are less plentiful and more compact than before treatment. Do this by lopping into small pieces, weighing them down with larger pieces, and ensuring that all slash is in direct contact with the ground to facilitate quick decomposition. Cutting material from the mid-story and crown and placing it on the surface will increase short-term fire hazard, but reduce long-term hazards.

[87] Niches: A species or population's role and/or function within an ecosystem. Includes resource use, interactions, etc.

[88] Sheltered Connectivity: Contiguous areas within a thinning treatment that are retained for wildlife cover and to support wildlife movement.

[89] Conks: Shelf-like mushrooms that grow on trees, stumps, and downed wood. They are known for their wood-decaying characteristics.

[90] Downed Woody Debris: The remains of dead trees, branches, and various woody brush that sit on the forest floor—generally refers to trunks of trees.

[91] Mycorrhizal: The mutually beneficial relationship between plant roots and fungi "roots," AKA mycorrhizae, where the fungus receives sugar from the tree while helping the tree with water and nutrient uptake. The majority of plants depend on this relationship.

[92] Stephens et al. (2007) and Stephens, S.L., and J.J. Moghaddas (2005b). "Fuel treatment effects on snags and coarse woody debris in a Sierra Nevada mixed conifer forest." *Forest Ecology and Management* 214: pp. 53–64.

[93] Green Islands: Patches of live tree and plant communities retained within a mosaic thinning prescription.

[94] Doghair: An excessively dense stand of trees. An example is an acre with 35,000 trees, all smaller than seven inches DBH.

[95] Codominant: Species that share dominance or are of equal importance. For example, a fir-pine forest may be dominated by both firs and pines.

[96] Merchantable: Timber that is viable for sale under the current economic situation. Generally determined by the part of the stem that is suitable for timber products.

Burning

- Swamper-burn pine slash prior to spring (May through July) when possible to prevent beetle infestations.
- When cutting pine between October and May, treat fuels immediately with swamper burning.
- Always use caution when burning in pine stands. When broadcast burning, pull duff back from the base of trees approximately ten feet to prevent steaming of the roots that grow into the duff.
- Follow general chaparral and foothill woodland burning prescriptions as described above for treatment of slash in ponderosa pine and mixed conifer forests.

  For more detailed information on burning, see Background C.2.1.

4.5. Upper-Elevation Fir Forests: Red Fir and White Fir

Forests dominated by a mix of red fir (*Abies magnifica*) and white fir (*Abies concolor*) occur at elevations above the mixed conifer and pine vegetation types. Other conifer species commonly found in this type include incense cedar (*Calocedrus decurrens*), lodgepole pine (*Pinus contorta*), western white pine, sugar pine (*Pinus lambertiana*), and Jeffrey pine (*Pinus jefferyii*).

4.5.1. Upper-Elevation Fir Role of Fire

Episodes of red fir regeneration are often associated with fire events. Seedling germination and establishment is most successful on bare mineral soils resulting from low- to moderate-intensity fires. Some scientists believe that the decrease in the frequency of fire in this century may have led to a decrease in the establishment of red fir.[97]

4.5.2. Upper-Elevation Fir Fire Regime

Historically, fires in this habitat type were likely more variable both through time and across the landscape. Although lightning ignition is more common in upper elevations, fires in the red fir type do not spread as readily as in the mixed conifer and pine types. This is because litter and duff accumulate more slowly, weather conditions that support fire occur less often, natural fuelbreaks such as barren areas and rock are more prevalent, and accumulated surface fuel is more compact. Compact fuels restrict air movement and often fail to carry fire. Red fir stands tend to grow up as an intact stand and fall apart as a stand, seemingly all at once. Fewer fires historically occurred in this zone, and fire-suppression efforts were not initiated until the 1930s. Therefore, the absence of fire has had less of an effect on the vegetative structure here than on forests at lower elevations.

Fire return intervals for these forests are quite variable, ranging from five to fourteen to greater than one hundred years.

4.5.3. Upper-Elevation Fir Plant Adaptations to Fire

Red fir in particular develops thick, fire-resistant bark. Mature trees are moderately resistant to low- to medium-intensity fire.

Fire can be sporadic or uncommon here. Even in the absence of fire, red fir and white fir seeds are able to germinate in light litter, are shade-tolerant, and can grow well under tree canopies. Thus, their growth requirements are variable and can utilize an environment with more or less frequent fire.

Lodgepole pine that occurs as a component of this type has an intermediate tolerance to fire (e.g. bark not very thick, foliage is of medium to low flammability, and taproot is deep). Lodgepole pines in the Sierra Nevada also produce an abundance of seeds each year and can produce seed at an early age. Its heavy, early seed production combined with the ability to reseed openings created by fire give lodgepole a competitive advantage in reestablishing after fire, compared to other conifers found in the red and white fir vegetation types.

4.5.4. Upper-Elevation Fir Conservation and Fuel Modification Objectives

Red fir forests are a vital forest community of the upper elevations of the Sierra Nevada region, supporting habitat and food for at least one season for 169 wildlife species, including some that are threatened, rare, or

[97] Chang, C. (1996).

endangered. Goshawks, wolverines, pine martens, and great owls inhabit red fir forests. If a red fir forest contains older trees or has had little disturbance, a wildlife biologist should visit the property prior to planning fuel treatments. Fuel reduction activities can combine habitat enhancement actions to help wildlife using the area.

Treatment in red fir should be avoided if bare patches or chaparral stands are nearby as this spacing may already protect the trees. Manage to enlarge openings near red fir.

Objectives for managing fuel loads in red fir stands are to retain canopy cover and move toward older forest conditions in an effort to limit the establishment of excessive understory shrub colonization. Other fuel modification objectives include reducing excessive slash; upper-elevation events such as high winds and snow can cause forest woody debris litter. Red fir forest types are comprised of meadow systems that often have both ecological and fuel hazard conditions as a result of lodgepole pine encroachment. *See section on Montane Meadows below for additional information.*

4.5.5. Upper-Elevation Fir Fuel Modification Treatment Prescription

- Treatment objectives in red fir are to creating spacing around the stand. Therefore, treatments should be avoided if bare patches or chaparral stands are already nearby. Manage to enlarge openings near red fir.
- If thinning is necessary, favored leave-trees in decreasing order of preference are: red fir, sugar pine, Jeffrey pine, western white pine, white bark pine, white fir, lodgepole, and western juniper. Release below the immediate circumferences of drip lines by thinning shrubs and smaller trees less than eight inches DBH.
- Retain a diversity of all species throughout the site, with a special emphasis on red fir and sugar pine.
- Canopy openings within red fir forests are present due to both natural landscape features (such as naturally exposed boulder fields) and weather events that result in tree mortality caused by *windthrow.*[98] Hence, fuel reduction efforts should focus on understory thinning and maintaining as much of the canopy as possible.
- Within dense *pole-sized*[99] stands, thin red fir at an average spacing of twelve by twelve feet, while retaining a diversity of other species.
- Within shrub fields, perform mosaic thinning by retaining clump patches spaced at an average of fifteen by fifteen feet. Favor conifer seedlings and saplings within these sites.
- Retain meadow openings within red fir habitat by cutting encroaching conifers and shrubs from openings and edges.
- In moist locations such as lakes, wet meadows, and riparian areas, retain aspen. Prune dead aspen branches to reduce ladder fuels. Aspen has a tendency to create woody debris litter; reduce excessive amounts through piling and burning.
- Retain vegetation with evidence of wildlife use (e.g. bird or woodrat nests, burrows, cavities, and hollows, etc.). Retain sheltered connectivity and major game trails between selected tree and vegetation patches. Retain lichen and moss species variety, some mistletoe-infected trees, and some live trees with heart rot (conks). Retain large, downed woody debris for moisture retention and wildlife habitat. Retain or create large snags.
- Retain a wide variety of age, size, and decay classes, including dead and dying vegetation, consistent with fire hazard reduction goals. Retain some deformed, *submerchantable*[100] trees (e.g. pistol butts, forked tops, poor *live crown percentages,*[101] etc.) for genetic diversity and wildlife.

<u>Slash Treatment</u>

Follow similar slash treatment practices as described in the foothill woodland vegetation type above (Section 4.3.5).

[98] Windthrow: Trees that are uprooted by wind events. May occur in logged areas or in stands of shallow-rooted trees such as white pines. Formerly protected stands whose edges are opened up become vulnerable to this effect.

[99] Pole sized: Generally younger trees with a trunk diameter between four and eight inches.

[100] Submerchantable: Trees that cannot be sold for timber products due to disease, deformities and/or size.

[101] Live Crown Percentages: The proportion of the height of the tree on which live branches and foliage are present.

4.6. Montane Meadows

Montane meadow communities in the Sierra Nevada occur above the foothill zone and are dominated by grasses, sedges, rushes, and perennial herbs. These areas can be very small (less than one acre) or quite large (over sixty acres), but are commonly ten to twenty acres. Species found in this vegetation type include blue grass (*Poa* spp.), blue wild rye *(Elymus glaucus)*, sedges (*Carex* spp.), and bulrushes (*Scrirpus* spp.). Various perennial herbs are also found in these meadows including paintbrush (*Castilleja* spp.), alpine aster *(Aster alpingenus)*, and various clovers (*Trifolium* spp.).

4.6.1. Montane Meadow Role of Fire

A primary role of fire in meadow systems is to control conifers that may encroach the boundaries, e.g. the reduction of meadow size due to lodgepole pine encroachment. The absence of periodic fire that would limit the establishment of lodgepole pine seedlings at the edges of meadows allows the pine to grow into and in some cases fill the meadows. Changing climates over the last three decades could have affected lodgepole encroachment.

4.6.2. Montane Meadow Fire Regime

Low- to moderate-intensity fires will generally not burn through meadow and riparian communities because of their moistness. However, groundwater availability can influence the frequency and severity of fire. For instance, fires are most likely to burn though meadows of high productivity and biomass, but only during periods of prolonged drought. Fire greatly influences the dynamics of the forest-meadow boundary.

4.6.3. Montane Meadow Plant Adaptations to Fire

Plants in the meadow system are not usually subjected to fire since the systems are generally too moist to carry fire and therefore are not generally adapted to fire. The herbaceous plants present in meadows can burn when conditions are dry; *tillering*[102] is enhanced with burning; adaptations are similar to perennial grasses.

4.6.4. Montane Meadow Conservation and Fuel Modification Objectives

Meadow ecosystems of the Sierra Nevada play a critical role in the health and sustainability of watersheds as they filter and capture sediment from surrounding slopes. Meadows also provide forage for wildlife through a diversity of grasses, sedges, and rushes. An abundance of insects, rodents, and reptiles utilize meadows and in turn provide food for other wildlife.

In addition to meadows being a valuable ecosystem in the Sierra Nevada landscape, they also serve an important role as natural fuelbreaks during wildfire events, providing safety zones and anchor points for fire-suppression activities.

Ecological edges between forests and meadows contain rich diversity. Over time they have become compromised and impacted by conifer encroachment, particularly lodgepole pine that prefers wet sites. In drier meadow systems, shrub species and drought-tolerant conifers may begin to colonize these sites. Fuel reduction activities in and around meadows will contribute to community wildfire protection and assist in the ecological recovery and conservation of these valuable habitats.

Meadows that historically flooded during spring runoff prevented the establishment of lodgepole pine by saturating soils, preventing sufficient oxygen to the roots, and increasing the likelihood of root rot and early mortality. Meadow hydrology has been altered through the construction of roads and developments, causing more arid conditions on these sites; this has contributed to lodgepole having better conditions to become established. Lodgepole will completely take over historic meadows and increase fire hazards. In this situation overstory lodgepole warrants removal. It can be sensitively removed from meadows with a *one-way transport route*[103] strategy.

Focus fuel reduction efforts on re-opening meadows by removing encroaching conifers or shrubs. Certain meadows are completely closed in, therefore removal and treatment of encroaching vegetation should be planned

[102] Tillering: The process by which new aerial shoots emerge from the base of the plant.

[103] One-Way Transport Route: A hauling trail used during tree extraction activities where one entry pass is made.

as a several-entry activity so as to not shock the system. Planning these activities will be very site-specific and depend on the meadow type Is it wet, moist, or dry? This will influence fuel treatments. Removing lodgepole pine will likely increase the water table, further enlarging the meadow.

4.6.5. Montane Meadow Fuel Modification Treatment Prescription

Thinning

- In dry meadows where drought-tolerant conifers and shrubs are encroaching, cut tree species less than eight inches DBH; remove and utilize or burn.
- In wet meadows colonized by lodgepole or western juniper, cut encroaching species less than eight inches DBH. Following this initial entry, identify remaining size classes and then select other trees for removal. Remove cut trees from the meadow. Use a one-way ingress and egress transport route and remove during the driest time of the year to minimize ground disturbance. Alternatively, transport material over snow.
- Retain some groupings of aspen within meadow systems. If aspen groves are encroaching into meadow habitat, reduce fuel connectivity from meadow to forest edge. Retain larger aspens.
- Some cut logs can be left on the ground in long lengths to serve as downed wood for wildlife habitat.
- Consider retaining scattered, well-established vigorous trees within meadow systems. Some trees can be selected to create snags by girdling. If snags are present, consider retaining them.
- Along the edges—where the forest meets the meadow—continue fuel reduction efforts into the neighboring vegetation community. What forest or plant community borders the meadow will determine what type of treatment prescription will be carried out (review other vegetation type treatment prescriptions).

Slash Treatment

Follow the removal of thinned materials by either burning or chipping. Consider getting the professional expertise of prescribed fire practitioners to assist in broadcast burning meadows for the long-term enhancement of native herbaceous plant communities and management of fine fuels.

4.7. Sagebrush and Bitterbrush

Sagebrush *(Artemisia tridentata)* and bitterbrush *(Purshia tridenta)* are shrubs that occur together east of the crest of the Sierra Nevada. Some other shrubs associated with this vegetation type include bush chinquapin *(Castanopsis sempervirens),* Nevada rabbit brush *(Chrysothamnus nauseosus consimilis),* and desert mahogany *(Cercocarpus ledifolius)*. More than fifty native plants, both woody and herbaceous, are associated with the sagebrush and bitterbrush community. From the crest eastward, the ponderosa pine and Jeffrey pine forest types transition into the sagebrush steppe type as one descends in elevation. Bitterbrush is also found as an understory plant in pine forests and juniper woodlands on the east side of the Sierra Nevada.

4.7.1. Sagebrush and Bitterbrush Role of Fire

The major role of fire in this type is to create openings in the shrub stands to provide space for new plants to grow. The release of nutrients held in the litter of the sagebrush is also noted as a benefit of fire. Fire keeps the sagebrush vegetation type from changing (succeeding) into a landscape of scattered juniper.

4.7.2. Sagebrush and Bitterbrush Fire Regime

The fire intensity of this type is quite variable and depends on the amount of fuel present and other site conditions. For example, site conditions that do not support dense growth (e.g. low water abundance) tend to burn with lesser intensity. Thus, the fire return intervals noted for sagebrush–bitterbrush communities are quite variable and range from a low of fifteen years to a high of more than one hundred years.

4.7.3. Sagebrush and Bitterbrush Plant Adaptations to Fire

Sagebrush itself does not resprout from rootstock following wildfire but rather slowly reseeds into the burned area. Depending on site conditions, it may take more than twenty-five years for sagebrush to regain the level of dominance found prior to fire. Bitterbrush and some of the other shrub species associated with this vegetation

type are well suited, however, to regrowing following fire. Bitterbrush is capable of both spouting from the rootstock and reestablishing from seed. The ability to regrow from seed has been found to be particularly important in areas that were severely burned as mature plants and their rootstocks were largely destroyed. Older bitterbrush does not resprout well after fire.

4.7.4. Sagebrush and Bitterbrush Conservation and Fuel Modification Objectives

Although less diverse than westside Sierra shrublands, the eastside sagebrush vegetation type contains a blending of different plant communities that warrant conservation awareness when implementing fuel treatments. Eastside sagebrush plant communities receive less rainfall than those on the west side, beginning with the Great Basin high-desert plant community where pine forests meet juniper-pinyon woodlands. Plant and tree regeneration is slower due to minimal precipitation. When planning fuel treatments, climate conditions should be of great consideration.

Fuel modification treatments within this plant community will follow a similar prescription to montane chaparral. Activities will focus on retaining species diversity while separating shrub connectivity through the use of mosaic thinning regimes. *For further details on mosaic treatments, review the montane chaparral prescription section above.*

4.7.5. Sagebrush and Bitterbrush Fuel Modification Treatment Prescription

- In sagebrush and bitterbrush fields, separate fuel continuity by isolating patches and creating mini fuelbreaks in a circumference around the patches. These isolated patches can be of varying shapes and sizes depending on the layout of the landscape.
- In addition to separating fuels into patches, individual plants can be selected to leave while cutting in between them at an average spacing of ten to fifteen feet.
- Bitterbrush will both tip-sprout and stump-sprout; therefore, the cutting of bitterbrush can be combined with a variation of two treatment methods where half of the species is cut to the ground and the other half is cut three feet from the ground, allowing tips to sprout to create fresh wildlife browse. The percentage of this cutting variation can be adjusted depending on the location of the site and site-specific objectives.
- Retain a diversity of shrub species throughout the site, especially species that are less abundant than sagebrush or bitterbrush. Prior to fuel treatments it is important to identify the less abundant species and make allowances to retain those for plant diversity. Less abundant species can be protected by flagging them to prevent them from being cut.
- Within the sagebrush–bitterbrush community, it is recommended that curl-leaf mahogany be retained. Thin around this species to break up fuel continuity. To diversify the site, retain mahogany within a patch, then thin around the patch to separate it from heavier fuels.
- Protect locations where sagebrush blends with pinyon pine and juniper. Perform drip-line thinning around larger, desired leave-trees. Reduce juniper encroachment on sagebrush communities while still retaining larger junipers for wildlife habitat. If burning, place burn locations at safe distances to avoid scorching leave-trees.

Slash Treatment

Follow slash treatment prescriptions as described in the chaparral section above (Section 4.2.5).

Add any other information you think relevant to the vegetation types in your planning area, their fire ecology, and management.

5. [Place] Community Features

This section is designed to provide a larger context to your fire planning efforts. You can better tailor your fire-safe activities to meet your community's needs and acceptance with an understanding of the other efforts and forces at play in your region. Find examples of this type of information in your local General Plan and other such governmental documents. You will likely be able to quote those documents directly.

The Draft Yosemite West CWPP provides a good example of a simple approach to this section. *See it at: yosemitewest.org/wfa50225.htm.* Look at the various Sierra Plans listed in Instructions H to see how others have approached fire-planning efforts in the larger scheme of their community.

Another resource for this section is ESRI's Community Tapestry, a classification system for "America's neighborhoods," www.esri.com/data/community_data/community-tapestry/index.html.

5.1. Social and Political Setting

The following sections briefly explain the social and political milieu of your planning area. You can write an introductory sentence or two here if it seems appropriate.

5.1.1. Cultural Resources

How have humans used the area over time? What remains of their presence? How might this affect fire safety and fuel reduction activities? Talk to local tribal representatives for information on Native American use of fire and historical land management practices in the area. They can be a great resource to help you understand your local fire ecology.

5.1.2. Population and Demographics

What is the overall human population? How is the population distributed over your planning area? Do you get many visitors to your area? How does this affect your population, especially during high-visitor months?

See the Amador County Plan for sample text, www.amadorfiresafe.org/AFSC_Final_Report.pdf, Section 2.2, p. 8.

5.1.3. Community Legal Structure and Jurisdictional Boundaries

How many different jurisdictions are included in your planning area? List all the incorporated communities, as well as the unincorporated ones (separately). Are there any areas of conflict in terms of jurisdiction or management responsibility?

See the Draft Yosemite West CWPP for sample text: yosemitewest.org/wfa50225.htm, Section 5.4, p. 14.

5.1.4. Infrastructure

Provide a brief but thorough description of the existing infrastructure. Think of these items in terms of fire prevention and suppression, and how each will contribute to reducing wildfire risks.

Where are roads paved versus unpaved? Is driveway access for firefighters a problem in any concentrated locations? Describe the road connectivity network. Are there many dead-ends and cul-de-sacs? Are there long roads along ridgelines, or many roads that cross these to connect together?

What utilities are present and how are they prepared for catastrophic fire situations?

What communication systems exist, such as microwave or cellular phone towers, and where are they? Do they have back up power sources in case of fire?

Describe the existing water supply system. Is it adequate to provide water for a large fire during the dry season?

How many school districts are present within your planning area? Where are they generally located?

Where are the hospitals? How are they prepared for wildfire?

Are there available runways for emergency air landings?

See the Tuolumne County Fire Safe Plan for sample text, www.tuolumnefiresafe.org/fire_tuo_county_cwpp.html, p. 39.

5.2. Public, Tribal, and Industrial Lands Fire Management

For each of the following land management entities, provide a general description, fire plan summary and objectives, a summary or list of priority fuel reduction and fire prevention projects, and maps if appropriate and accessible.

See Chapter 7 of the Del Norte Fire Safe Plan for sample text, www.dnco.org/cf/topic/topic4.cfm?Topic=Del%20Norte%20Fire%20Safe%20Plan&SiteLink=100089.html.

5.2.1. Public Lands

How many different forests, parks, or other public ownerships exist, and where are they located? Include Community Service Districts, and city and county lands. You can reference the ownership table in section 1.4 here. Are any of these lands being managed for fire prevention or suppression? Summarizes those activities in this section.

5.2.1.1. USDA Forest Service: *[Place]* National Forest

Which lands are under National Forest management within your planning area? What is the extent of these areas and general land use activities? Is there a fire management plan for the area? If so, get a copy and summarize its goals here. What major activities has the agency undertaken to reduce fuels in the planning area? What projects has it proposed? Are they partnering with the local Fire Safe Council or others to reduce fuels and improve fire safety? Summarize these activities in this section. Put copies of any plans or projects in your Project File 5: Public Lands Fire Management Background Information.

5.2.1.2. USDI Bureau of Land Management: *[Place national lands]*

Which BLM lands are within your planning area? What is the extent of these areas and general land use activities? Is there a fire management plan for the area? If so, get a copy and summarize its goals in this section. What major activities has the agency undertaken to reduce fuels here? What projects has it proposed? Are they partnering with the local Fire Safe Council or others to reduce fuels and improve fire safety? Summarize these activities in this section. Put copies of any plans or projects in your Project File 5: Public Lands Fire Management Background Information.

5.2.1.3. California State Lands

Which state lands are within your planning area? What is the extent of these areas and their general land use activities? Is there a fire management plan for those lands within the planning area? If so, get a copy and summarize its goals in this section. What major activities has the agency undertaken to reduce fuels in the planning area? What projects has it proposed? Are they partnering with the local Fire Safe Council or others to reduce fuels and improve fire safety? Summarize these activities in this section. Put copies of any plans or projects in your Project File 5: Public Lands Fire Management Background Information.

5.2.2. Tribal Lands

Are there tribal lands within your planning area? If so, to which tribe do they belong? What is the extent of these areas and general land use activities? Is there a fire management plan for the area? If so, summarize its goals in this section. What major activities has the agency undertaken to reduce fuels in the planning area? What projects has it proposed? Are they partnering with the local Fire Safe Council or others to reduce fuels and improve fire safety? Summarize these activities in this section.

5.2.3. Industrial Lands

Are there industrial lands within your planning area? If so, who are the companies who own or manage them? Do they have a fire management plan for these lands? If so, summarize the goals in this section. What major activities have they undertaken to reduce fuels in the planning area? What projects have they proposed? Are they partnering with the local Fire Safe Council or others to reduce fuels and improve fire safety? Summarize these activities.

5.3. Community Planning Context

Think about your fire planning, fuel reduction, and other fire safety activities in terms of any community planning currently taking place or proposed to occur in your planning area.

Is there a Community Action Plan, General Plan, or other document guiding planning and development activities within your planning area? If so, how do these documents meet the goals identified in the Executive Summary and Appendix 1 of your fire safe plan? Are there any conflicts between the goals and proposed actions of this document and those plans? If so what are those conflicts? What possible solutions are available to resolve these planning conflicts and ensure that fire safety is incorporated into local and regional planning efforts?

What other planning processes are occurring in your community (e.g. general plan, housing plan, trails plan, etc.)? How does your fire planning process fit into those processes?

Is there a long-term community vision? If so, what is it and how does your fire planning fit into it, or not?

An interesting resource for this section is “CommunityViz … designed to help people visualize, analyze, and communicate about important land-use decisions,” www.communityviz.com/,

5.3.1. Land Use Goals and Objectives

What overall land use goals and objectives have been identified by the community for the planning area? What has been identified by public and private land managers? Are they consistent? Describe both short term and long-term objectives. For instance, are there priorities for wilderness, recreation, or a “working forest” landscape? How do these fit with the fire safety goals and actions identified in this plan? If they don’t fit, what possible solutions are there to facilitate their coalescing?

5.3.1.1. Land Use and Development Trends

What are the current trends in land use and development? Are more homes being built in the wildland and/or wildland/urban interface (WUI)? Is wildland being converted to urban use? Is there adequate water supply (for fire fighting in the dry season) for these new developments? How is the road network being redesigned (or not) to accommodate this new traffic? Where are those roads going in terms of fire safety (dead-end versus ridgeline roads, etc.)? How does this development either exacerbate the issues described above or provide solutions to those issues?

See the Amador County Plan for sample text: www.amadorfiresafe.org/AFSC_Final_Report.pdf Section 2.3, p. 9.

5.4. Community Infrastructure to Address and Implement Objectives

What social infrastructure is in place to carry out the actions identified in this plan? Is there an active Fire Safe Council, Neighborhood Emergency Response Team, homeowner's association, watershed group, or conservation organization to provide community leadership? If so, how best can this plan be integrated into their programs? If not, what community organizing can happen to ensure the plan's implementation?

6. Fire Protection Organizations

Summarize existing fire agencies by the categories identified below. You will get this information from using the survey in Instructions E with each of your local fire agencies. This document is designed to give a general overview of the state of fire protection in the planning area, especially within the context of fire safety in the WUI.

In [planning area] there are [#] local fire departments:

- [ ]
- [ ]

There are also a number of governmental fire agencies including:

- California Department of Forestry and Fire Protection, [ ] Unit, CAL FIRE
- US Forest Service, [ ]National Forest
- US Bureau of Land Management, [ ]
- [ ]

Discuss mutual aid, does it exist, does it work, are there areas not covered? Are there any areas within your planning area not provided basic fire protection? If so, identify those areas.

The following is sample text. Change this to fit your situation.

In order to ensure that fire agencies operate in an efficient and cost-effective manner, "mutual aid" and "auto aid" agreements can be established. Mutual aid means that a fire department can request the services of another nearby fire department based upon predetermined agreements to provide such services. Mutual aid agreements exist among the major governmental agencies for back-up in large or multiple-fire scenarios and for general emergencies. [All of the PLACE fire agencies have mutual aid agreements with each other.]Auto aid means that the parties of an auto aid agreement will be dispatched to respond to incidents outside their regular district or jurisdiction to assist with suppression or other emergencies. [These fire agencies] are the only entities that have an auto aid agreement (with each other). This means that they are [both/all] automatically dispatched at the same time.

There are also contracting agreements between [fire agency names]. For example, when [CAL FIRE] has to leave their station to fight a fire elsewhere in the state, they contract with [fire agency name] to provide first response in their absence.

Private lands not within one of these agencies' jurisdictions include: [name of areas]. Local and state fire crews try to provide assistance when possible.[1]

The following map shows local response area (LRA) boundaries (as defined by [CAL FIRE]), State (SRA), and Federal Response Areas (FRA). CAL FIRE is primarily responsible for wildlands in the SRA as well as structure fires that threaten wildlands. The [federal agency] is responsible for wildlands in the FRA.

Create and insert your fire protection responsibility areas map from Fire Planning and Mapping Tools. *(See Instructions D for details on how to make a map there.)*

→ Under Layers, select **Boundaries**. (Use the scroll bar to the right to see the entire list of available layers.)

→ To display the SRA layer (which shows FRA, SRA, and LRA), select the **visible** box to the left of the layer: **State Responsibility Areas (SRA05_2).**

→ Select **Refresh Map** for the map to show your specified layers.

[1] [Provide your source for this information.]

If you are able to get local response area data and fire station locations and have GIS capacity, add that information to this map. This data is sometimes available from your city or county planning department, local CAL FIRE unit, or other fire agencies.

Figure 1. [Planning Area] Local, State, and Federal Responsibility Area Map

6.1. Local Fire Agencies

For each of the following agencies, use the survey in Instructions E to get the necessary information. Contact each agency and use the survey (by phone or in person) to complete the following sections.

6.1.1. [Local Fire Agency 1]

The [Local Fire Agency 1] provides first-response fire and medical service to approximately [#] residents in their [#]-square-mile [district, coverage area, etc.] in [planning area].

[Number] local residents currently volunteer with [Local Fire Agency 1], approximately [#] of which are "active" firefighters. [Number] are paid. The [Local Fire Agency 1] has identified a need for more volunteers. The [Local Fire Agency 1] is funded primarily through [funding sources], totaling approximately $[###] annually. [Local Fire Agency 1] has [#] fire stations located throughout the [local area], as shown in the following table.

The following table shows the extent of equipment resources currently available to [Local Fire Agency 1]. [Number] of the structural engines (those used for structure fires such as homes) are more than [age] years old and [condition]. [Number] of the wildland engines (those used for wildland fires) are more than [age] years old and [condition]. They also have [summary of other equipment and condition].

Figure 1. [Local Fire Agency 1] Stations and Equipment Resources[2]

[2] This table is adopted from: Texas Forest Service, Texas A&M University, *A Guideline for Developing Community Wildfire Protection Plans*, tfsfrp.tamu.edu/_training/cwpp/assets/pdf/CWPPTemplate.pdf.

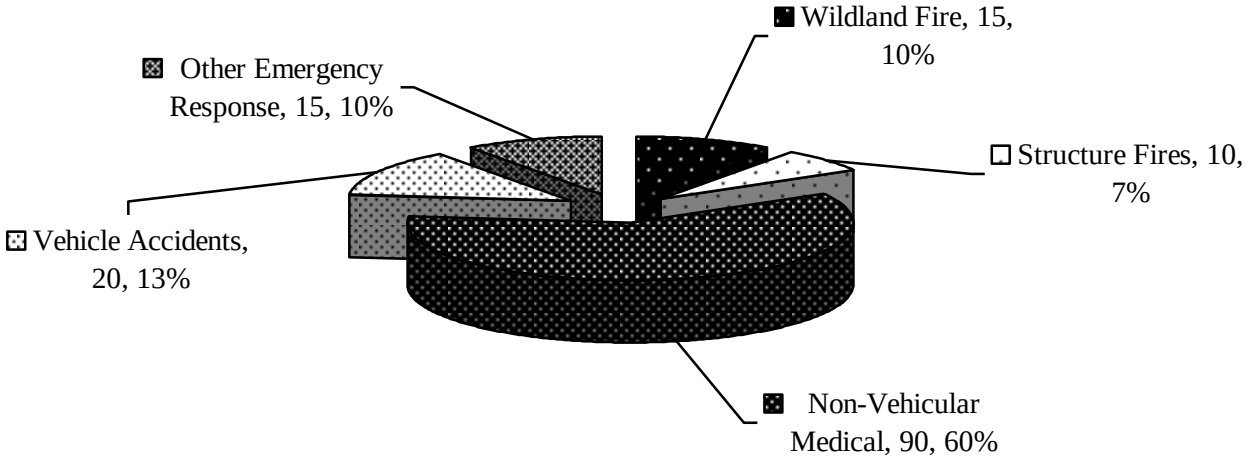
Agency Name	Station Address	Contact Name, Title, Email	Phone Numbers
Resources			
Structural Engines Type/ID/Capacity	**Wildland Engines**	**Dozers and Tractor Plows Type/ID/Capacity**	**Miscellaneous Capacity (Tankers, Tenders, Aircraft, etc.)**

The amount of time it takes first responders to arrive at a scene usually has a big impact on their ability to save a structure from fire or a person with a medical emergency. Within [planning area], [Local Fire Agency 1] can respond to incidents in the [area] within fifteen minutes. [Percent] of the [area] can be reached within ten minutes, [#]% within five minutes, and [#]% of the [area] is within a three-minute response from one of the [Local Fire Agency 1] stations or engines.

In [year], [Local Fire Agency 1] responded to a total of [#] incidents within the [planning area]. The following chart summarizes the type and frequency of incidents.

Figure 2. [Local Fire Agency 1] Number of Incidents by Type of Incident

Double-click on the following chart to open an incident table. To create your own chart, replace the numbers in the table with the numbers you received from the first local fire agency.



In addition to providing service within the [response area] area, [Local Fire Agency 1] [on occasion] will respond outside their boundaries to incidents [where]. [Local Fire Agency 1] has mutual aid agreements with [other local agencies], as well as [public agencies].

[List of identified needs (equipment, training [wildland vs structural], seasonal staffing, etc.)] have been identified as priority needs for [Local Fire Agency 1]. [Discussion of priority needs.]

6.1.2. [Local Fire Agency 2]

Copy, paste, and complete the above text for each local fire agency below.

6.2. California Department of Forestry and Fire Protection (CAL FIRE)

The California Department of Forestry and Fire Protection (CAL FIRE) provides wildland fire protection for private, industrial, county, state, [other], and municipal forest lands. CAL FIRE provides wildland fire protection to approximately [#] residents in their [###]-square-mile service area in [local Unit].

All CAL FIRE staff is paid. CAL FIRE's [Name] Battalion, located [in/near the planning area] has [#] staff members including: [#] Fire Captains, [#] Fire Prevention Captain, [#] firefighters, and [#] Battalion Chief. CAL FIRE is funded through the state. CAL FIRE's [Name] Unit headquarters is at [address]. There are [#] fire stations located within or near the [planning area], as shown in the following table.

The following table shows the extent of equipment resources currently available to CAL FIRE.

Figure 3. CAL FIRE Stations and Equipment Resources

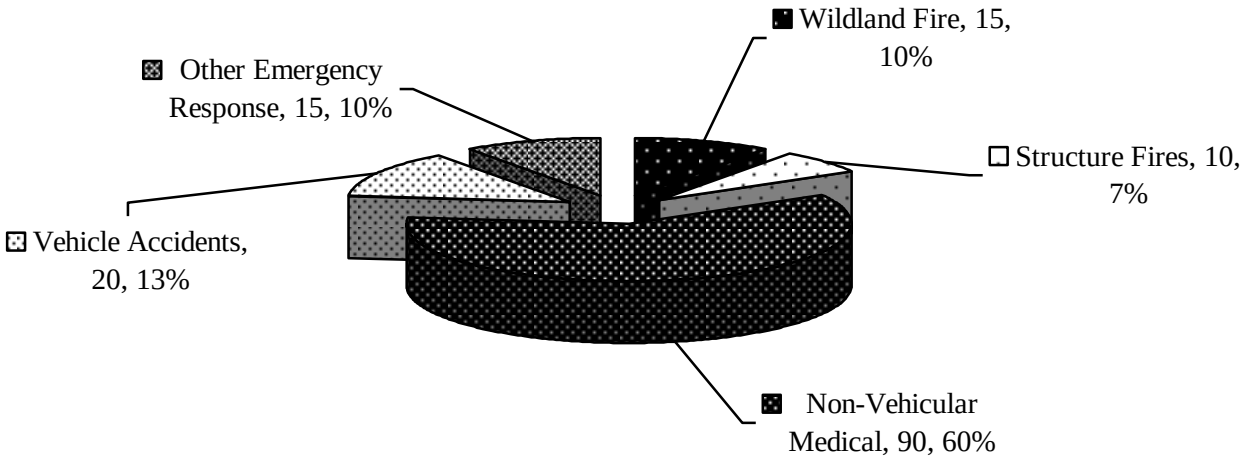
Agency Name	Station Address	Contact Name, Title, Email	Phone Numbers
Resources			
Structural Engines Type/ID/Capacity	**Wildland Engines**	**Dozers and Tractor Plows Type/ID/Capacity**	**Miscellaneous Capacity (Tankers, Tenders, Aircraft, etc.)**

In terms of response times, within [planning area], CAL FIRE can respond to approximately [#]% of its service area within fifteen minutes. [Number] percent of CAL FIRE's service area can be reached within ten minutes, [#]% within five minutes, and [#]% of their service area is within a three-minute response from one of the CAL FIRE stations or engines. This means that [amount/percentage] of CAL FIRE's service area is located more than [#] minutes away.

At times, CAL FIRE does respond to more than just wildland fires. This is primarily when a structural fire threatens wildlands, and usually during fire season. The following table summarizes the type and frequency of incidents responded to by CAL FIRE in [year].

Figure 4. CAL FIRE Number of Incidents by Type of Incident

Double-click on the following chart to open an incident table. To create your own chart, replace the numbers in the table with the numbers you received from CAL FIRE.



In addition to providing service within [planning area], CAL FIRE responds outside the area to incidents all over the state. CAL FIRE has mutual aid agreements with [agency names] and automatic aid agreements with [agency names]. They have contracts with [agency names] to provide [type of protection service].

[List of identified needs (equipment, training [wildland vs structural], seasonal staffing, etc.)] have been identified as priority needs for CAL FIRE. [Discussion of priority needs.]

6.3. Federal Fire Agencies

6.3.1. [Federal Fire Agency 1 (USFS)]

Within [planning area], the [US Forest Service (USFS)] provides wildland fire protection on [National Forest] lands and private in-holdings within the boundaries of the [Name] National Forest ([acronmyn]NF). [Acronmyn]NF's service area includes the communities of [community names]. The [acronmyn]NF provides wildland fire protection to approximately [#] residents in their [##]-square-mile service area in [planning area].

The [Unit Name] unit of the [Forest Name]NF has [#] staff members, all paid through federal government funding. [Forest Name]NF [District, Regional, etc.] offices are located at [address].

The following table shows the extent of equipment resources currently available to the local USFS.

Figure 5. [Forest Name] USFS Stations and Equipment Resources

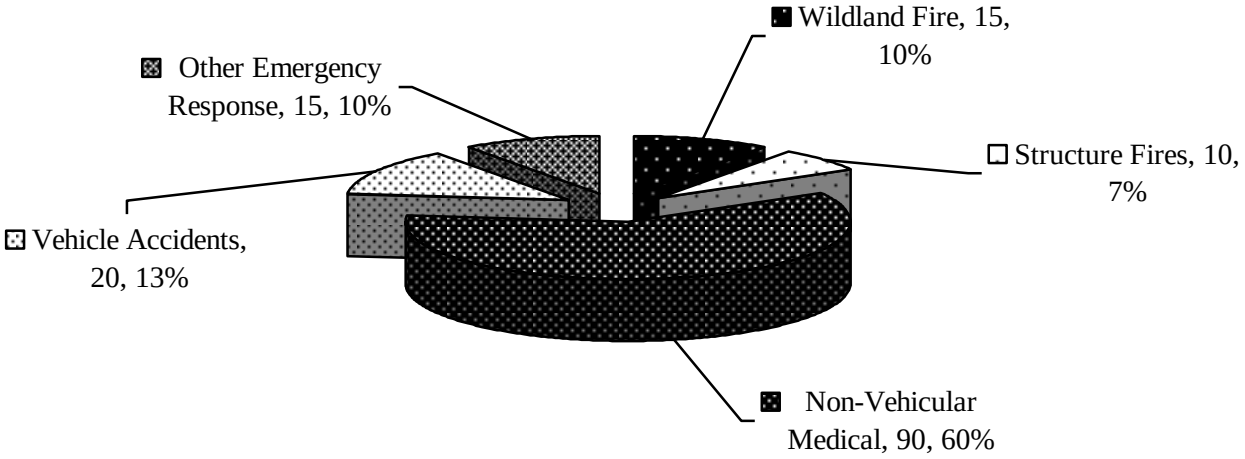
Agency Name	Station Address	Contact Name, Title, Email	Phone Numbers
Resources			
Structural Engines Type/ID/Capacity	**Wildland Engines**	**Dozers and Tractor Plows Type/ID/Capacity**	**Miscellaneous Capacity (Tankers, Tenders, Aircraft, etc.)**

In terms of response times within [planning area], #% of [ ]NF's service area can be reached within fifteen minutes, [#] within ten minutes, [#]% within five minutes, and [#]% of their service area is within a three-minute response from the [Acronym]NF station or engines. [Percentage] is greater than a fifteen-minute response.

In [year], the [Acronym]NF responded to approximately [#] incidents within their local service area. At times, the [Acronym]NF does respond to more than just wildland fires. For instance, they will respond to vehicle fires because such incidents have the potential to become wildland fires, and these vehicle fires often require medical response. The following table summarizes the type and frequency of incidents responded to by [Acronym]NF in [year].

Figure 6. [Forest Name] USFS Number of Incidents by Type of Incident

Double-click on the following chart to open an incident table. To create your own chart, replace the numbers in the table with the numbers you received from the first federal fire agency.



The [Forest Name] NF has mutual aid agreements with other federal agencies, CAL FIRE, and [agency names] (agreements, not true mutual aid). The [Forest Name]NF also is signatory to the statewide OES "California Fire Assistance Agreement" which has access to all resources that are in the "California Fire Service and Rescue Emergency Mutual Aid System."

[List of identified needs (equipment, training [wildland vs structural], seasonal staffing, etc.)] have been identified as priority needs for [Forest Name]NF. [Discussion of priority needs.]

6.3.2. [Federal Fire Agency 2]

Copy, paste, and complete the above text for each federal fire agency.

6.4. Tribal Fire Agencies

6.4.1. [Tribal Fire Agency 1]

Within [planning area], the [Tribe Agency Name] provides wildland fire protection on tribal lands and private in-holdings within the boundaries of the [Tribe]. [Type of service, first response, fire, medical, police] service area includes the communities of [community names]. The [tribe] provides wildland fire protection to approximately [#] residents in their [#]-square-mile service area in [planning area]. It has [#] staff members, all paid through [funding source] funding. [Tribal agency name] offices are located at [address].

The following table shows the extent of equipment resources currently available to [Tribe Agency Name].

Figure 7. [Tribe Agency Name] Stations and Equipment Resources

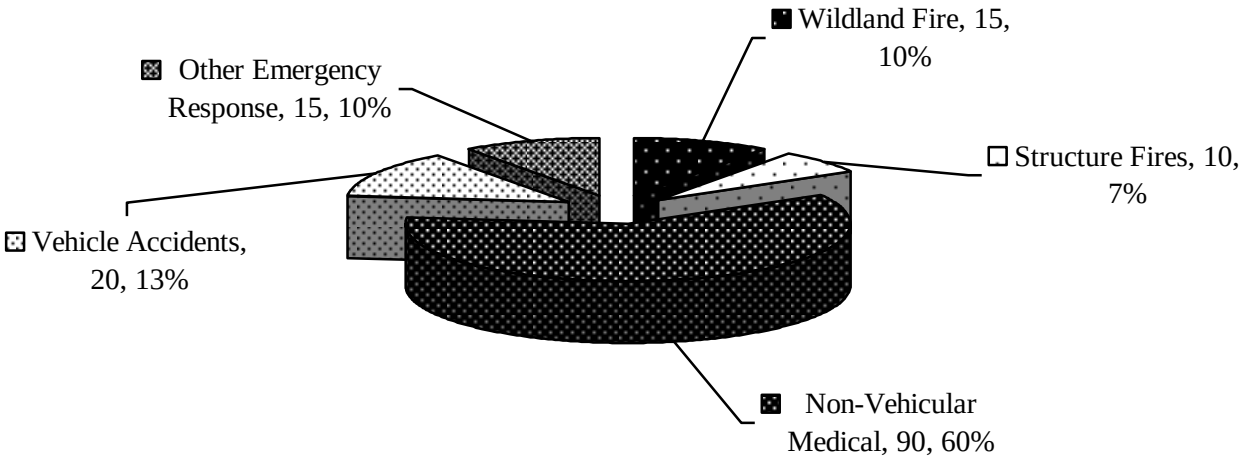
Agency Name	Station Address	Contact Name, Title, Email	Phone Numbers
Resources			
Structural Engines Type/ID/Capacity	**Wildland Engines**	**Dozers and Tractor Plows Type/ID/Capacity**	**Miscellaneous Capacity (Tankers, Tenders, Aircraft, etc.)**

In terms of response times within [planning area], [#]% of [tribe] service area can be reached within fifteen minutes, [#] within ten minutes, [#]% within five minutes, and [#]% of their service area is within a three-minute response from the [Tribal agency name] station or engines. [Percentage] is greater than a fifteen-minute response.

In [year], the [Tribal agency name] responded to approximately [#] incidents within their service area. The following table summarizes the type and frequency of incidents responded to by [Tribal agency name] in [year].

Figure 8. [Tribal agency name] Number of Incidents by Type of Incident

Double-click on the following chart to open an incident table. To create your own chart, replace the numbers in the table with the numbers you received from the first tribal fire agency.



In addition to providing service within the [name] area, the [Tribal agency name] fire agency will respond outside their boundaries to incidents [where]. [Tribal agency name] has mutual aid agreements with [other local agencies], as well as [public agencies].

[List of identified needs (equipment, training [wildland vs structural], seasonal staffing, etc.)] have been identified as priority needs for [Tribal agency name]. [Discussion of priority needs.]

6.4.2. [Tribal Fire Agency 2]

Copy, paste, and complete the above text for each tribal fire agency

7. Risk Assessment: Identifying and Evaluating Assets at Risk

A fundamental part of any fire plan is identifying what you might lose in a wildfire, known as assets or values[1] at risk. This section is for that identification and evaluation. In Appendices 4 and 5, you identified your various community assets (e.g. vegetation and infrastructure). Here you will analyze those assets and estimate which are at greatest risk from wildfire.

Introductory and background information on assets at risk is available in the California Fire Plan, Chapter 4: Assets at Risk, and Appendix C: Assets at Risk and their Role in the Fire Plan, cdfdata.fire.ca.gov/fire_er/fpp_planning_cafireplan.

7.1. Assets at Risk in [Your Planning Area]

The information you will use in the following sections is available from several sources: 1) community meetings and completed surveys for each sub-planning area (see your Project File 2); 2) Fire Planning and Mapping Tools website and the maps you have created from it throughout your plan; and 3) local CAL FIRE unit fire plan (available at cdfdata.fire.ca.gov/fire_er/fpp_planning_plans).

For an example of a simple approach to identifying and evaluating assets at risk, see Tuolumne County CWPP, p. 18, www.tuolumnefiresafe.org/fire_tuo_county_cwpp.html. For a more complex, GIS-based assessment, see the Kern River Valley Fire Safe Plan, p. 20, www.krvfiresafecouncil.com/, and the CWPP for the California Portion of the Lake Tahoe Basin, p. 10, www.trpa.org/default.aspx?tabindex=3&tabid=127.

Check out the resident survey developed by the Orleans-Somes Bar FSC to assess assets at risk in your community: www.firesafecouncil.org/ca/attachments/OSB_FSC_.doc.

7.1.1. Structures and Other Development Assets

Where are concentrations of structures? These areas tend to be valued higher both in terms of fire protection resources as well as being a potential ignition source. Where are structures located within the wildland or WUI? Which are the highest priorities to protect in case of wildfire? Which are most vulnerable to wildfire and why? Do structures have fire-resistant roofing materials? What are the ISO[2] ratings?

Where are the primary commercial and/or economic centers of your planning area? How will they be affected by wildfire? How will this affect the local economy? Which are the highest priorities to protect in case of wildfire?

Where are the principal recreation areas? How will they be adversely affected by wildfire? How will wildfire affect the local tourism economy in general? Which areas are most vulnerable to wildfire and why?

Which natural resource-based businesses and/or industries exist (e.g. timber, ranching, farming, etc.)? Where are they? How will they be positively or negatively affected by wildfire? Which areas are most vulnerable to wildfire and why?

7.1.2. Infrastructure Assets

Provide a brief but thorough description of the existing infrastructure in terms of fire prevention and suppression. See what you wrote in Appendix 5 for a summary of existing infrastructure and related issues. How will each affect or be affected by wildfire? Which are the highest priorities to protect in case of wildfire? Which are most vulnerable to wildfire and why?

What utilities are present and how are they prepared for catastrophic fire situations? What communication systems exist, such as microwave or cellular phone towers, and where are they? How many school districts are

[1] The California Fire Plan calls these "assets" at risk. Others may call them "values" at risk. They usually refer to the same.

[2] ISO. (2007). Mitigation Online. www.isomitigation.com/

present within your planning area? Where are they generally located? Where are the hospitals? Are there available runways for emergency air landings? What back-up power systems are in place or available for all of these entities in case of power loss during wildfire?

7.1.3. Cultural Assets

What are the existing cultural resources? Include Native American and post-settlement historical assets to determine how they will be affected by fire. Talk to local tribes and historical societies to understand their sense of vulnerabilities and priorities for protection from wildfire. Which are the highest priorities to protect in case of wildfire? Which are the most vulnerable to wildfire and why?

7.1.4. Natural Assets

Where are the principal ecologically sensitive areas as discussed in Appendix 4? How resilient are these areas to disturbance, both natural and man-made (i.e., how well and how quickly do they recover)? Which are the highest priorities to protect in case of wildfire? Within this section, describe specific issues regarding wildlife and their habitat, threatened or endangered plants, overall ecosystem health, and any existing primitive areas such as wilderness, parks, and Research Natural Areas. How will these be affected either positively or negatively by wildfire? Which are the highest priorities to protect in case of wildfire?

7.1.5. Conflicts between Natural Assets and Human Occupation

Identify areas where there is conflict between the natural environment and human occupation, and discuss what your community is doing to address this. For instance, lodgepole and chaparral are catastrophic fire types, and mixed conifer and ponderosa pine types tend to have frequent, recurring fire. These kinds of fire regimes may pose a greater concern regarding conflicts with nearby structures.

7.2. Assessing Risks in [the Planning Area]

There are many approaches to assessing your risks. These approaches range from simple to very complex. We've used the example of a community process below to determine and prioritize risks and projects. We've also included the California Fire Alliance tables to help provide consistency among plans. Contact Fire Alliance member organizations for more information regarding the process associated with these tables. (*See cafirealliance.org/member_agencies/ and cafirealliance.org/cwpp/ for more information.)* For examples of other community approaches to assessing risks, see Tuolumne County CWPP, p. 44, www.tuolumnefiresafe.org/fire_tuo_county_cwpp.html. See the South Fork American River assessment included in the El Dorado County CWPP for an example of a complex assessment: www.edcfiresafe.org/edc_wildfire_protection/appendix_c.htm.

7.2.1. Community-Identified Risk and Hazard Assessment Summary[3,4]

This is where you summarize the information you learned from your neighbors and other community members. Review the notes (Project File 1) and maps (Project File 2) generated from each community meeting, as well as the outreach survey responses (Project File 2), Organize the latter into the geographical planning areas you are using and include those within each planning area below.

[3] Hazards are the potential fuel that can start a fire, while risks are the potential for the fuel to ignite.

[4] These comments, risks, and hazards (and those identified for the other community planning areas) are made by meeting participants.

Summarize identified risks and hazards here. If you have organized this plan around sub-planning areas (as identified in Section 2.1), summarize each one here, and then summarize the planning area in general. If not, do this for the entire planning area. (We show the example of two planning areas below. T*o review an example of neighborhood planning areas, see the Upper Mattole Fire Plan, mattole.org/pdf/UMFP_final.pdf.)*

The following lists are perceived risks and hazards identified by residents at the specified community meeting. These features are not necessarily accepted by the [Fire Safe Council] or any Plan collaborators. They are provided here to identify community concerns.

7.2.1.1. [Planning Area1] Community-Identified Risks and Hazards

List all community/neighborhood-identified risks and hazards from your community meetings and outreach surveys here. The list below shows examples of what these might include and how much detail you need in this section.

The information listed below was generated at the [ ] community meeting, on [date]. Additionally, [#] surveys were received from residents in this planning area. Their responses are included below.

- [Junk cars on Fifth Street are a potential ignition and fuel source, surrounded by private timber.]
- [Mole Hill, entire hill is a hazard.]
- [Around homes on Salmon Road.]

7.2.1.2. [Planning Area2] Community-Identified Risks and Hazards

The information listed below was generated at the [ ] community meeting, on [date]. Additionally, [ ] surveys were received from residents in this planning area. Their responses are included below.

- [Overgrown lot on corner of 6th street.]
- [Dead end on Spruce.]
- [Limited water storage in summer and fall in Mill Creek watershed.]

7.2.2. Summarizing Risks in the [Planning Area]

Using the table below from the California Fire Alliance, summarize the assets identified in 7.1 above and their associated risks. At your community fire planning meetings, the combination of expertise in the room will guide this analysis: fire professionals (both agency representatives and volunteer firefighters) and local knowledge from residents. The difference between low, medium, and high in the table below is relative. There is no magic methodology to determine this for your community. However, you will find that the results of educated, informative community discussions will likely lead to agreement around these ratings.

To rate fuel hazard, review the information developed in Appendices 3 and 4 and your community meetings. What vegetation types are represented in each of the areas identified in your table? Where are those areas that you have identified with a high concentration of fuel? Which have the highest fuel hazards?

To rate risk of wildfire occurrence, review the maps from your community meetings. What places are identified where it was thought a fire would be most likely to start?

To rate structural ignitability, look at the areas where homes have defensible space versus those that don't. If you have information on roofing or other structural components, use that information here. You can also use the Fire Information Toolkit analysis (firecenter.berkeley.edu/toolkit/) developed by UC Berkeley.

To rate firefighting capability for each area, ask your local fire department as well as representatives from area fire-fighting agencies (e.g. CAL FIRE, USFS, etc.). Consider where there are one-way roads or transportation issues and amount of water supply available for fire fighting

Look at what you have developed for each identified community, structure, or area at risk to develop the overall risk. Once you have drafted this, take it back to your community if possible or at a minimum to your planning committee, to review it and see if it makes sense. You may need to change it a little for the final assessment.

Based on the assets at risk and community-generated information above, and the analysis done in Appendices 4, 5, and 6, the following list documents assets and associated risks.

***Figure 1. Assets and Associated Risks*[5]**

Community, Structure, or Area at Risk[6]	Fuel Hazard	Risk of Wildfire Occurrence	Structural Ignitability	Firefighting Capability	Overall Risk
[ ]	High	High	High	High	High
[ ]	High	High	High	High	High
[ ]	High	High	High	High	High
[ ]	High	High	High	High	High
[ ]	High	High	High	High	High
[ ]	High	High	High	High	High
[ ]	High	High	High	High	High
[ ]	High	High	High	High	High
[ ]	High	High	High	High	High
[ ]	High	High	High	High	High
[ ]	High	High	High	High	High
[ ]	High	High	High	High	High
[ ]	High	High	High	High	High
[ ]	High	High	High	High	High
[ ]	High	High	High	High	High
[ ]	High	High	High	High	High
[ ]	High	High	High	High	High
[ ]	High	High	High	High	High
[ ]	High	High	High	High	High
[ ]	High	High	High	High	High

7.2.3. Developing Community Priorities

The table below also comes from the California Fire Alliance. This is where the tough decisions are made in your community. Some communities choose not to do this step because they do not want to attempt to value one community or asset over another. However, we encourage you to start this conversation at your community fire meetings. Look at which projects are identified as community priorities using the community meeting (Instructions A), outreach materials (Instructions B), and mapping methodology (Instructions C) processes identified in those documents and Appendix 2. Think about project readiness; if there is a community ready to implement a project, take that into consideration in this prioritization. Remember that this list is not permanent. Plan to update it regularly, every year or whenever your resources allow it. Take the time you need to complete this assessment. Take a stab at a draft and then hold a community meeting to discuss it. Be sure to allow time for everyone to

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[5] This table comes from Step 5a of the CFA Simplified CWPP Template, p. 5, cafirealliance.org/cwpp/.

[6] From section 7.1 above.

share their concerns; a democratic process with complete community buy-in will ensure successful implementation of your plan. Give the community a minimum of one month to review this information after the meeting. The planning committee can then evaluate the comments received and finalize this list. You will get another opportunity for community input when you send your draft plan out for public comment. Be patient and compassionate with your neighbors. Building successful community consensus around fire safety priorities can be a timely process. Generally, communities that have taken the necessary time to develop agreement around priorities for action are those where there is support for implementation. This often includes residents taking the responsibility to create and maintain their defensible space, a key for any successful fire-safe community.

You can add text before this table to explain anything about it that seems appropriate. This is your plan; make it work for your community.

Figure 2. Assets, Risks, and Priorities[7]

Community, Structure, or Area at Risk[8]	Overall Risk	Community Value	Cultural Value	Overall Priority
[ ]	High	High	High	High
[ ]	High	High	High	High
[ ]	High	High	High	High
[ ]	High	High	High	High
[ ]	High	High	High	High
[ ]	High	High	High	High
[ ]	High	High	High	High
[ ]	High	High	High	High
[ ]	High	High	High	High
[ ]	High	High	High	High
[ ]	High	High	High	High
[ ]	High	High	High	High
[ ]	High	High	High	High
[ ]	High	High	High	High
[ ]	High	High	High	High
[ ]	High	High	High	High
[ ]	High	High	High	High
[ ]	High	High	High	High
[ ]	High	High	High	High

[7] This table comes from Step 5b of the CFA Simplified CWPP Template, p. 6.

[8] From Section 7.1 and Figure 1 above.

8. Meeting Your Objectives: [PLACE] Fire Safe Action Plan

8.1. Summary of Objectives

Summarize your objectives here. General objectives are listed in Section 1.8. If you identified any more specific objectives, include them here.

Objectives include minimize ignitions, decreasing wildfire intensity and damage, and increasing wildfire permeability and resiliency.

Include a summary here of overall recommendations within your approved County Fire Plan or County or City General Plan that are supported by this community fire plan. This can help generate the necessary political will to implement your projects, by showing that they are consistent with overall community goals. The following are samples from the Del Norte County General Plan that were supported by the Del Norte Fire Safe Plan, (www.dnco.org).

The following mitigation strategy and policy recommendations support the [ ] County Board of Supervisors' "Adopted Goals". Specifically, Board goals addressed are:

- [To prioritize and coordinate the grants process.]
- [Empower our community by affirming safe and healthy children, families, and individuals].
- [Identify, develop, and prioritize a long-range and short-range plan for meeting future buildings, facilities, roads, equipment, and recreational facility needs].
- [Manage County government to be more effective and efficient in the delivery of quality customer-focused services].
- [Build and improve partnerships with all public and private entities; and]
- [Do everything within our authority to ensure that the public is provided with adequate and efficient infrastructure (i.e. Transportation, Sewer, Roads, Cable, Water)].

8.2. Community-Identified Potential Projects[1]

List all community and/or neighborhood-identified projects from your community meetings here. The list below shows examples of what the projects might be and how much detail you need here. We've included two planning areas in this example. You can use only one, or add additional sections for additional planning areas, based on the information you developed in Section 2.1.

8.2.1. [Planning Area1] Community-Identified Potential Projects

The information listed below was generated at the [ ] community meeting, on [date]. Additionally, [ ] completed surveys were received from residents in this planning area. Their responses are included below.

- [Brushing back of roads in residential areas for safety and fire/emergency vehicle access.]
- [Addressing (visible signs) of residences and roads is a major issue in XX neighborhood.]
- [Protect Frank's Market as a major local economic resource, with a fuelbreak and/or water tank.]
- [Need fire hydrant on Third Street].

[1] These comments, and others identified at community meetings, are suggestions made by meeting participants. By listing them here we do not take a position on the statement. They are listed solely to demonstrate community concerns.

8.2.2. [Planning Area2] Community-Identified Potential Projects

The information listed below was generated at the [ ] community meeting, on [date]. Additionally, [ ] surveys were received from residents in this planning area. Their responses are included below.

- [Clearing along 3rd street.]
- [Education program at elementary school.]
- [Install community water tank on Moore Hill.]
- [FSC chipping program].

8.2.3. Summary of Community-Identified Priority Projects

Analyze the data generated from your fellow community members. Are there projects that were identified as a top priority by most or several community members and/or at the community meeting? If so, list those here. Summarize this information in the table below, taken from the California Fire Alliance Simplified Template. Use the information developed in Appendix 7 to populate the first column. The second column," types of fuel treatments", includes prescribed fire, mechanical treatments, hand treatments, etc. Other types of treatments could include community education, policy changes, etc. Column three, "methods of fuel treatments" are refinements of types, e.g. pile versus surface fire, thinning versus removal of surface fuels, etc. Community educational methodologies could include door-to-door canvassing, newspaper advertisements, and the like.

From the information generated and discussed above, the following actions have been identified as community priorities through the public process.

Figure 1. Community-Identified Priority Projects[2]

Community, Structure, or Area at Risk	Type of Treatment	Method of Treatment	Overall Priority

8.3. Existing Projects and Actions

Summarize here any existing projects that meet your objectives. These are often excellent building blocks for a long-term, proactive fire hazard reduction strategy. This information is likely available from each of the following entities listed in the section headings. Ask for summary information of their past, present, and future proposed projects. You can find some of this information in your County Fire Plan, in the land-management and fire-management plans of public agencies, and the local CAL FIRE unit paln. Make a separate table for each entity, and identify the entity with an opening sentence (e.g. one for the USFS projects, another for BLM projects, and another for NPS projects).The tables are designed to incorporate information from fuel treatment projects. For other types of projects, you can leave some columns empty.

8.3.1. Fire Safe Council, Homeowner's Associations, Community Organizations

The following projects were identified by [organization] as being undertaken to further the goals of this plan.

[2] The table formats used in this chapter were taken from the California Fire Alliance Simplified CWPP Template to ensure consistency among plans. CFA CWPP Simplified Template, Step 6a, p. 7, cafirealliance.org/cwpp/.

Figure 2. [Organization Name] Existing Projects[3]

Community, Structure, or Area at Risk	Project Name	Method of Treatment	Funding Needs	Acres Treated	Expected Completion Date

8.3.2. Public Lands

The following projects were identified by [agency] as being undertaken to further the goals of this plan.

Figure 3. [Agency Name] Existing Projects

Community, Structure, or Area at Risk	Project Name	Method of Treatment	Funding Needs	Acres Treated	Expected Completion Date

8.3.3. Tribal Lands

The following projects were identified by [tribe] as being undertaken to further the goals of this plan.

Figure 4. [Tribe Name] Existing Projects

Community, Structure, or Area at Risk	Project Name	Method of Treatment	Funding Needs	Acres Treated	Expected Completion Date

8.3.4. Industrial Lands

The following projects were identified by [company name] as being undertaken to further the goals of this plan.

Figure 5. [Company Name] Existing Projects

Community, Structure, or Area at Risk	Project Name	Method of Treatment	Funding Needs	Acres Treated	Expected Completion Date

[3] Adapted from CFA Simplified Template, Step 7 and USFS Six Rivers National Forest project summary table.

8.4. Proposed Actions

➢ *Action items are identified with this arrow throughout this chapter.*

8.4.1. Designation of Wildland-Urban Interface Areas

The wildland-urban interface (WUI) is a general term describing the area where homes and wildland meet. It also has a federal definition as the "line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuel as defined in the Federal Register."[4] It is within the WUI that specific federal management actions take place in order to reduce fuel risks based on guidelines established by the Healthy Forest Restoration Act (HFRA). According to HFRA, "the HFRA provides administrative procedures for hazardous-fuel-reduction projects on [USFS] and BLM lands in the WUIs of at-risk communities. The act encourages the development of Community Wildfire Protection Plans under which communities will designate their WUIs, where HFRA projects may take place."[5] At the same time, federal agencies are charged with developing WUI designations for the properties they manage.

In 2001, the Sierra Nevada Forest Plan Amendment (also known as the Framework for Conservation and Collaboration) identified two specific zones of treatment near communities, or WUI areas. The "Defense Zone" consists of a ¼-mile buffer around a community. The "Threat Zone" consists of a 1 and ¼ mile buffer beyond the Defense Zone. These buffers apply to areas adjacent to federal lands that are settled to a minimum density of one home per five acres.[6]

As per HFRA, this Plan proposes WUI designations for [planning area.]. These designations were developed combining [federal agency proposed WUI designations], Community-Identified High Risk and Hazard Areas, Community-Identified Project Areas, Community Assets, CAL FIRE's WUI designation, and issues of topography, landscape characteristics, access, fire threat designation, fire weather, etc. Projects in these designated areas should be prioritized for funding and implementation under the National Fire Plan. The following map outlines the proposed WUI designation for [planning area.]

To create your WUI designation, look at the maps and other information generated from your community meetings and planning process. Where are the proposed projects located? Where are areas of high hazard and risk? Use geographical boundaries such as ridgelines (or even roads) to make a shape that includes all of these identified features. You can use a GIS to create this map or you can make a hand map and scan it to include in this section.

Consider the following information from the California Fire Alliance's "CWPP Enhancement Guidance – Lessons Learned":

"HFRA provides communities the opportunity to designate a locally appropriate definition and boundary for the Wildland Urban Interface (WUI). The default definition is ½ to 1½ miles from the boundary of an at-risk community, depending on slope, geographic features and condition class, or an area that is adjacent to an evacuation route. HFRA includes advantages for communities that designate larger WUIs by providing

[4] *Federal Register* (January 4, 2001), Vol. 66, No. 3, pp. 751–754,"Implementation Direction for Identifying and Prioritizing Hazardous Fuel Reduction in Wildland-Urban Interface/Intermix," Region 5.

[5] Healthy Forests Initiative and Healthy Forests Restoration Act (February 2004). Interim Field Guild, Title I, Wildland-Urban Interfaces Within or Adjacent to At-Risk Communities, FS-799.

[6] Sierra Nevada Forest Plan Amendment. (January 2004). FEIS Volume 2. Chapter 3, part 3.5. "Affected Environment and Environmental Consequences." p. 276.

streamlined NEPA documentation for projects that are greater than 1½ miles from the community but within the community -designated WUI. A community-designated WUI of 1½ miles loses this advantage."[7]

See the CAL FIRE WUI map for your area to check where your WUI exists from the State's perspective: frap.cdf.ca.gov/projects/wui/. Remember, HFRA gives communities the power to designate this WUI where it makes sense to you. This plan provides you the framework to make that designation.

- *Federal agencies accept WUI designations defined in this plan, including those previously identified by CAL FIRE.*
- *Federal agencies work with [FSC] and other interested community members to reach agreement on projects proposed within WUI areas in [planning area.]*
- *[Identify other action steps here.]*

Figure 6. [Planning Area] Wildland-Urban Interface Designation Map

8.4.2. Designation of Communities at Risk

Contact your local CAL FIRE unit for assistance in adding communities to the Communities at Risk list. *See cafirealliance.org/communities_at_risk/ for more information.*

Most eligible communities have already been designated as a Community at Risk, either by federal or state designation. The California Fire Alliance has a process to add new communities to this list.

[7] California Fire Alliance, CWPP Enhancement Guidance – Lessons Learned!, p. 1, www.cafirealliance.org/cwpp/downloads/cwpp_lessons_learned2.pdf.

- *CAL FIRE and California Fire Alliance add [Community Name] to Communities at Risk list.*

8.4.3. Defensible Space

"Defensible Space" is a fundamental concept to impart to local residents reading your plan. The basic concept is to reduce the amount of flammable materials surrounding structures so that they are *defensible* by firefighters during a wildfire. Summarize the defensible-space projects identified through this process as priorities. List any "Target Areas" you have identified through this process, localized areas where hazards and risks are especially high and in need of defensible space.

Through this process, several areas in [planning area] have been identified as being either especially hazardous, with high fire risk, or both. It makes sense to focus enforcement of existing regulations in these Target Areas *(see below)* as well as to place stricter regulations on any new developments there.

The following statement from the California Attorney General's office provides the legal framework for local governments to take action to ensure local fire safety:

> The Legislature of the State of California hereby finds and declares that the unrestricted use of grass-, grain-, brush-, or forest-covered land within the State is a potential menace to life and property from fire and resulting erosion…. Counties, cities and counties, cities, and districts may adopt ordinances, rules, or regulations to provide fire prevention hazard conditions.[8]

Target Areas in [Planning Area] for Defensible Space, Fire Safe Construction, and Alternate Access Programs:

- [Local Area Name]
- [Local Area Name]
- [Local Area Name]
- [Local Area Name]

- *Focus fire safety efforts in the Target Areas listed above, including defensible space, fir -resistant building, and providing for alternate access routes.*
- *[Identify other action steps here.]*

8.4.3.1. Defensible Space in New Developments

If your community is experiencing development pressure, address that here. If not, delete this section.

Development pressures are increasing in [planning area]. This can be seen especially in the interface between wildlands and residential areas. The [ ] area has examples of development that do not meet adequate fire safety standards.

As more lands are being developed, the risk to existing homes generally increases. The [local government] has a responsibility to current residents to minimize the impact on them from future development. One way to do this is to ensure that all new development adheres to accepted fire safety standards.

- *[Local government] explore options to mandate and enforce fire safe standards for new developments.*

8.4.4. Fuel Reduction

The following are more "Lessons Learned" from the California Fire Alliance regarding successful CWPPs in California:

"**Include Federal Projects**

[8] Office of State Fire Marshal, Fire Hazard Zoning Guide, Appendix D, osfm.fire.ca.gov/pdf/fireengineering/zoning/AppendixD.pdf

"One of the purposes of HFRA is 'to reduce wildfire risk to communities, municipal water supplies, and other at-risk Federal land through a collaborative process of planning, prioritizing, and implementing hazardous fuel reduction projects'….. Accordingly, HFRA provides for meaningful community participation in federal project planning through the opportunity to recommend projects on federal lands. When Federal agencies implement the community recommendations, the NEPA process is streamlined, reducing planning time and expenses. An easy method to realize this benefit is to consider all federal projects near a community that are in some stage of planning development. Considering planned federal projects also helps meet the requirement to consult with Federal land management agencies. The community may recommend changes to the scope of the projects or method of treatments. Communities may also recommend additional projects. The greatest benefit will be for those projects that NEPA has not yet begun."[9]

"**Include Projects outside the WUI**

"Another purpose of HFRA is 'to enhance efforts to protect watersheds and address threats to forest and rangeland health, including catastrophic wildfire, across the landscape.' Just as projects within a WUI, CWPPs provide meaningful community participation in developing recommendations for private and federal projects outside the WUI. Private and Federal land managers also receive similar (but reduced) benefits to implementing the community recommendations as they do with projects within the WUI." [10]

Reducing hazardous fuel is a challenge for most communities in the western United States. The amount of accumulated fuel is far greater than most communities can afford to handle, hence the need to prioritize projects. The research is still unclear regarding the most effective and efficient way to reduce fuel without compromising ecosystem health. Research by Mark Finney at the Fire Science Lab[11] challenges current theories in landscape-level fuel treatments and models strategic locations for fuel reduction treatments. That said, it is generally agreed that such treatments should be focused first around communities in the wildland-urban interface. Many residential areas in [planning area] qualify for such treatments, and thus were identified at the community meetings and are listed in this document.

Fuel reduction treatments need to begin within the Wildland Fuel Reduction Zone (see Background C). Beyond this, strategic locations around neighborhoods and communities should be identified and prioritized for creating shaded fuelbreaks. "Fuelbreaks are never designed to stop fires but to allow suppression forces a higher probability of successfully attacking a wildfire."[12] The combination of home construction modifications with effective defensible space and shaded fuelbreaks around communities is one of the best-known strategies to protect communities from wildfire.

There is no "one size fits all" prescription for shaded fuelbreaks. For example, the width can vary widely, ranging from 50 to 300 feet. "A shaded fuelbreak is created by altering surface fuel, increasing the height to the base of the live crown, and opening the canopy by removing trees."[13] Sample prescriptions are described in Background C. In addition to initial implementation, maintenance of fuelbreaks is often costly. Maintaining the shade helps to reduce these costs by slowing regeneration.

"Manual treatment is very expensive, and mechanical treatment is only feasible on gentle terrain. Prescribed fire can be effective (Schimke and Green, 1970) but there is potential for fire escape along the edges. Late winter burns, where the previous year's production is cured, the perennials have not yet greened up, and the adjacent forest is not very flammable, may be a possible cost-effective treatment to avoid risk of escape from maintenance burns and achieve effective maintenance at low cost."[14]

[9] CFA, "Lessons Learned," p. 1.

[10] CFA, "Lessons Learned," p. 1.

[11] www.firelab.org/index.php?option=com_content&task=view&id=43&Itemid=82, outreach.cof.orst.edu/resilientfire/finney.htm

[12] Agee, J.K.et al. (2000). "The Use of Shaded Fuelbreaks in Landscape Fire Management." *Forest Ecology and Management* 127: pp. 55–66.

[13] Agee et al. (2000). p. 56.

[14] Agee et al. (2000). p. 60.

A program should be developed in conjunction with CAL FIRE [and other agencies] to regularly burn shaded fuelbreaks where they are not in immediate proximity to residential development. This could be done in cooperation with local tribes, who have centuries of burning experience. To most effectively maintain fuelbreaks throughout the [planning area], an "Adopt a Fuelbreak" program could be developed by the [FSC] in cooperation with community or neighborhood groups, homeowner's associations, and others whereby each group would be responsible for ongoing maintenance of their adopted fuelbreak. This should be done in cooperation with experienced fire professionals to ensure participant safety and fuelbreak effectiveness.

- *[FSC] develop an "Adopt a Fuelbreak" program for maintenance of fuelbreaks. Work with CAL FIRE, tribes, and other fire professionals to employ prescribed fire techniques where appropriate.*

The following list includes the shaded fuelbreaks and other fuel-reduction projects that were prioritized for implementation in [planning area]. These projects were generally identified at a community meeting, or otherwise resulted from this planning process. Projects were prioritized based on [describe your process here, e.g. CDF fire threat level and assets at risk], with an emphasis on human population centers.

- *[FSC] work with appropriate agency and community partners to fund and implement the following identified strategic fuelbreaks and fuel reduction efforts throughout [planning area].*

Use the following table to list priority fuel reduction projects identified at your community meetings and as a result of your planning committee's analysis.

Figure 7. Proposed Fuel Reduction Projects

Community, Structure, or Area at Risk	Project	Treatment	Acres	Agency/ Landowner	Time Table
					2006
					2006
					2006
					2006
					2006
					2006
					2006
					2006
					2006

8.4.5. Reducing Structural Ignitability

Reducing the chance that structures (our homes, businesses, etc.) will burn is an important component of any fire safety action plan. The following sections identify specific actions that will be taken to reduce structural ignitability.

8.4.5.1. WUI Building Standards

Become familiar with the new California Wildland-Urban Interface Building standards: osfm.fire.ca.gov/WUIBS.html.

Local government officials should become familiar with the WUI building standards if they are not already and identify specific steps to implement these throughout the planning area.

- *[Plan partners] educate decision-makers and residents on the WUI standards.*
- *[Plan partners] work with local government to get current WUI standards adopted for the planning area.*

8.4.5.2. **Roofing**

Efforts should be made to eliminate all untreated wood shake roofs. Shake roofs are a leading cause of home loss in wildfires. Research shows that homes with a non-combustible roof and clearance of at least 30 to 60 feet have an 85-95% chance of survival in a wildfire.[15]

- *[Plan partners] educate residents on the importance of replacing wood shake roofs.*
- *[Plan partners] explore incentives for homeowners to replace wood shake roofs.*

8.4.5.3. **Vent Openings**

Provided that adequate defensible space is maintained, screening of vent openings with ¼" mesh corrosion-resistant steel screens will minimize the entry of embers (during the ember blizzard that comes with a wildfire) into attics (most important) and crawl spaces.

- *[Plan partners] educate residents on importance of steel vent screening.*
- *[Plan partners] explore incentives for homeowners to encourage steel screening of vent openings.*

8.4.5.4. **Windows**

Double-pane windows are far more effective in their ability to survive a wildfire, as well as being smart for energy conservation within your home.

- *[Plan partners] educate residents on need to have double-paned windows throughout their homes.*
- *[Plan partners] explore existing incentive programs to upgrade windows to double pane, such as through local energy companies.*

8.4.5.5. **Decks**

Provided that adequate defensible space is maintained, most solid wood decking is fire-resistant enough to withstand short-term heat load. The next greatest threat from decks is firefighter safety. Many new materials (synthetics) ignite more easily than wood and have a rapid structural collapse when subjected to high heat loads, creating a situation where firefighters could fall through.[16]

- *[Plan partners] educate residents on importance of fire-safe decking.*

8.4.5.6. **Outbuildings**

Outbuildings (e.g. storage, wood, and tool sheds) with less than thirty feet of separation from main structures place homes at a high risk of loss, because if they catch fire, they can more easily catch the house on fire.

- *[Plan partners] educate residents on need for separation of heat loads from their residence.*
- *[Local government, fire departments] and CAL FIRE enforce clearing 30-100 feet around structures, as per State law.*

8.4.5.7. **Wood Piles**

Wood piles with less than thirty feet of separation from structures often place homes at a high risk for loss.

[15] Foote, Ethan. (August 2004). "Wildland-Urban Interface Ignition-Resistant Building Construction Recommendations." Community Wildfire Protection Plan Workshops. California Fire Alliance and the California Fire Safe Council.

[16] Further information on this available through the California State Fire Marshal's Building Materials Listing,. osfm.fire.ca.gov/bmllisting.html.

- *[Plan partners] educate residents on need to have a minimum of thirty feet separation of firewood piles and woodsheds from their residence.*

8.4.5.8. Propane Tanks

Tanks with less than ten feet of clearance around them and thirty feet of separation from houses may place homes at a risk of loss.

- *[Plan partners] educate residents on need to have vegetative and flammable material clearance around propane tanks near their residence.*
- *[Plan partners] educate residents on need to keep propane tanks and other flammable materials at least thirty feet from homes and outbuildings.*

8.4.6. Utilization

What steps can you take to ensure that any forest products removed from your fuel reduction efforts are utilized to the maximum extent possible? This is an excellent way to help offset the costs of forest management. Options include biomass, compost, small-diameter lumber, artisan wood products, florals, etc.

Are there any projects proposed to remove forest thinnings, brush piles and/or grass piles? A community chipper day is an example of such a project.

Do you have any projects to inform residents of safety requirements for burn piles?

Is there potential for biomass facilities in your community? Explore possible product quantities for supporting a biomass facility. Look at your fuel type and overlay a forest prescription to estimate the potential amount of biomass volume. Biomass facilities can be developed on a small-scale to be locally appropriate and sustainable, while protecting the forest.

The following is another CFA Lesson Learned:

"**Include Revenue -Generating Projects**

"The CWPP provision is designed to coordinate efforts to reduce fire risk among all landowners. Some CWPPs have included only projects that require grant funding, which limits the opportunity for a coordinated approach to fire risk reduction. It also limits the opportunity for community members to recommend a community fuel reduction strategy and expedited implementation of federal and private projects."[17]

8.4.6.1. Small-Diameter Wood Products

- *[FSC], CAL FIRE, [public agencies], timber industry, and economic development community work with local wood processing and manufacturing businesses to develop markets for small-diameter wood products.*

8.4.6.2. Biomass

List any identified biomass projects. For information on USFS research to support biomass projects, see www.fs.fed.us/psw/biomass2energy/overview.shtml.

- *[Plan partners] research existing regional biomass facilities and initiatives for possible models to implement in the planning area.*

8.4.7. Fire Protection

This section includes programs to support existing fire protection services such as equipment and training, as well as community water supply, evacuation, and neighborhood emergency preparedness. List prioritized projects from Section 8.2 above.

[17] CFA, "Lessons Learned," p. 2.

Are there any proposed projects to install tanks for fire-suppression water storage? Are there any projects to help residents acquire National Hose (NH) Thread and fire hose?

Do you have any projects to widen or improve road conditions to allow unimpeded access by firefighters?

8.4.7.1. Signage of Roads and Structures (Addressing)

Throughout [planning area], firefighters and other emergency personnel are faced with the challenge of finding homes quickly and safely during an emergency. At a minimum, existing [County] standards that require streets and homes to be visibly addressed must be enforced. This enforcement action needs to be explored creatively.

- *Law Enforcement, Fire Departments, CAL FIRE, [federal agencies], and [local government] collaborate to enforce existing signage requirements for streets and residences.*
- *Fire Departments, Law Enforcement, CAL FIRE, [federal agencies], [FSC], and [local government] explore incentives for private signage conformance, including public education.*

8.4.7.2. Water

Water is critical for successful fire suppression. Minimum fire-fighting water requirements for developments not on a hydrant system are 2,500 gallons.

- *Encourage RAC[18]-funded program to place water storage tanks on lands adjacent to federal lands.*
- *[Plan partners] explore funding for a water storage tank program on private lands not adjacent to federal lands.*
- *County Assessor do not increase property values and taxes when water storage is added to private properties for fire protection..*
- *[FSC], [local government], Fire Chiefs, and CAL FIRE explore incentives for increasing water storage on private properties.*

8.4.7.3. Fire Atlas

A fire atlas is an option if you have a GIS system and collected this data at your community meetings. If not, delete this section.

A firefighter's map book or Fire Atlas can be developed with this Fire Plan through the geographic information system (GIS) used to create these maps. The Atlas will provide both local and out-of-area firefighters and other emergency responders detailed maps of all residential areas in [planning area], as well as information on water sources, and other fire-fighting resources.

- *[Plan partners] and law enforcement create and update [planning area] Fire Atlas.*

8.4.7.4. Evacuation Planning

A preliminary description of evacuation routes is contained in each community planning area map in Project File 2. However, a more detailed [planning area] evacuation plan is needed for all emergencies.

[18] RAC is the Resource Advisory Committee. Most National Forests have an appointed RAC. Contact your local Forest Service for more information.

- *[Local government] work with Law Enforcement, [FSC], CAL FIRE, [federal agencies], and Fire Chiefs to update (where necessary) and educate residents on evacuation options for their community.*
- *[Local government], Law Enforcement, Fire Chiefs, CAL FIRE, [federal agencies], and [FSC] explore development of alternate evacuation routes.*
- *Residents in remote areas must be prepared for evacuation. To this end, they should create a Family Disaster and Evacuation Plan (See the American Red Cross at: www.redcross.org/services/disaster/0,1082,0_601_,00.html for how to do family disaster planning, or visit www.redcross.org/services/disaster/0,1082,0_6_,00.html for how to create an evacuation plan). Additionally, residents in remote, rural Target Areas (see 8.4.3) should consider storing their most valuable items in [nearby urban area] during extreme fire weather conditions.*

In terms of evacuation, gates can pose a serious obstacle. Automatic gates that do not open during power outages are especially dangerous.

- *Law Enforcement, Fire Chiefs, CAL FIRE, [federal agencies], and [FSC] initiate informational programs to educate residents about the importance of easily passable gates during emergencies.*
- *County, Law Enforcement, Fire Chiefs, CAL FIRE, [federal agencies], and [FSC] explore incentives for fire-safe gates.*

Finally, are pet and livestock owners in the plan area prepared for emergencies and evacuation? Note that most shelters will not allow animals other than seeing-eye dogs. Are there locations for sheltering evacuated animals such as local fairgrounds? *See www.redcross.org/services/disaster/beprepared/animalsafety.html for more information.*

- *[Plan partners] identify existing options for local pet and livestock emergency evacuation. Work through local feed stores, veterinarians, boarding facilities, and animal associations to educate residents on options.*

8.4.7.5. Neighborhood Emergency Response Teams and Community Communication

Discuss whether such an organization exists within your planning area, and if so, describe it. Make specific suggestions for how neighborhoods can organize themselves and/or how this can be accomplished on a larger scale. Talk to your local Office of Emergency Services regarding assistance for establishing a neighborhood or community team. You can find information on starting a Community Emergency Response Team or CERT at: www.citizencorps.gov/cert/.

Do you have a local phone tree or other way to spread information quickly? What systems are in place for emergency communication, assuming phone lines are down and cellular service is jammed? Are there CB and/or HAM radio operators in your communities?

A neighborhood or community emergency response team is a pre-planned group of people who will coordinate local efforts during an emergency. Responsibilities can include communication to agencies and outside entities, ensuring individual safety, delivery of first aid, or food and water services.

- *[Plan partners] explore establishment of Neighborhood/Community Emergency Response Teams.*
- *[Plan partners]research existing alternative emergency communication options and educate community about those available.*
- *[Plan partners] provide a list of recommended personal protective equipment and firefighting tools to have available for home and neighborhood defense, including pumps for drafting out of swimming pools, standpipes, and fire hose adapters.*

8.4.8. Education

Educating residents about wildfire issues is one of the most effective ways to reduce fire hazards, whether that be in K-12 schools, via use of road signs, or programs designed for adults. Describe any educational projects you are proposing, including the target audience, and how you hope to effectively educate them.

Many people are happy to create a fire-safe home if they understand why it is to their advantage. To this end, educational programs targeted at local residents are very successful.

- *[FSC] work with CAL FIRE, [federal agencies], [local government], insurance industry, and others to implement a countywide community fire safety education program, including Public Service Annoucements in all local media.*

Educational programs in the local schools are a great way to get the word out about fire safety and emergency preparedness. Several curricula exist and likely would only need minimal adjustments to be used in [planning area]. Community projects such as fire safety education signs created by schoolchildren can be very effective. Informative signs could be created by local children and placed in high fire risk and hazard areas throughout the community.

- *[FSC] work with agencies and School District to implement fire safety curricula in all grade levels throughout the [planning area], in conjunction with community educational projects.*
- *[FSC] work with insurance industry to fund and develop a service learning program in local high schools focused on fire safety and defensible space.*

Trinity County Fire Safe Council has developed a "Big Red Truck Program." In this program they take a fire truck to homes as part of a defensible space assessment. This is a very graphic and effective way to show homeowners whether or not their home could be defended in a fire by first seeing if the truck can even safely make it to their home. This has also been a fundraiser for local fire departments, as they get paid for each assessment. A similar program in [planning area] could be developed. It would be necessary to structure this with a set schedule to allow fire department volunteers to participate.

- *[FSC] work with Fire Chiefs to institute a "Big Red Truck Program" for defensible space education and assessments. Explore state and federal funding options for the program.*

As stated elsewhere, development and real estate are healthy industries in [planning area]. Through those ventures, new people are moving to [planning area], many of them from urban areas. These new residents often do not have experience with fire in a wildland-urban interface. Educational programs are needed targeting both the development and real estate industries, as well as their clients.

- *[FSC], CAL FIRE, [federal agencies], Fire Chiefs, and [local government] target fire safety educational efforts to real estate and development industries.*
- *[FSC], CAL FIRE, [federal agencies], Fire Chiefs, and [local government] target fire safety educational efforts to new [planning area] residents, especially those coming from urban areas and others with little experience with fire in the wildland-urban interface.*
- *[FSC] develop a welcome-neighbor program where a welcome basket with fire safety information is given to new residents.*

8.4.9. Policy

In incorporated communities you can explore policy options. This can include upgrading codes for many of the items in the "Reducing Structural Ignitibility" and "Fire Protection" sections above. If your planning area does not include an incorporated area, this may not be relevant to your plan and you can delete this section.

8.5. Project Prioritization and Timing

Look at your list of existing proposed actions. Which of them are ready to start now? Think about issues such as funding, permitting (NEPA and CEQA), and access. Which projects were identified as a priority at a community meeting? Which areas did you identify as a priority in Section 7.2.3? Think about projects in terms of short term (next year or two), medium term (two to ten years), and long term (over ten years). Describe your prioritization and timing process and results here.

8.6. Action Plan Summary

Take the information that you have developed in this and the previous appendices to create the following table. This will be the result of many conversations amongst your Planning Committee members. As in your assessment in Appendix 7, take the time necessary to develop agreement around these priorities. Involve affected community members in relevant discussions. You can update this as often as you like. Find a place to start and make a list of where and how you want to start improving the fire safety of your community while balancing conservation needs.

The following is the Action Plan for [planning area] as identified through this fire planning process.

Figure 8. Plan Name Action Plan Summary[19]

Community, Structure, or Area at Risk	Project	Agency/ Landowner	Funding Need	Funding Source	Time Table	Community Recommend-ation
[ ]	(name)	[ ]	[$####]	Agency budget	2006	Yes
[ ]	(name)	[ ]	[$####]	Agency budget	2006	Yes
[ ]	(name)	[ ]	[$####]	Agency budget	2006	Yes
[ ]	(name)	[ ]	[$####]	Agency budget	2006	Yes
[ ]	(name)	[ ]	[$####]	Agency budget	2006	Yes
[ ]	(name)	[ ]	[$####]	Agency budget	2006	Yes
[ ]	(name)	[ ]	[$####]	Agency budget	2006	Yes
[ ]	(name)	[ ]	[$####]	Agency budget	2006	Yes
[ ]	(name)	[ ]	[$####]	Agency budget	2006	Yes
[ ]	(name)	[ ]	[$####]	Agency budget	2006	Yes
[ ]	(name)	[ ]	[$####]	Agency budget	2006	Yes
[ ]	(name)	[ ]	[$####]	Agency budget	2006	Yes
[ ]	(name)	[ ]	[$####]	Agency budget	2006	Yes
[ ]	(name)	[ ]	[$####]	Agency budget	2006	Yes
[ ]	(name)	[ ]	[$####]	Agency budget	2006	Yes
[ ]	(name)	[ ]	[$####]	Agency budget	2006	Yes
[ ]	(name)	[ ]	[$####]	Agency budget	2006	Yes

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[19] Adopted from CFA Simplified CWPP Template, Step 7, p. 9.

9. Facilitating *[PLACE]* Fire Safety in the Long Term

Use this section to plan for how you will implement and monitor your projects over time and update your plan as needed. See the Josephine County Integrated Fire Plan, Chapter 10 for a systematic approach to monitoring and long-term implementation: www.co.josephine.or.us/SectionIndex.asp?SectionID=158.

9.1. Monitoring

What will you do to monitor the success of your project?

Do you have photo points established where you take pictures of your site from the same place before, during, and at regular intervals after your activities? See the USFS Photo point Monitoring Handbook (www.fs.fed.us/pnw/pubs/gtr526/) for more information on how to do this effectively.

The greater Flagstaff, AZ area CWPP set up a special Review Team for ongoing monitoring and implementation of their plan. You can see that at www.gffp.org/media/pdf/CWPP-Report-02-28-05.pdf, p. 50. The Applegate Fire Plan has a social monitoring component, see www.grayback.com/Applegate-Valley/fireplan/index.asp, p. 159.

9.1.1. Strategic Planning and Projects

Use the following table to track your projects over time. See how the El Dorado County FSC uses this matrix to track their projects at www.edcfiresafe.org/documents/edc_wpp_appendix_m_2006-08-23.pdf.

Figure 1. Strategic Planning Matrix[1]

Project # or Code	Start Year	Project Title & Description	Estimated Resources Required	Proposed Funding Source	Current Status (Date)	Current Funding Required & Potential Source	Year 1 Project Status & Update	Year 2 Project Status & Update	Project Completed Date	Out-year Maintenance Required? Responsible Party	Funding Source(s)

[1] Adopted from El Dorado County Fire Safe Council Strategic Planning Project Matrix, www.edcfiresafe.org/documents/edc_wpp_appendix_m_2006-08-23.pdf.

9.1.2. Project-Specific Ecological Monitoring

What ecological monitoring have you established to track the success of your project? Talk to your local Resource Conservation District (RCD, www.carcd.org/wow/citmont.htm) or watershed groups to find out about existing monitoring programs and resources in your community. General monitoring information can be found at: www.partnershipresourcecenter.org/resources/monitoring-evaluation/index.php.

The National Park Service, Lake Chelan Forest Fuel Reduction/Firewood Management Plan Monitoring section has a good summary of a forest-based fuels monitoring program, www.nps.gov/archive/noca/svplan/plan6.htm.

9.2. Project Maintenance

What plans do you have to maintain your projects after grant funding to implement them has expired? One concept is "Adopt a Fuelbreak" where a group (ideally neighbors) agrees to adopt a fuel treatment project in order to maintain it over time, such as cutting back brush.

9.3. Updating This Plan

Prepare now for updating your plan over time. When your plan is done, put it in a three-ring binder. Leave room for future updates. It is recommended that, at a minimum, every five years the planning committee stakeholder groups meet to review the plan. If you have the resources, do this annually. What has changed since the last version of the plan? What needs to be revised? How can that be accomplished most simply? Remember that changes will need to be approved the same way your plan was approved (local fire, government, and CAL FIRE). Use the California Fire Alliance template in Instructions F to update your project's table and signatures.

No plan is ever permanent. This plan was written in [year] based on current conditions and best available information. The field of fire safety is rapidly changing. It is likely that new developments will occur in the coming years. Therefore, it will be important to review this plan at least every [five] years and update it as needed. Copies of this plan will be available for public review at [list locations].

9.4. Resources Needed to Support Ongoing Efforts

As a result of this process, it likely became clear what resources you and your community will need to continue your fire safety efforts over time. Document those needs here. What level of funding is required to implement your projects and maintain your local organizational infrastructure (e.g. FSC Coordinator)? What other resources are needed and where might you find those (e.g. use of heavy equipment from local agencies or timber industry)? Think creatively. Find ways to invite community members to participate in implementing the plan. Invite them to make a difference in their community.

Project File 1—Planning Process

Use this as a place to keep documents developed as part of your planning process, such as:

Community Outreach Materials

Community Meeting Notes

Public Comments Received on Draft Documents

Project File 2—Community Meeting Input

Use this as a place to keep documents developed as part of your community meeting process, such as:

Outreach Survey Results

Community-Generated Maps

Project File 3—GIS Data Layers and Mapping Information

Use this as a place to keep copies of data generated or used and their metadata in this process.

Project File 4—Fire Protection Surveys

Use this as a place to keep copies of the fire protection surveys you created using the form in Instructions E.

Project File 5—Public Lands Fire Management Background Information

Use this as a place to keep background information you gathered regarding management of public lands in the planning area in terms of fuel reduction and fire safety.

Reference A—Glossary

1-Hour Fuel: Fuels that are less than ¼ inch in diameter. These fuels will only take about an hour to lose or gain two-thirds of the equilibrium moisture content of their environment.

10-Hour Fuel: Fuels that range in diameter from ¼ inch to 1 inch, and take about ten hours to lose or gain two-thirds of the equilibrium moisture content of their environment.

100-Hour Fuel: Fuels that range from 1 inch to 3 inches and take about 100 hours to lose or gain two-thirds of the equilibrium moisture content of their environment.

20-Foot Wind Speed: The speed of wind, measured 20 feet up, in miles per hour.

90th Percentile: Weather observations that are among the most extreme—only 10% of the observations are more extreme under 90th percentile conditions.

Access Roads: Roads that allow entrance into and out of a property.

Adaptive Management: An approach to managing the environment/property that is based on a "learn by doing" technique that adjusts to changing conditions. Adjustments in management change over time as new information is learned.

Age Classes: A way of classifying the age range of trees or forests, usually divided into 20-year age classes.

Aloft Winds: Upper winds that occur in the atmosphere above the surface level, generally 2,000 feet and higher.

Anchor Point: The point at which firefighters begin fire line construction, usually blocked from the spreading fire to protect firefighters from harm.

Anthropogenic: The result of human activities or the influence of humans on nature.

Aspect: The direction that a slope faces—north, south, east, west, etc.

Backfire: A technique used in certain locations to direct fire spread against the wind while doing prescribed burns.

Bare Mineral Soil: The exposure of a layer of inorganic earth below the litter and duff layer that is composed of sand, silt, and clay and has little combustible materials.

Benches: Flat landscape areas that occur along foothill and mountainous slopes. These "benches" can be the result of natural land formations through slope movement and sluffing, or can be the result of land alteration by previous resource extraction activities such as logging.

Biodiversity: The abundant variety of plant, fungi, and animal species found in an ecosystem including the diversity of genetics, species, and ecological type.

Biomass: The total weight of living matter in a given ecosystem. May also be defined as the total weight of plant debris that can be burned as a fuel.

Blackline: Preburning of fuels adjacent to a control line before igniting a prescribed burn.

Broadcast Burning: A controlled burn, where the fire is intentionally ignited and allowed to proceed over a designated area within well-defined boundaries for the reduction of fuel hazard after logging, for site preparation before planting and/or for ecosystem restoration.

Broadcast Patch Burning: A controlled burn, where the fire is intentionally ignited and allowed to proceed over a designated smaller area for site specific management of fuels or plant community enhancement for certain groupings of vegetation or patches.

Broadcast Underburning: A method of burning where a prescribed fire is allowed to burn in the understory of a designated area to reduce fuel hazards or as a silvicultural treatment, or both.

Brush : To control and/or clear small woody debris.

Brushing: The act of removing brush such as dead materials, shrubbery, and branches.

BTU: British Thermal Units (heat)/feet/second.

Burn Plan: Detailed document with specific information on prescribed burns. Used by the burn boss for implementing specific prescribe burn projects.

Burn-Out Time: The length of time in which flaming and smoldering phases occur in a given area or for the whole fire.

Reference A—Glossary

Cambium: The growing layer of a tree located between the bark and wood of the stem.

Canopy: The top layer of a forest or tree, which is formed by leaves, needles, and branches creating a continuous cover.

Cavities: A hole or opening, usually in a decayed area of a tree, where birds and animals may live.

Chunked: Completing the pile burning process by turning in, or placing the unburned woody material ends into the fire ring.

Closed-Canopy: Occurs when the canopies of trees touch and blend together enough so that light does not reach the floor of the forest.

Codominant: Species that share dominance or are of equal importance. For example, a fir-pine forest may be dominated by both firs and pines.

Colonize: The act of establishing populations in new sites, such as burned areas, by seed.

Compact: To pack closely or tightly together, as in the fragments of soil being compacted from heavy equipment, thereby limiting the ability of oxygen or water to pass freely.

Composition: The percentage of each species that comprise a given area.

Conks: Shelf-like mushrooms that grow on trees, stumps, and downed wood. They are known for their wood decaying characteristics.

Containment: The process of completely surrounding a fire with natural or man-made fuel breaks.

Contour Falling: A treatment that utilizes positioned logs to control erosion from water flow. Logs are offset on the contour of the slope so the logs slow the water by creating a meandering path of travel.

Control: The act of managing a fire, which generally entails a completed control line around the fire.

Convection Column: Heat generated from a fire into a column that rises into the air at varying heights, depending on the size of the burn.

Cover: Any plants or organic matter that holds soil in place or grows over and creates shade that provides wildlife with an area to reproduce and find protection from predators and weather.

Crop: The amount of fruits a group of plant yields in one growing season.

Crown Density: A measurement of the thickness or density of the foliage of the tree crown in a stand.

Crown Fire: A fire that spreads from treetop to treetop, and is characteristic of hot fires and dry conditions. Crown fires are generally more complex to control than fires on the surface.

Crown Scorch: When a fire or a convection column burns a portion or the entire crown of a tree.

Crown Structure: The structure or arrangement of the uppermost branches and foliage of a tree.

Dappled Light: When the forest canopy has small openings where filtered sunrays project through the tree tops onto the forest floor.

DBH: Diameter at Breast Height, a measurement of a tree's diameter at the level of an adult chest (approximately 4.5 feet above the ground.)

Dead Out: When a fire has completely burned out or been entirely extinguished.

Decay Classes: Decomposing wood is categorized based on the level of decomposition, broken into five classes.

Defensible Fuel Profile Zone: Defensible Fuel Profile Zones: a term used by federal and state land management agencies to describe a larger shaded fuelbreak normally O.25 mile in width. The object of these measures are to reduce the fuel ladder and add space between the tree top canopy in order to keep the fire out of the canopy on the ground.

Defensible Space Zone: The one-hundred foot zone around the home.

Defensible Space: An area around a home/structure that has been cleared of flammable materials to act as a barrier between wildfires and property, thereby decreasing the risk of damage or loss. This space is now defined as 100 feet around a structure in California.

Discing: Cultivating or roto-tilling the soil.

Reference A—Glossary

Disturbance Factor: The aspects that influence changes to the environment, both human-caused and natural occurrences, such as logging or development, and fire, wind, or floods.

Disturbance Regime: The characteristic and usually historical pattern of disruptions to the environment (such as fire or flood or drought, for example) in a given area.

Disturbance: Various activities that disrupt the normal state of the soil such as digging, erosion, compaction by heavy equipment, etc.

Diurnal: Belonging to or active during the day.

Doghair: An excessively dense stand of trees. An example is an acre with 35,000 trees, all smaller than seven inches DBH.

Dominant: The species that is the most abundant or influential on an ecosystem. For example, a dominate tree is one that stands taller than the rest and receives full sun.

Downed Woody Debris: The remains of dead trees, branches, and various woody brush that sit on the forest floor—generally refers to trunks of trees.

Draft: Using the forces of suction to draw water from ponds, swimming pools, or other bodies of water. This technique utilizes a partial vacuum formed by a suction pump and atmospheric pressure. The water is then moved where it is needed.

Draw: A channel that is shallower than a ravine.

Drip Torch: A device held by hand to ignite fires by dripping flaming liquid fuel on the materials to be burnt.

Drip-Line Thinning: Clearing ladder fuels under the drip-line circumference of a leave tree.

Drip-Line: The boundary of a tree's canopy, generally estimated by the extent of the tree's outermost limbs and the circular moisture line formed when rainfall drips from the limb tips.

Duff: A layer on the forest floor that is made up of decomposing organic matter such as leaves, needles, and small branches.

Ecosystem: A community of organisms including plants, animals, and fungi and the non-living aspects of the physical environment that make up a specific area. Examples of ecosystem types include a pond or a forest.

Ecotone Edge: The boundary between two or more ecosystems. The change in ecosystems may be due to elevation, soil type, disturbance, or other factors.

Ember Attack: Embers blown by the wind during a firestorm that accumulate at intersections between horizontal and vertical members on the outside of your house, igniting debris and combustible materials. Embers can also enter into openings (e.g., attic vents and other wall openings), igniting debris on the inside of your home.

Embers: A piece of wood or a coal that is hot and glowing from fire activity, often dispersed by wind ahead of a fire. Also called firebrands.

Endemic: A plant that is native to a certain limited area and found nowhere else.

Ephemeral Stream: A stream or watercourse that does not flow all year round, only during rainy season.

Ephemeral: Meaning short duration or life, as in an ephemeral stream that only exists after a rainstorm or during the rainy season.

Erosion: The removal of soil over time by weather, wind and/or water such as rain or water runoff from roads.

Escape Route: A path or road that has been preplanned to get out of harm's way in a fire situation. The route should be well understood by all participants, and if there is any unclear direction, the path should be marked.

Escapes: Wildfires that cannot be contained with the first attempts at suppression.

Excessive Stems: Stems (tree or shrub main trunks) in high density.

Extension Agent: An employee from the government or a university who provides information to rural communities about agriculture, land management and/or resource management. In California, the University of California Cooperative Extension (UCCE) provides this service. For more information on UCCE, see: http: //ucanr.org/.

Extinction Moisture: The moisture level in fuels when fires tend to stop burning.

Reference A—Glossary

Facultative Sprouter: A species of plant that can resprout after a fire from the rootstock, although this may not be its usual method of reproduction in the absence of fire. The ability to resprout may be dependent on the intensity of the fire.

Feathering: A process that reduces the appearance of change between treated and untreated sites by gradually softening the transition.

Fire Adapted: The ability of organisms or ecosystems to make long-term genetic change for the most advantageous response to fire-prone environments.

Fire Behavior: The combination of fire spread, heat output, flame length intensity, etc. as the fire responds to weather, topography, types of fuels, etc.

Fire Climax: The stage of vegetation that is sustained with frequent fire.

Fire Free Zone: A five- foot minimum zone around the home that is free of all fuels.

Fire Ignition: The act of setting on fire or igniting a fire.

Fire Intensity: A measurement of the heat released in an area during a specific amount of time (btu/ft/sec). Intensity has a large influence on an ecosystems' recovery from fire.

Fire Prevention: Actions taken by homeowners and community members to lessen wildfires and damage caused by wildfires. Includes education, enforcement, and land management practices.

Fire Regime: The characteristic patterns of fire in a given ecosystem. May include fire behavior, distribution, frequency, size, and season.

Fire Resiliency: The ability of an ecosystem to maintain its native biodiversity, ecological integrity, and natural recovery processes following a wildland fire disturbance.

Fire Return Interval: A period of time between fires in a specific region or area.

Fire Safe Council: Public and private organizations that comprise a council intended to minimize the potential for wildfire damage to communities and homeowners, while also protecting the health of natural resources. Goals are achieved by distributing fire prevention materials, organizing fire safety programs, implementing fuel reduction projects, and more.

Fire Safe Practices: Activities such as creating defensible space, firebreaks, access to your home, fire-resistant landscapes, changes to your home in terms of material and design, etc., that make your home/property safer in wildfire situations.

Fire Weather: The various types of weather that affect how a fire ignites, behaves, and is controlled.

Fire-Adapted Ecosystem: A local mix of mature natural vegetation (ideally native species but often found in combination with exotic species) that maintains its ability to survive and regenerate, and perhaps even to thrive, with regular disturbance from wildfire. Some species may actually require fire to trigger seed maturation, such as the giant sequoia. Opportunistic species benefit from fire and the openings it can create in a woodland; this is part of their adaptation.

Firebrands: A piece of wood or a coal that is hot and glowing from fire activity, often dispersed by wind ahead of a fire. Also called embers.

Firebreak: A strip of land that has been cleared of vegetation to help slow or stop the spread of wildfire. It may be a road, trail, or path cleared of vegetation or other burnable materials. A firebreak could also be a stream.

Fire-Resilient Landscape: A natural landscape featuring plants that have adapted to local wildlife conditions, or a domestic outdoor space where appropriate actions have been taken to make it less vulnerable to wildfire and certainly less prone to causing one.

Fire-Resistant Building Materials: Materials used in the construction of a house that are resistant to ignition when exposed to radiant heat or flames. Examples include clay tile roofs, metal roofs, and stucco siding.

Fire-Sensitive: A species of tree that is more susceptible to fire damage. Sensitivity may be due to thin bark or easily ignitable foliage.

Fireshed: An area or areas with similar fire management, fire history, and risk of wildland fire issues.

First Entry Thinning Treatment: The *Initial Entry* first stage of tree thinning performed in a fuels reduction treatment.

Flame Length: The span of the flame from the tip to the base.

Flammable: A quantity of a substance that makes it likely to catch fire, be easily ignited, burn quickly, and/or have a fast rate of spreading flames.

Flanks: Slope areas on both sides below a ridge top.

Flashy Fuel: AKA fine fuels, such as grass, leaves, pine needles, ferns, moss and some kinds of slash which ignite readily and are consumed rapidly when dry.

Foehn Events: A wind that blows warm, dry, and generally strong, creating extremely dry fuel and dangerous fire potential.

Forest Stand Density: The amount of trees in a forest per unit area. Can be measured in terms of basal area and crown cover.

Forest Stand Enhancement: A combination of both silvicultural thinning practices and other forest restoration activities such as prescribed fire, which aim to increase the health, resiliency, and vigor of tree communities within a forest ecosystem.

Fragment: Used as a verb, the transformation of forests or vegetation into one or more patches of smaller size than the original area. Can also refer to one of the patches.

Fragmentation: The transformation of forests or vegetation into one or more patches of smaller size which can occur by natural means such as fire, disease, etc., or by management practices such as timber harvesting.

Fuel Bed Height: A measurement of the height of fuel composition on the forest floor.

Fuel Complex: The volume type, condition, arrangement, and location of fuels.

Fuel Continuity: The amount of continuous fuel materials in a fire's path that allows the fire to extend in vertically towards the crowns of trees or horizontally into the forest or other fuels.

Fuel Ladder: A ladder of vegetation from the forest floor into the canopy (or upper branches) of the trees that allows fire to climb upwards.

Fuel Load Conditions: The amount of combustible material (dead and live fuels), which relates to the *fuel model* of a given site, the slope, aspect, and the fuel's moisture content.

Fuel Modification: The management of fuels for fire safety. Examples include prescribed burns and creation of firebreaks.

Fuel Treatment: The act of removing burnable materials to lower the risk of fires igniting and to lessen the likelihood of damage to property and communities. Treatments may include creating a defensible space, developing fuelbreaks, initiating prescribed burns, and thinning vegetation.

Fuel Volumes: The quantity of fuel in a specified area that is susceptible to fire consumption.

Fuel: All burnable materials including but not limited to living or dead vegetation, structures, and chemicals that feed a fire.

Fuelbreak: A strategic area where fuel volumes have been intentionally reduced to slow down a fire and reduce its flame lengths and intensity; as distinguished from fire breaks where all fuels are removed to bare mineral soil for fire suppression.

Future Desired Condition: The short-term and long-term goals desired from activities on a property. It is important to keep Conservation Principles in mind.

Generalist: A species with the ability to utilize a wide variety of resources and tolerate various environmental situations.

Girdling: A technique used to kill trees by cutting through the cambium and sapwood layer around the circumference of the tree. The flow of water and nutrients is broken and the tree eventually dies.

Global Positioning System: A hand held navigational device that uses satellites to determine positions on the earth.

Green Islands: Patches of live tree and plant communities retained within a mosaic thinning prescription.

Reference A—Glossary

Ground Fuels: The layer of combustible materials that exists below the layer of surface littler. This layer includes plant roots, duff, etc., which will combust without a flame.

Ground-Disturbing Activities: Actions that interrupt the natural condition of the ground, such as digging and compaction from heavy equipment.

Growth/Vigor: The ability of plants to exhibit healthy natural growth and survival.

Hammerhead Turnout: A "T" shaped roadway that allows for large emergency vehicles to turnaround. This space allows for a three-point turnaround and should be as wide as other surrounding roads.

Hand Pile and Burn: The act of gathering slash into piles by hand and then burning the pile.

Hand Pile Burning: Hazardous fuels piled by hand for burning in a manner that will not damage surrounding trees or soil.

Heat Output: The total amount of heat a fire released in a specific area during the passing of the flaming front.

Heat Per Unit Area: The amount of heat produced by burning fuels in a given unit area through the entire duration of the fire.

Herbaceous Overstory Vegetation: The vegetation layer that forms the uppermost canopy layer and is partly composed of non-woody plants that die back in the winter.

Herbaceous Understory Vegetation: The layer of vegetation under the forest canopy that is composed of non-woody plants that die back in the winter.

High-Pruning: Cutting of both the dead and live branches ten to fifteen feet from the base of the tree (height to live crown). This is done on larger trees to separate the fuel connectivity from the ground to the crown of a tree.

Historic Natural Conditions: The natural condition of a property/area that occurred in the past before fire suppression and industrial activities. Old photos, settler's journals, elder's oral history, and clues on the property such as old stumps may be helpful in identifying the historical natural condition of and area.

Home Ignition Zones: Includes the home and a 100 to 200 foot area around the home.

Hydrology: A science that deals with the waters of the Earth including movement, distribution, seasonal patterns, and conservation.

Hydrophobic: Literally meaning "water-fearing" as in a substance such as oil, which does not mix well with water. Also refers to a soil that will no longer absorb water.

Ignition Specialist: A trained professional who specializes in ignition and prescribed fire techniques and management. Ignition specialists are certified through the National Wildfire Coordinating Group and have years of experience in wildland fire suppression and prescribed fire use, and have met all necessary requirements to perform firing applications.

Ignition Zones: The zone where combustion is initiated.

Ingress-Egress: Roads and other avenues to enter and leave your property. The act or right to come in, or go through as in entering a property (ingress). The act or right to, depart or go out as in exiting a property (egress).

Ingrowth: The trees that grow large enough in a season to be considered a sapling or pole timber.

Initial Data Assessment: Information gathered from initial site assessment based on a series of questions.

Initial Entry: The first stage of vegetation and tree thinning performed in a fuel reduction treatment.

Initial Site Assessment: The preliminary steps of a site assessment where fuel hazards and health conditions of a property are determined. Information is gathered to help plan a fuel hazard reduction treatment.

Invasive Weeds: Undesirable plants that are not native and have been introduced to an area by humans. These plants generally have no natural enemies and are able to spread rapidly throughout the new location. Some examples include Himalayan Blackberries, English Ivy, and Scotch Broom.

Jack Pots: Generally, small pockets of dense fuels which could allow a fire to flare up and burn more intensely.

Reference A—Glossary

Key Ecosystem Component: An important piece of an ecosystem such as soil, native species, or mature/rare habitats, which are essential to the stability of an ecosystem.

Ladder Fuel Continuity: The amount of continuous fuel materials in a fire's path that allows the fire to extend in a vertical direction towards the crowns of trees.

Ladder Fuels: Materials such as shrubs or small trees connecting the ground to the tree canopy or uppermost vegetation layer. In forests, this allows fire to climb upward into trees.

Layout: In this case, defining and designating forest operations for a specific location.

Leading Edge: The foremost part of a fire that is guiding the fire in the direction of travel.

Leave Trees: Trees that have been selected to remain standing in an area of thinning or harvesting.

Leave-Patches: Swaths or clusters of trees or other vegetation that have been selected to remain standing in an area of fuel treatment.

Limb Up: To remove the lower branches from a woody plant to create a defined space between the forest floor and the canopy.

Limbing: Removing selected branches of a standing or fallen tree.

Live Crown Percentages: The proportion of the height of the tree on which live branches and foliage are present.

Lop and Scatter: The act of cutting and evenly spreading branches over the ground to reduce fire hazard and erosion potential while promoting the decomposition of branches via their close proximity to the ground.

Mast: Nuts or fruits of trees and shrubs such as acorns, walnuts, or berries that collect on the forest floor and are a food source for animals.

Merchantable: Timber that is viable for sale under the current economic situation. This is generally determined by the part of the stem (trunk) that is suitable for timber products.

Mesic: The condition of being normally moist, as in vegetation or ecosystems.

Mixed-Structural Thinning: Practice of selectively eliminating multi-stemmed species to achieve a variety of densities where either one stem is retained or groupings of stems are retained.

Modify Fire Behavior: Using fire-safe practices such as fuel treatments, thinning, creating firebreaks, etc., to change the way a fire will behave, with a goal of slowing it down and/or suppressing it more easily.

Moisture Content: The dry weight of a material, such as wood or soil, compared to the wet weight of the same material. It is not unusual for live material to have moisture content greater than 100% because it could contain more water than solid material by weight.

Monitor: To watch, keep track of, or check regularly for changes - in this case, to the environment.

Montane: A mountainous region of moist cool upland slopes that occurs below the tree line and is predominately composed of evergreen trees. It is also described as the lower vegetation belt on mountains that is composed of montane plants and animals.

Mosaic Thinning Regimes: A system of thinning to create patches and openings that emulate the structural composition created by a wildfire.

Mosaic Thinning: A style of vegetative thinning that creates openings and patches of vegetation to increase the potential variety of habitat types.

Mycorrhizal: The mutually beneficial relationship between plant roots and fungi "roots," AKA mycorrhizae, where the fungus receives sugar from the tree while helping the tree with water and nutrient uptake. The majority of plants depend on this relationship.

Natural Disturbance: Disturbances, like fire and floods, which occur in the environment without the intervention of humans.

Natural Place Community: A simple term describing a specific type of ecosystem.

Natural Range of Conditions: The normal assortment of circumstances under which an organism or group can survive.

Niches: A species or population's role/function within an ecosystem. Includes resource use, interactions, etc.

Reference A—Glossary

Nurse Log: A tree that has fallen, died, and started to decompose. The decaying log is rich in moisture and nutrients and provides a germination spot for plants, as well as habitat for insects.

Obligate Seeder: A plant that reseeds itself after fire as a means of recovery and regeneration.

Obligate Sprouter: A plant that resprouts after fires as a means of recovery and regeneration.

Offshore Flow: The flow of wind blowing from the land to the water, or in other words wind blowing offshore.

One-Way Transport Route: A hauling trail used during tree extraction activities where one entry pass is made.

Overstory Trees: Tress that form the uppermost layer of the canopy in a forest.

Overstory: The topmost trees in a forest which compose the upper canopy layer; compared to the understory, which is the lower woody or herbaceous layer underneath treetops.

Patch Burning: A method of prescribed burning where patches are burnt to prepare an area for planting or to form an obstruction to future fires.

Patch Under-Burns: A designated area, or vegetation patch, where fire is utilized to consume surface fuels but not trees and shrubs.

Patch-Retention Thinning: A silvicultural thinning practice where patches of trees and vegetation are retained in a given area while other parts of the treatment area are thinned (selectively cut) at intermediate levels.

Perennial Stream: A stream or watercourse that has water all year round.

Perennial: In reference to water, a stream that holds water year-round during a typical year. May have some flux in a drought year.

Permeability: Where fire can spread through a community with minimal negative impact.

Pilot Ignition Piles: Small piles of primarily small fine fuels such as branches and dead materials organic matter.

Pistol Butts: Trees within a forest stand that have a crooked sweep beginning at the base of the tree, then growing straight toward the sky. A “pistol butt” tree indicates erosive soil movement on the slopes of a particular area.

Plant Community: A group of plants that are interrelated and occupy a given area.

Plant Succession: In ecology, progressive change of the plant and animal life of an area.

Pole-Sized: Generally younger trees with a trunk diameter between four and eight inches.

Precautionary Principle: A concept that promotes a cautious approach to development and managing the environment when information is uncertain or unreliable. Erring on the side of caution and conservation is encouraged, along with a “Better safe than sorry” attitude.

Prescribed Fire: A forest management practice that uses fire to improve habitat or reduce hazardous fuels. A plan for the prescribed burn must be written out and approved, and specific requirements must be met.

Present Condition: The conditions that occur on a property at the present time.

Productive: A term used for land or forests that are growing efficiently and in a vigorous manner.

Pump Chance: An area where water can be pumped from a pond or creek for fire-suppression purposes.

Rate of Spread: The speed of an advancing fire. May be measured by the growth in area or by the speed of the leading edge of the fire.

Regeneration: The renewal of trees or forests by planting seedlings or direct seeding by humans, wind, birds, or animals after large disturbances like fire. “Regeneration” also refers to the young trees that were naturally seeded or planted.

Registered Professional Forester (RPF): A person licensed in California to manage state or private forestlands and advise landowners on management of their forests. For more information, see: www.bof.fire.ca.gov/licensing/licensing_current_docs.aspx.

Release: Using thinning techniques to free a tree or group of trees from competition for nutrients, sunlight, and water by removing the competing small trees and shrubs.

Repeating Skips and Gaps: The forest structure throughout a treatment area following a variable density treatment where some areas are retained and not thinned (skips) and other portions of the stand are heavily

harvested (gaps). The range of size of the skips and gaps are from a few hundred square feet to up to an acre where site conditions dictate.

Residence Time: How long the flaming front burns in any one location.

Resilient, Resiliency: The ability of an ecosystem to return to its balanced state after a disturbance.

Retention Patch: A clump of vegetation that has been isolated from contiguous fuels and retained for wildlife habitat and/or native plant species diversity.

Rhizome: An underground stem that has the ability to send out roots and shoots. Grasses and irises are two plants that exhibit rhizomes.

Riparian: A strip of land along the bank of a natural freshwater stream, river, creek, or lake that provides vast diversity, and productivity of plants and animals.

Salvage Logging: Logging and removing merchantable trees after a fire to capture economic potential. This is a very controversial subject.

Saturated: The broad meaning is "full." Saturated soil refers to the point at which the soil is so full of water that no more water can get into (be absorbed by) the soil, and therefore must run off.

Scalping: The act of removing the surface layer to expose the bare mineral soil.

Scratch Line: An incomplete control line in beginning stages that is constructed as an emergency backup for spreading fires.

Sediment: Particles of topsoil, sand, and minerals that come from soil erosion or decomposing plants and animals. Wind, water, and ice carry these particles; when the sediment collects in waterways it can destroy fish and wildlife habitat.

Seed Bank: A repository of dormant seeds found buried in the soil.

Seep: An area where water rises from an underground source to the surface and creates a wet area.

Sensitive Species: A plant or animal species that can tolerate a small range of resources and environmental situations. These species raise concerns about population numbers and may be recognized locally as rare.

Shade Tolerant: Attribute of a species that is able to grow and mature normally in and/or prefers shaded areas.

Shaded Fuelbreaks: : A fire-suppression technique using fuelbreaks in forested areas. Vegetation is reduced and/or modified to reduce fire risk, but an adequate amount of crown canopy remains intact, thus inhibiting weedy undergrowth.

Shaded: Blocked from light with shade or shadows.

Shape: The act of pruning a tree to a desired form or appearance.

Sheltered Connectivity: Contiguous areas within a thinning treatment that are retained for wildlife cover and to support wildlife movement.

Silvicultural: The practice of caring for forest trees in a way that meets management objectives. For example, foresters may control the composition and quality of a forest stand for goods such as timber and/or benefits to an ecosystem.

Site Specific: Applicable to a specific piece of land and its associated attributes and conditions (e.g microclimate, soils, vegetation).

Size Class: The division of trees by the size of their diameter, sometimes split into three categories—seedlings, pole, and saw timber—or by diameter in inches.

Slash Paper: Paper used to cover slash piles before ignition with the intention of keeping the slash dry or allowing it to dry. Paper is more environmentally appropriate than plastic.

Slash: The wood debris left on the ground after pruning, thinning, or brushing—may include branches, bark, chips, or logs.

Slope Stability: The degree to which a slope is susceptible to erosion and slides, or the measure of how stable a slope is.

Reference A—Glossary

Slope: A percentage or degree change in elevation over a defined distance that measures the steepness of a landscape.

Snag: A standing dead tree that has usually lost most of its branches. Snags offer essential food and cover for a host of wildlife species.

Soil Type: Refers to the different combinations of soil particles and soil composition. Soil can vary greatly within short distances.

Spatial Distribution: The manner in which plants are arranged throughout an area.

Spot Fire: A smaller fire outside the boundary of the main fire, started by airborne sparks or embers.

Spur: A road branching off the main road to provide access to a designated area.

Stacking Function: The act of accomplishing several goals with one activity.

Stand Structure Model: The spatial arrangement of the forest stand, describing the density and connectivity of the understory, mid-story, and overstory vegetation.

Stand: A group of trees with similar species composition, age, and condition that makes the group distinguishable from other trees in the area.

Steady State Climax: The stage of vegetation that is self-sustained without disturbance.

Stem and Poles: The trunk of a tree or a piece of wood that is long and slender.

Stemwood: The wood of the main stem or trunk of a plant

Stocking Levels: The density and calculation of tree seedlings, saplings, and poles in a given area.

Strip Patch: In prescribed burning, a narrow section or area where the fuel is burnt while the surrounding area is left untreated.

Structural Protection Zone: Immediate thirty- foot buffer zone around the home.

Structure: The composition of a forest or vegetation, specifically looking at the density, cover, size or diameter, and arrangement.

Stump-Sprout: The ability of a tree to resprout from its cut stump.

Submerchantable: Trees that cannot be sold for timber products due to disease, deformities and/or size.

Surface Fire: A fire on the forest floor that consumes debris and smaller plants.

Surface Fuels: Materials on the ground like needles or low-growing shrubs that provide the fuel for fires to spread on the ground. Surface fuels are generally considered all fuels within six feet of the ground.

Surface or Crown: The distinguished location that a fire burns. Surface refers to the forest floor while crown refers to fires in the top of trees.

Suspended Dead Material: Typically composed of pine needles that are draped on living brush. Made up of dead fuels not in direct contact with the ground, consisting mainly of dead needles, foliage, twigs, branches, stems, bark, vines, moss, and high brush. In general these fuels easily dry out and can carry surface fires into the canopy.

Swamper Burning: A method of prescribed fire where fuel is added gradually and continually to a burning pile over the course of a day.

Thermal Cover: Vegetation cover that modifies unfavorable affects of weather for animals. For example, elk may move to a fir forest with trees at least 40 feet tall and a crown closure of 70% to protect themselves from bad weather.

Thicket: A thick area of brush containing close-growing plants. Provides habitat to wildlife but may be difficult for humans to pass through.

Thinning Away Contiguous Fuels: The practice of cutting back fuel loads from the edge of a desired leave-tree or patch in an effort to separate fuel connectivity.

Thinning From Below: Silvicultural practice where smaller understory trees are selectively removed below overstory trees. This method is also called “low thinning.”

Tillering: The process by which these new aerial shoots emerge from the base of the plant.

Tip Sprout: The ability of a shrub to resprout from a cut limb.

Torching: A rapid and intense burning of a single or small group of trees/shrubs, causing the upward movement of fire; a.k.a. crown fire initiation or flare-up.

Touch-Off: A prescribed fire operation performed by a forestry or fire crew where large quantities of forest treatment slash that are arranged in hand piles are ignited with drip torches at one time by multiple crew members.

Treatment: An action or controlled technique that is applied in a specific process. Refer to "Fuel Treatment" for a more specific definition.

Underburn: A prescribed fire method where burning is conducted in the understory of the forest below the dominant trees.

Understory: Generally herbaceous or shrubby vegetation that makes up the layer of forest under the tree canopy layer.

Uneven-Aged Treatment: A treatment that deals with three or more age-classes of trees.

Unstable: Land that is lacking stability, or liable to change with activity, such as in the case of step slopes or crumbly soils.

Untreated: Not altered from a natural or original state; unprocessed, e.g. no fuel reduction or defensible space activities.

Variable-Density Thinning: Thinning or selectively cutting trees in a manner to restore repeating variability or redundancy in a forest. This technique ensures diversity in stand density and canopy cover.

Variable-Density Treatments: Silvicultural thinning practice where some portions of a stand are left lightly or completely unthinned ("skips"), providing areas with high stem density, heavy shade, and freedom from disturbance; while other parts of the stand are heavily cut ("gaps"), including removal of some dominant trees to provide more light for subdominant trees and understory plants. Intermediate levels of thinning are also applied in a typical variable-density prescription. This practice is also known as "free thinning."

Vertical and Horizontal Structure Diversity: Describes the configuration of trees within a forest stand that create a variation of structure where trees stand straight up and down (vertical) or grow at an angle (horizontal).

Vertical Fuels: Those fuels (brush, small trees, decks, etc.) that provide a continuous layer of fuels from the ground up into the top fuel layers (i.e. tree canopy).

Watershed: All of the land that drains water runoff into a specific body of water. Watersheds may be referred to as a drainage areas or drainage basins. Ridges of higher elevation usually form the boundaries between watersheds by directing the water to one side of the ridge or the other. The water then flows to the low point of the watershed.

Weed Eater: A hand-held tool that utilizes a gas or electric motor and a rotating nylon string or metal blade to cut down vegetation.

Wick: A combustible material that allows fire to travel along a confined path to larger fuel sources. An example would be a wooden fence connected to your home.

Wildlands: An area of land that is uncultivated and relatively free of human interference. Plants and animals exist in a natural state, thus wildlands help to maintain biodiversity and to preserve other natural values.

Windthrow: Trees that are uprooted by wind events. May occur in logged areas or in stands of shallow-rooted trees such as white pines. Formerly protected stands whose edges are opened up become vulnerable to this effect.

WUI: Wildland Urban Interface, the area where wildlands and communities converge, often assumed to be at high risk of wildfire.

Yarding: A technique for moving felled trees, limbs, and brush by hauling them to the road with a cable and tractor.

Reference B – Internet Links for Further Information

The following links are provided for more information on the various topics and sections covered in this Guidebook. Some are quoted within the documents, others are provided as additional information. If there are no links identified for a section, it is not listed here. The text to the right of the link provides a short description of the information contained on the web page. Some of these links may become outdated. If a site doesn't work, try searching for some its key words. If you have additional relevant links or updates, please send them to office@forevergreenforestry.com.

GENERAL INTEREST WEBSITES

cafirealliance.org/cwpp/, California Fire Alliance, CWPPs.

fire.ca.gov/education.php, CAL FIRE, Fire Safety Education.

frap.cdf.ca.gov, The California Dept. of Forestry and Fire Protection, Fire and Resource Assessment Program.

www.cafirealliance.org, California Fire Alliance homepage.

www.fire.ca.gov/education_homeowner.php, California Department of Forestry and Fire Protection (CAL FIRE), Homeowner's Responsibility.

www.firesafecouncil.org, California Fire Safe Council homepage.

www.firewise.org, Firewise homepage.

www.firewise.org/resources/homeowner.htm, Firewise Homeowners Resources.

www.safnet.org/policyandpress/cwpp.cfm, Society of American Foresters, "Preparing a Community Wildfire Protection Plan, A Handbook for Wildland Urban Interface Communities."

www.wildfireprograms.usda.gov/, National Wildfire Programs Database, provides information about policies and programs that seek to reduce the risk of loss of life and property through the reduction of hazardous fuels on private lands.

APPENDICES

1. [PLACE] COMMUNITY CONSERVATION AND WILDFIRE PROTECTION PLAN INTRODUCTION

1.4. Introduction to [Place], California

www.census.gov/popest/estimates.php, US Census population data.

1.5. [Place] Communities at Risk

cafirealliance.org/communities_at_risk/, California Fire Alliance, "Communities at Risk."

1.7. Introduction to [Place] Fire Safe Council

www.dnco.org/downloads/DNFSPFinal.pdf, Del Norte Fire Safe Plan, see section 1.5 for example of text.

2. [PLACE] FIRE SAFE PLANNING PROCESS

2.1. Planning Area Boundaries

cwp.resources.ca.gov/browser/, California Watershed Portal, searchable by subregion.

mattole.org/pdf/UMFP_final.pdf, Upper Mattole Fire Plan, an example of neighborhood-level planning.

support.esri.com/index.cfm?fa=knowledgebase.gisDictionary.search&search=true&searchTerm=global+position+system GIS dictionary.

wildfire.cr.usgs.gov/fireplanning/, Fire Planning and Mapping Tools.

2.2. Process and Plan Development

jfsp.fortlewis.edu/collaboration2.asp, Joint Fire Sciences, "Enhancing Community Collaboration and Building Community Capacity."

www.mattole.org/html/publications_main.html, Lower Mattole Fire Plan.

www.ncrs.fs.fed.us/pubs/bro/applegate.pdf, Applegate Fire Plan, Steps to improve Community Preparedness, includes "Lessons for Other Communities from the Applegate."

Reference B – Internet Links for Further Information

3. WILDFIRE: CURRENT ENVIRONMENT AND BEHAVIOR

www.lomakatsi.org/ A great example of a group doing fire hazard reduction work while improving basic watershed and ecosystem function in southern Oregon. They have created a list of ecological principles to use in implementing fuel reduction projects.

3.1. Introduction: Defining the Wildfire Problem

frap.cdf.ca.gov/infocenter.html, California Fire Resources Assessment Plan.

3.2. Fire Behavior Characteristics

cdec.water.ca.gov/queryTools.html, California Department of Water Resource site. One of the best for weather data sources.

fire.boi.noaa.gov, The National Fire Weather website on fire weather.

raws.wrh.noaa.gov/cgi-bin/roman/past.cgi, University of Utah, Mountain Meteorology Group. One of the best fire weather data sources.

www.firelab.org/, USFS - Missoula Fire Science Labs Homepage.

www.fs.fed.us/fire/planning/nist/ffp_305_rn.rtf, A sorting program called Fire Family that facilitates analysis of weather information.

www.stormcenter.com/envirocast/fire/2003-09-16/, A comprehensive newsletter resource about forest and wildland fires.

www.wrcc.dri.edu/summary/Climsmnca.html, A useful source on climate data for local environment.

3.3. General Wildfire Environmental Description

cdec.water.ca.gov/snow_rain.html, I Information on precipitation and snow levels in California.

cwp.resources.ca.gov/browser/, Watershed information.

frap.cdf.ca.gov/data/frapgismaps/select.asp, Fire Resource Assessment Plans Maps.

jfsp.nifc.gov/projects/01B-3-3-28/01B-3-3-28_Final_Report.pdf, Fire Effects on Rare Flora and Fauna in Southern California National Forests.

mapserver.maptech.com/homepage/index.cfm?BPID=MAP0060030900&CFID=1175344&CFTOKEN=955679,07 Map Tech USGS Topographic maps, NOAA Nautical Charts, and more. Free website.

plasma.nationalgeographic.com/mapmachine/, National Geographic satellite maps, street maps, theme maps and more.

water.usgs.gov/waterwatch/?m=real&w=map&r=ca, USGS Water Watch site.

watersupplyconditions.water.ca.gov/, California Department of Water Resources "Drought Preparedness."

watersupplyconditions.water.ca.gov/hydrologic.cfm, Department of Water Resources "Hydrologic and Water Supply Conditions."

www.calflora.org/, Information on wild California plants.

www.ceres.ca.gov/, California Environmental Resource Evaluation System Home Page.

www.cnrfc.noaa.gov/, National Oceanic Atmospheric Administration's river forecast center.

www.dfg.ca.gov/bdb/html/cawildlife.html, Information on California's wildlife.

www.dfg.ca.gov/bdb/html/cnddb.html, California Natural Diversity Database.

www.dfg.ca.gov/bdb/html/vegcamp.html, Information about vegetation mapping.

www.fs.fed.us/database/feis/, Information on how wildfire affects specific wildlife species.

www.geographynetwork.com/maps/index.html, Free USGS, map site.

www.ipm.ucdavis.edu/WEATHER/wxretrieve.htmlve.html, Weather data from the statewide Integrated Pest Management Program.

www.maptech.com, Map Tech homepage.

www.topozone.com/, Interactive topographic maps, orthophoto maps, and aerial photos of the entire US.

www.usbr.gov/mp/, Bureau of Reclamation web site for the mid-Pacific region.

www.usgs.gov, US Geological Service, Maps for a fee.

www.water.ca.gov/, CA Department of Water Resources.

Reference B – Internet Links for Further Information

www.water.ca.gov/nav.cfm?topic=Water_Conditions&subtopic=River_Conditions_and_Forecasts, CA Department of Water Resources, river conditions and forecasts.

www.wrcc.dri.edu/summary/Climsmnca.html, Western Regional Climate Center, California climate information.

3.4. Fuel: Description of Fuel Through Fuel Models

gisdata.usgs.net/website/landfire/, Fuel models mapped by the USGS Landfire program.

3.5. Fire History

frap.cdf.ca.gov/projects/fire_data/fire_perimeters/, CAL FIRE FRAP fire history from fire perimeters.

www.ceres.ca.gov/snep/pubs/web/v1/ch04/v1_ch04_03.html, Sierra Nevada Ecosystem Project, Effects of Human Activity Beginning in the Mid-1800s.

www.cpluhna.nau.edu/Change/native_fire.htm, Land Use History of North America, "Native Use of Fire."

www.nifc.gov/preved/comm_guide/wildfire/fire_8.html, National Interagency Fire Center, Wildland Fire History.

3.6. Fire Hazard

frap.cdf.ca.gov/data/fire_data/fuel_rank/index.html, FRAP Fuel Rank Maps and Data.

frap.cdf.ca.gov/data/fire_data/fuels/fuelsfr.html, FRAP surface fuels maps and data.

frap.cdf.ca.gov/data/fire_data/hazard/mainframes.html, FRAP Hazard Maps and Data.

www.fs.fed.us/fire/fuelman/, USFS, spatial data for wildland fires and fuel management.

3.7. Fire Regime

gisdata.usgs.net/website/landfire/, USGS Landfire, Fire Regime Condition Class data throughout Sierra Nevada.

www.fireplan.gov/resources/reference_library.html, National Fire Plan Reference Library.

www.frcc.gov/, Fire Regime Condition Class.

www.nifc.gov/preved/comm_guide/wildfire/fire_5.html, National Interagency Fire Center, "Condition Class Attributes: Defining Fire Regimes," defines importance of fire regimes for local ecosystems.

3.8. Fire Threat

frap.cdf.ca.gov/data/frapgismaps/output/fthreat_map.txt, FRAP fire threat data..

3.9. Changing Fuels in the Wildland Urban Interface

www.nps.gov/fire/download/pub_pub_wildlandurbanfire.pdf, Wildland-Urban Fire, A Different Approach, by Jack Cohen.

4. Fire Ecology and Management of Sierra Nevada Vegetation Types

www.amazon.com/exec/obidos/tg/detail/-/1559632305/102-8101392-1784141?v=glance, Fire Ecology of Pacific Northwest Forests, James K. Agee, Island Press, 1993.

www.fire.ca.gov/rsrc-mgt_pestmanagement_socalbeetle.php, CAL FIRE, Information on Southern California beetle infestation and integrated pest management.

www.fire-ecology.org/, Western Fire Ecology Center, fire ecology research in Sierra Nevada forests, the California shrublands, and the Mojave and Sonoran deserts.

www.landfire.gov/models_EW.php, Landfire Rapid Assessment.

www.lomakatsi.org, Lomakatsi Forest Restoration.

www.werc.usgs.gov/fire/, USGS Western Ecological Research Center.

5. [Place] Community Features

www.grayback.com/applegate%2Dvalley/fireplan/, The Applegate (Oregon) Fire Plan: Balancing Act, Living with Fire in the Applegate, Chapter II is a great example of a community description.

yosemitewest.org/wfa50225.htm, The Draft Yosemite West CWPP; a simple but effective approach to writing this section.

5.1. Social and Political Setting

gis.ca.gov/, California Spatial Information Library (CaSIL).

Reference B – Internet Links for Further Information

www.amadorfiresafe.org/AFSC_Final_Report.pdf, Amador County Plan, Section 2.2, page 8.

www.assembly.ca.gov/acs/defaulttext.asp, Assembly member information, and maps of districts.

www.census.gov/, Local planning and tourism departments, US census data.

www.ceres.ca.gov/org/edu.list.html, A comprehensive list of educational institutions, Schools by type.

www.esri.com/data/community_data/community-tapestry/index.html, Classifies U.S. neighborhoods into 65 segments based on their socioeconomic and demographic composition.

www.firstgov.gov/index.shtml, Local offices of federal agencies.

www.leginfo.ca.gov/, State of California official legislative information website, to get background and/or updates on any relevant legislation.

www.my.ca.gov/state/portal/myca_homepage.jsp, State agencies' public information on current fires and fire conditions.

www.senate.gov/, State senator information and district maps.

www.tuolumnefiresafe.org/fire_tuo_county_cwpp.html, Tuolumne County Fire Safe Plan, page 39.

yosemitewest.org/wfa50225.htm, Draft Yosemite West CWPP for sample text: Section 5.4, p. 14.

5.2. Public, Tribal, and Industrial Lands Fire Management

www.blm.gov/nhp/, Bureau of Land Management homepage.

www.dnco.org/cf/topic/topic4.cfm?Topic=Del%20Norte%20Fire%20Safe%20Plan&SiteLink=100089.html, Del Norte Fire Safe Plan, Ch. 7.

www.doi.gov/bureau-indian-affairs.html, Bureau of Indian Affairs.

www.foresthealth.org/, California Forestry Association. Extensive information about forest conditions and related issues.

www.fs.fed.us/r5/, US Forest Service, California.

www.fws.gov/, US Fish and Wildlife Service.

www.nps.gov/, National Park Service.

5.3. Community Planning Context

www.amadorfiresafe.org/AFSC_Final_Report.pdf, Amador County Plan, Section 2.3, page 9.

www.ceres.ca.gov/planning/, LUPIN, California Land Use Planning Information Network.

www.ceres.ca.gov/planning/countylists/county_gov.html, LUPIN County and City Governments by County.

www.communityviz.com/, "CommunityViz is advanced yet easy-to-use GIS software designed to help people visualize, analyze, and communicate about important land-use decisions."

6. Fire Protection Organizations

www.calchiefs.org, California tribal fire chief association.

www.iafc.org, International Fire Chiefs Association.

www.nifc.gov/, National Interagency Fire Center.

www.nwcg.gov/, National Wildfire Coordinating Group.

6.2. California Department of Forestry and Fire Protection (CAL FIRE)

www.fire.ca.gov/ CAL FIRE's homepage.

6.3. Federal Fire Agencies

www.blm.gov/ca/st/en.html, Bureau of Land Management, California.

www.fs.fed.us/r5/, US Forest Service, California.

7. Risk Assessment: Identifying and Evaluating Assets at Risk

cdfdata.fire.ca.gov/fire_er/fpp_planning_cafireplan, Introductory and background information on assets at risk, California Fire Plan, Chapter 4: Assets at Risk, and Appendix C: Assets at Risk and their Role in the Fire Plan.

Reference B – Internet Links for Further Information

gis.esri.com/esripress/display/index.cfm?CFID=335927&CFTOKEN=64578432, ESRI book: Disaster Response: GIS for Public Safety, ISBN: 1-879102-88-9.

7.1. Assets at Risk in Your Planning Area

cwp.resources.ca.gov/browser/, California Watershed Portal, watershed information.

www.arb.ca.gov/smp/district/adstat.htm, Air Districts Program Approval Status.

www.arb.ca.gov/smp/district/district.htm, Air Resource Board, Smoke Management Programs.

www.arb.ca.gov/smp/smp.htm, California Air Resources Board.

www.ca.nrcs.usda.gov/, Natural Resource Conservation Service (NRCS), California.

www.calcattlemen.org/, California Cattleman's Association.

www.californiahistoricalsociety.org/programs/ccd.html, California historical Society, cultural directory page.

www.carcd.org/frameset.htm, California Association of Resource Conservation Districts. Allows you to cContact any local conservation organizations to inquire about other groups in the area who may be addressing fire-related issues.

www.consrv.ca.gov, CA Dept. of Conservation.

www.dfg.ca.gov/whdab/html/cnddb.html, CA Department of Fish and Game (DFG) Natural Diversity Database.

www.dfg.ca.gov/whdab/index.html, DFG Wildlife and Habitat Data Analysis Branch.

www.dwr.water.ca.gov/, CA Department of Water Resources.

www.epa.gov/airnow/, For US Environmental Protection Agency, air quality informationPA.

www.fb.com, Farm Bureau.

www.firesafecouncil.org/ca/attachments/OSB_FSC_.doc, A great Orleans-Somes Bar Fire Safe Council survey to get information from local residents on local fire conditions.

www.foresthealth.org/, California Forestry Association.

www.krvfiresafecouncil.com/, For a more complex, GIS-based assessment, see the Kern River Valley Fire Safe Plan, p. 20.

www.kstrom.net/isk/maps/ca/california.html, Map of federally recognized tribes, list and contact information for California tribes and other useful maps.

www.swrcb.ca.gov, State Water Resource Control Board.

www.trpa.org/default.aspx?tabindex=3&tabid=127, CWPP for the California Portion of the Lake Tahoe Basin CWPP, p. 10.

www.tuolumnefiresafe.org/fire_tuo_county_cwpp.html, An example of a simple approach to identifying and evaluating assets at risk, Tuolumne County CWPP, p. 18.

7.2. Assessing Risks in the Planning Area

firecenter.berkeley.edu/toolkit/, Fire Information Toolkit analysis.

gis.ca.gov/, California Spatial Information Library.

gis.esri.com/esripress/display/index.cfm?CFID=335927&CFTOKEN=64578432, ESRI book: Disaster Response: GIS for Public Safety, ISBN: 1-879102-88-9.

mattole.org/pdf/UMFP_final.pdf, Upper Mattole Fire Plan, an example of neighborhood planning areas.

www.edcfiresafe.org/edc_wildfire_protection/appendix_c.htm, El Dorado County CWPP, South Fork American River assessment.

www.tuolumnefiresafe.org/fire_tuo_county_cwpp.html, Tuolumne County CWPP, p. 44.

8. Meeting Your Objectives: [Place] Fire Safe Action Plan

www.cafirealliance.org/cwpp/downloads/cwpp_lessons_learned2.pdf CWPP enhancement guidance-lessons learned.

www.fireplan.gov/overview/States/ca.html National Fire Plan: Success Stories in California, reports, and links.

8.3. Existing Projects and Actions

Reference B – Internet Links for Further Information

www.blm.gov/nhp/, Bureau of Land Management homepage.

www.dnco.org/cf/topic/topic4.cfm?Topic=Del%20Norte%20Fire%20Safe%20Plan&SiteLink=100089.html, Del Norte Fire Safe Plan, Ch. 7.

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Conservation Principles for Community Wildfire Protection in California's Sierra Nevada

"Fire always has been and always will be an ecological force in the Sierra Nevada. Decades of fire suppression have changed this role, allowing stands to thicken and fuels to accumulate, especially in the foothills and lower montane[1] zone, where developments are increasing. We either manage fire and live with fire on our terms or let fire dictate the terms. The choice is ours."

— Jan W. van Wagtendonk, *Wildfire* (2006)

Most Sierra Nevada residents choose to live here because of the natural beauty. What many of us don't realize is that living within these forests and *wildlands*[2] carries a responsibility. We need to be good stewards of the land, learning to live in balance with the natural world, of which fire is a significant part. This document summarizes what residents can do to coexist with fire in the Sierra. It will show you how to provide a positive balance among *fire prevention,*[3] conservation, and wildlife protection at your Sierra Nevada home. You've chosen to live here, and with your choice comes a stewardship responsibility.

For more information on fire safety in general, please contact your local Fire Safe Council, or go to
www.fire.ca.gov/education_homeowner.php
www.firesafecouncil.org/homeowner/index.cfm
firewise.org/resources/homeowner.htm

Some Basic Concepts to Remember for Living with Fire in the Sierra Nevada

- **Fire is a dynamic element of the Sierra.** Your property has likely burned before and will burn again. The landscape where you live today may seem "natural." In fact it has changed drastically over the last 150 years as we have attempted to manage fire. In preparing your property for fire, you can help restore it to a more ecologically appropriate state. In doing so, you will learn how to be prepared for wildfire—it is not only possible, it's smart. While it is rarely practical to completely "fire proof" your property, there are many steps you can take to survive inevitable wildfire. *For more information see http://www.fire.ca.gov/education_content/downloads/live_w_fire.pdf.*
- **One size does not fit all in terms of homeowner fire safety.** Every place is unique. Work with your local *Fire Safe Council,*[4] fire department, Cooperative *Extension Agent,*[5] *Registered Professional Forester,*[6] and/or contractors to design the appropriate *fire-safe practices*[7] and *defensible space*[8] for your

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[1] Montane: A mountainous region of moist cool upland slopes that occurs below the tree line and is predominantly composed of evergreen trees. It is also described as the lower vegetation belt on mountains that is composed of montane plants and animals.

[2] Wildlands: An area of land that is uncultivated and relatively free of human interference. Plants and animals exist in a natural state, thus wildlands help to maintain biodiversity and to preserve other natural values.

[3] Fire Prevention: Actions taken by homeowners and community members to lessen wildfires and damage caused by wildfires. Includes education, enforcement, and land management practices.

[4] Fire Safe Council: Public and private organizations that comprise a council intended to minimize the potential for wildfire damage to communities and homeowners, while also protecting the health of natural resources. Goals are achieved by distributing fire prevention materials, organizing fire safety programs, implementing fuel reduction projects, and more.

[5] Extension Agent: An employee from the government or a university who provides information to rural communities about agriculture, land management and/or resource management. In California, the University of California Cooperative Extension (UCCE) provides this service. For more information on UCCE, see: http://ucanr.org/.

[6] Registered Professional Forester (RPF): A person licensed in California to manage state or private forestlands and advise landowners on management of their forests. For more information, see: www.bof.fire.ca.gov/licensing/licensing_current_docs.aspx.

[7] Fire Safe Practices: Activities such as creating defensible space, firebreaks, access to your home, fire-resistant landscapes, changes to your home in terms of material and design, etc., that make your home/property safer in wildfire situations.

[8] Defensible Space: An area around a home/structure that has been cleared of flammable materials to act as a barrier between wildfires and property, thereby decreasing the risk of damage or loss. This space is now defined as 100 feet around a structure in California.

property. *See* *www.fire.ca.gov/education_100foot.php* *and* *www.firesafecouncil.org/homeowner/index.cfm* *for more information.*

- **Your home exists within a larger *watershed.*[9]** It is located in the midst of a much larger landscape. Think about where your property is on the *slope.*[10] Are you on top of a ridge, where fire will easily burn toward your home? Is your slope steep or gentle? Fire moves quickly up steeper slopes, which means that you may need to treat a larger area to create your defensible space. What is below and above you? What direction, or "*aspect,"*[11] does your property face? Generally, south-facing properties are hotter and drier; they can therefore be more susceptible to fire. Are there any natural *firebreaks*[12] around you such as streams, rivers, or rocky outcrops where a fire might naturally go out? Do wildlife use or move through your property to get to food, shelter, or water? In what watershed are you located? Do the roads in and out of your property follow ridges or rivers? Look beyond your property lines to understand the ecological perspective of your place. *See* *www.audubon.org/bird/at_home/Explore.html* *for more information.*

- **Fire can behave both predictably and unpredictably.** We can generally predict fire direction and behavior; it will go the way the wind is blowing and burn as much *fuel*[13] as is available. Predicting the exact time and place where fire will burn is less obvious. As fire moves across the landscape it can climb up into your trees. A key fire safety objective is to prevent that spread. Dead leaves and branches on the ground *(surface fuels*[14]*)* act as a *wick*[15] to move fire horizontally across the land. Shrubs, small trees, and live branches *(ladder fuels*[16]*)* can carry fire vertically into the larger trees. Too much of these surface and ladder fuels can cause the *overstory*[17] trees to burn up in what is called a "crown fire"—when fire spreads from tree to tree in the forest canopy (or tree tops). One of the main principles in creating defensible space and reducing hazardous fuel conditions is to create physical space between vegetation layers (both vertically and horizontally) so a fire cannot climb easily from the ground into the trees or to your home. *See* *www.for.gov.bc.ca/protect/suppression/behaviour.htm#Behaviour* *for more information.*

- **Timing is everything.** There are appropriate times for different actions on your property, much as there are different seasons of work in your garden. Do your defensible space and fuel reduction work well before fire season, to avoid having sparks from equipment start fires in dry vegetation. Avoid *ground-disturbing*[18] activities in your forest or wildland when the ground is too wet or when birds and animals are nesting. Don't try to do everything at once—think about your fire safety seasonally: plan your activities in

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[9] Watershed: All of the land that drains water runoff into a specific body of water. Watersheds may be referred to as drainage areas or drainage basins. Ridges of higher elevation usually form the boundaries between watersheds by directing the water to one side of the ridge or the other. The water then flows to the low point of the watershed.

[10] Slope: A percentage or degree change in elevation over a defined distance that measures the steepness of a landscape.

[11] Aspect: The direction that a slope faces—north, south, east, west, etc.

[12] Firebreak: A strip of land that has been cleared of vegetation to help slow or stop the spread of wildfire. It may be a road, trail, or path cleared of vegetation or other burnable materials. A firebreak could also be a stream.

[13] Fuel: All burnable materials including but not limited to living or dead vegetation, structures, and chemicals that feed a fire.

[14] Surface Fuels: Materials on the ground like needles or low-growing shrubs that provide the fuel for fires to spread on the ground. Surface fuels are generally considered all fuels within six feet of the ground.

[15] Wick: A combustible material that allows fire to travel along a confined path to larger fuel sources. An example would be a wooden fence connected to your home.

[16] Ladder Fuels: Materials such as shrubs or small trees connecting the ground to the tree canopy or uppermost vegetation layer. In forests, this allows fire to climb upward into trees.

[17] Overstory: The topmost trees in a forest which compose the upper canopy layer; compared to the understory, which is the lower woody or herbaceous layer underneath treetops.

[18] Ground-Disturbing Activities: Actions that interrupt the natural condition of the ground, such as digging and compaction from heavy equipment.

the winter and spring; start clearing when the ground begins to dry (when it's not *saturated*[19]) or when there is snow on the ground; finish treatments by early summer before the vegetation is dry; do your defensible space maintenance around and inside your home in the fall; and burn your piles after the rains begin in the winter.

- **Your house is likely a fuel source.** Many Sierra homes are located in places where a fire can start and spread into surrounding vegetation. The more you prepare your house and other structures, the less you will have to treat the surrounding vegetation. The biggest improvement you can make to reduce your fire risk is to build or remodel your house to resist the millions of tiny *embers*[20] created by *ember-attack*[21] from wildfires. When wildfires burn in extreme conditions they send burning firebrands (embers) ahead of them; these firebrands ignite new fires. Using *fire-resistant building materials*[22] and appropriately designed structures will give you the best chance to survive wildfire. Replace wood shake roofs with fire-resistant materials. Don't let your home be part of the problem. An interactive source of information to reduce homeowner risk in the wildland-urban interface is provided by the University of California Center for Fire Research and Outreach; it's called the Fire Information Engine Toolkit. *See firecenter.berkeley.edu/toolkit/homeowners.html for details on how this web-based program can help you make better decisions to reduce your fire risk, and the related UC Extension's Homeowner's Wildfire Mitigation Guide groups.ucanr.org/HWMG/index.cfm. Consult your local fire marshal or see firewise.org/resources/files/wildfr2.pdf for more information.*
  If you are building a new home, consider slope, aspect, surrounding fuels, and your potential environmental impacts before deciding where to site your home. This may be more important than the view in the long term. Talk to your local planning department to learn about local fire-safe building regulations, or *see osfm.fire.ca.gov/WUIBS.html, or cdfdata.fire.ca.gov/pub/fireplan/fpupload/fppguidepdf99.pdf for more information about state regulations.*
- **Know your legal obligations.** Learn the legal requirements regarding defensible space and fire-safe building and construction. Discover how to balance these with the ecological needs of your place.
- **Firefighters need your help to protect your home**. Make it safe for them and their equipment to get to and from your house. Be sure they can find you with visible road and address signs. Remember that fire-safe landscaping and construction greatly improves firefighters' ability to protect your home. *See principle 4C below, and www.livingwithfire.info/beforethefire/accesszone/index.php for more information.*

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[19] Saturated: The broad meaning is "full." Saturated soil refers to the point at which the soil is so full of water that no more water can get into (be absorbed by) the soil, and therefore must run off.

[20] Embers: Small glowing or smoldering pieces of wood or other organic debris, often airborne in a fire.

[21] Ember Attack: Embers blown by the wind during a firestorm that accumulate at intersections between horizontal and vertical members on the outside of your house, igniting debris and combustible materials. Embers can also enter into openings (e.g., attic vents and other wall openings), igniting debris on the inside of your home.

[22] Fire-Resistant Building Materials: Materials used in the construction of a house that are resistant to ignition when exposed to radiant heat or flames. Examples include clay tile roofs, metal roofs, and stucco siding.

Conservation Principles

Consider the Conservation Principles below in how you approach your fire safety and defensible space. It's all about balance. It is possible to have an aesthetically pleasing landscape that is fire-safe, supports local plant and animal species, and still provides you with privacy and plantings.

1. **Remember the Vegetation (Native Trees and Other Plants)**

   a. **Discover and monitor your forest and vegetation's dynamic changes.**

   Plan for the future of your forest. Because you are the conservation steward of your land, your work in the forest will be ongoing. Watch the wild areas on your property and learn from them as they grow and change with your stewardship. Think both in the short term (what will happen this year) and the long term (what will happen over time). Document those changes as the years go by; keep notes and records. Learn how to *monitor*[23] the ecological changes on your property and use that information for *adaptive management*[24] of your wildlands. To live with wildfire we need to take the responsibility to manage, adapt, and guide the vegetation around our homes. *For more information see www.dnr.state.mi.us/publications/pdfs/huntingwildlifehabitat/Landowners_Guide/Habitat_Mgmt/Planning/Evaluating_Land.htm.*

   b. **Act conservatively.**

   We are manually recreating a more *fire-resilient landscape.*[25] In doing this, we need to apply the general concepts of the *precautionary principle*[26] while implementing *fuel treatments*[27]*:* you can always remove more trees and vegetation at a later time, but you cannot immediately replace what you have cut. The vegetation you leave is ultimately most important. Be sure that what you remove is done with careful planning and consideration to ensure that what you leave standing is healthy and *resilient.*[28] *See www.mindfully.org/Precaution/Precautionary-Principle-Common-Sense.htm for more information.*

   c. **Protect native species that share your home.**

   Look at the native vegetation around your property—or ask a local plant or forestry specialist for help—to see what different plants share your home. There may be plants that are rare. If so, protect them by providing defensible space (while keeping in mind their needs, such as shade). Find out if those plants exist in other areas within your watershed and how they are being managed there. Watch for *invasive weeds.*[29] Follow vegetation treatments with invasive weed removal. Minimize the

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[23] Monitor: To watch, keep track of, or check regularly for changes—in this case, to the environment.

[24] Adaptive Management: An approach to managing the environment/property that is based on a "learn by doing" technique that adjusts to changing conditions. Adjustments in management change over time as new information is learned.

[25] Fire-Resilient Landscape: A natural landscape featuring plants that have adapted to local wildfire conditions, or a domestic outdoor space where appropriate actions have been taken to make it less vulnerable to wildfire and certainly less prone to causing one.

[26] Precautionary Principle: A concept that promotes a cautious approach to development and managing the environment when information is uncertain or unreliable. Erring on the side of caution and conservation is encouraged, along with a "Better safe than sorry" attitude.

[27] Fuel Treatment: The act of removing burnable materials to lower the risk of fires igniting and to lessen the likelihood of damage to property and communities. Treatments may include creating a defensible space, developing fuelbreaks, initiating prescribed burns, and thinning vegetation.

[28] Resilient, Resiliency: The ability of an ecosystem to return to its balanced state after a disturbance.

[29] Invasive Weeds: Undesirable plants that are not native and have been introduced to an area by humans. These plants generally have no natural enemies and are able to spread rapidly throughout the new location. Some examples include Himalayan Blackberries, English Ivy, and Scotch Broom.

introduction of exotic plant species near your home, especially those that can spread into adjacent wildland areas. Invasive species can change your fire hazard very quickly and be difficult to manage.

Avoid unnecessarily introducing water into your landscape, as water will generally help non-native plants out-compete native plants. *See www.cnps.org/activities/natives.htm, www.cal-ipc.org, and www.ipm.ucdavis.edu/PMG/weeds_common.html for more information.*

d. Keep the oldest and biggest trees.

Generally, most of the oldest trees in the forest are no longer present. If you have old or very large trees, create defensible space around them so they will survive wildfire. This may include raking away thick *duff*[30] at the base of the trees. Notice that these trees often have thick bark so they are generally fire-resistant (they have evolved with fire). Think about their protection in terms of building a fire in your woodstove: A big log won't start burning without a lot of smaller kindling (e.g. small trees, shrubs, branches, etc.). In your forest, make sure that the smaller kindling isn't around the bottom of your big trees, and generally the trees will make it through a wildfire on their own. In some cases, you'll need to remove smaller trees that touch the crown of the tallest trees. At the same time, you don't want to remove all of the small trees in your forest. Small trees are the next generation of large trees. Keep enough *regeneration,*[31] possibly in small patches, to provide for the future forest, while still providing adequate space between all the trees you keep standing. An additional benefit of keeping your biggest trees is that they can break up the wind as it's moving through, which can slow down fire spread. *See www.eri.nau.edu/cms/content/view/544/740/ for more information.*

2. Remember the Wildlife

a. Provide local wildlife a place to live.

Become familiar with the animals that share your property. Talk to local wildlife experts and/or bird watchers. Learn what wildlife need in terms of shelter, food, water, and reproduction. Remember that your property is their home too. Find ways to balance your land management activities with their needs, and leave some areas *untreated*[32] for the birds and wildlife using them. Protect them as you would your home by creating defensible space while still considering their needs for *cover.*[33] If you watch quietly you may see animals using those areas. *For more information, see www.fs.fed.us/psw/rsl/projects/wild/verner/psw_37.html,* and *cetuolumne.ucdavis.edu/newsletterfiles/Master_Gardener_Articles_20044858.doc*.

b. Provide access to food and water.

Protect and retain trees with nests and cavities, or where obvious wildlife feeding or nesting activities are occurring. Leave some plants that have berries or other fruit or *mast*[34] used by wildlife. Act especially carefully and leave cover around streams, *seeps,*[35] or other wet areas to keep those areas cool and wet; this will provide wildlife the protective cover they need when they are using those places or moving to and from them. Make sure all natural water supplies are clean by keeping any

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[30]Duff: A layer on the forest floor that is made up of decomposing organic matter such as leaves, needles, and small branches.

[31] Regeneration: The renewal of trees or forests by planting seedlings, or the direct seeding by humans, wind, birds, or animals after large disturbances like fire. "Regeneration" also refers to the young trees that were naturally seeded or planted.

[32] Untreated: Not altered from a natural or original state; e.g. no fuel reduction or defensible space activities.

[33] Cover: Any plants or organic matter that holds soil in place or grows over and creates shade that provides wildlife with an area to reproduce and find protection from predators and weather.

[34] Mast: Nuts or fruits of trees and shrubs such as acorns, walnuts, or berries that collect on the forest floor and are a food source for animals.

[35] Seep: An area where water rises from an underground source to the surface and creates a wet area.

poisons and *sediment*[36] away from any water that could drain into them. *For more information, see www.dnr.state.mi.us/publications/pdfs/huntingwildlifehabitat/Landowners_Guide/Habitat_Mgmt/Backyard/Backyard_Intro.htm.*

c. Protect future generations of wildlife.

Find out when local species are nesting and/or breeding and avoid working in and around your wildlands during those times. Learn what kind of habitat local species might use for nesting and breeding, and be sure to protect those areas during your management activities. *See www.paws.org/about/emailnetwork/archive/wildagain/wild_2004_06_02.html and www.audubon.org/bird/at_home/SafeMisc.html for more information.*

d. Value the standing dead trees.

Standing dead trees—or *snags*[37]—are especially important for wildlife. They provide both shelter and food to many birds and other animals. However, they can also be a wildfire hazard if they are near enough to fall on your home or fall and block an evacuation road during a fire. Balance the needs of wildlife with your need for fire safety. Think about your home within the landscape; if you've got snags in the area, you don't need them next to the house. Take the time to find the most appropriate actions for your unique place. *See www.nwf.org/backyard/snags.cfm for more information*.

e. Conserve rare and endangered species.

One of the bonuses—and responsibilities—of living in the Sierra is living with the many rare and endangered species with which you share habitat. Find out if there are rare or endangered species in your area by talking to your local Cooperative Extension Agent or Forest Service wildlife biologist. Plan your fuel reduction actions around the needs of these species. Often by a fairly minor refinement of your activities, such as timing, technique, or extent, you can protect species while realizing your fuel reduction goals. *For more information, see www.dfg.ca.gov/hcpb/species/t_e_spp/tespp.shtm, www.dfg.ca.gov/habitats/wdp/region-sierra_nevada-cascades/overview.html*.

3. Remember the Soil

a. Maintain the life in your soil.

There is as much or more activity below the ground on your property as there is above the ground. Keep this in mind in terms of what you do above ground. Talk to your Cooperative Extension Agent or local gardeners to find out what *soil types*[38]are on your property. Some soil types can tolerate much more *disturbance*[39] than others. Minimize activities that could *compact,*[40] flood, or poison your soil. The health of your land is directly dependent on the health of your soil. As such, the soil is one of the most valuable assets of your property. *See managingwholes.com/new-topsoil.htm for more information.*

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[36] Sediment: Particles of topsoil, sand, and minerals that come from soil erosion or decomposing plants and animals. Wind, water, and ice carry these particles; when the sediment collects in waterways it can destroy fish and wildlife habitat.

[37] Snag: A standing dead tree that has usually lost most of its branches. Snags offer essential food and cover for a host of wildlife species.

[38] Soil Type: Refers to the different combinations of soil particles and soil composition. Soil can vary greatly within short distances.

[39] Disturbance: Various activities that disrupt the normal state of the soil such as digging, erosion, compaction by heavy equipment, etc.

[40] Compact: To pack closely or tightly together, as in the fragments of soil being compacted from heavy equipment, thereby limiting the ability of oxygen or water to pass freely.

b. Ensure that your soil cover is fire safe.

Replace cover that burns easily (such as dry or dead vegetation) with cover that is less *flammable*[41] (e.g. gravel, fleshy green plants, etc.). The objective is to ensure that if and when a fire comes through, it is not so hot that it kills the life in your soil. Rather, it should move through without a lot of fuel to consume in its path. For example, a very light layer of pine needles can help with soil erosion *(see below)*, but too much can be a fuel problem. *See http://www.laspilitas.com/classes/fire_burn_times.html for more information.*

c. Minimize erosion.

Protect your soil by keeping it covered. Cover helps to prevent *erosion*,[42] especially on ground that is not flat; it keeps the soil in place. Don't let soil move across your property, most importantly not into streams or other natural water sources. Keep ground-disturbing activities away from *unstable*[43] areas and *riparian*[44] areas. Pay special attention on steep slopes. The steeper the slope, the faster the soil can move downhill if it's disturbed, and the faster a fire can climb uphill under the right (or wrong!) conditions. *See http://www.uri.edu/ce/healthylandscapes/tips/6.html and http://www.pfmt.org/fire/topos_effect.htm for more information.*

d. Protect your soil after a fire.

Soil can be most fragile after a wildfire. This is often exacerbated when winter rains come soon after a fire. The potential for erosion and loss of soil is huge with this combination of conditions. If you have experienced fire on your property, get cover onto your soil as soon as you can to prevent erosion. Remember, your soil is alive, so help it grow. *See www.ext.colostate.edu/PUBS/NATRES/06308.html* and *www.cnr.uidaho.edu/extforest/AftertheBurnFINAL.pdf for more information.*

4. Remember the People

a. Plan your actions with your neighbors.

Talk to your neighbors. Find out what they are doing on their land. Find ways to cooperate in your land management actions. Your defensible space will likely impact your neighbor's chances of surviving a wildfire and vice-versa. Talk about what to do in an emergency and how to most safely evacuate. Find out if there is a Fire Safe Council (FSC) in your community, and if so, get involved. Help make your community a Firewise community. Coordinated work amongst neighbors will have a greater impact on your individual fire safety. *For more information, see www.firesafecouncil.org, www.fire.ca.gov/about_content/downloads/Evacuation2006.pdf, and www.firewise.org.*

b. Find experienced workers and treat them well.

Forestry workers with chainsaws in hand are the actual decision-makers as to what stays or goes—what lives or dies—in your forest. If your objective is to reduce fuels while still maintaining ecological integrity and diversity on a site, your workers must have the knowledge and experience to help you achieve this. Involve the workforce in the design, planning, and monitoring of projects. Talk to your local FSC or neighbors and check references to find reputable contractors. Pay workers well and maybe even bring them chocolate chip cookies; this will achieve better ecological outcomes on the ground. Happy, respected people do the best work. *See ewp.uoregon.edu/programs.html for more information.*

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[41] Flammable: A quality of a substance that makes it likely to catch fire, be easily ignited, burn quickly and/or have a fast rate of spreading flames.

[42] Erosion: The removal of soil over time by weather, wind and/or water such as rain or water runoff from roads.

[43] Unstable: Land that is lacking stability, or liable to change with activity, such as in the case of step slopes or crumbly soils.

[44] Riparian: A strip of land along the bank of a natural freshwater stream, river, creek, or lake that provides vast diversity and productivity of plants and animals.

c. Work with your local fire department.

Talk to your local firefighters. Find out what they need to safely get to your house and back out. Make sure that your *access roads*[45] are safe; maintain your fuel treatments along all roads, both for firefighter safety in protecting your home and your safety in case of evacuation. Let firefighters know where you live and what's on your property; invite them out to see it. Have street and address signs visible so out-of-town firefighters can find you if there is a big fire. Make sure you have a water supply they can find and use. Know where and how to turn off any fuel sources such as natural gas or propane. *See www.projecttahs.org/pdf/firedepartment.doc for more information.*

These Principles were developed by the following Steering Committee members between September 2006 and June 2007 for the Sierra Nevada Community Conservation and Wildfire Protection Plan Guidebook:

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- Louis Blumberg, California Forest Initiative Director, The Nature Conservancy
- Susan Britting, PhD
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- Rich Fairbanks, Forest and Fire Program Associate, The Wilderness Society
- Tracy Katelman, ForEverGreen Forestry
- Paul Mason, Legislative Representative, Sierra Club California
- Wayne Mitchell, Asst. Deputy Director, Fire Prevention and Planning, CAL FIRE
- Gary Nakamura, Forestry Specialist, University of California (UC) Cooperative Extension
- Christine Nota, Regional Forester's Representative, US Forest Service Region 5
- Carol Rice, Wildland Resource Management
- Carl Skinner, Science Team Leader, US Forest Service Pacific Southwest Research Station
- Scott Stephens, Assistant Professor of Fire Science, UC Berkeley
- Craig Thomas, Director, Sierra Forest Legacy
- Jay Watson, Director, California Fire Safe Council
- Vicki Yorty, Executive Director, El Dorado County Fire Safe Council

For more information, see forevergreenforestry.com/SierraConservationCWPP.html.

Katelman, Tracy, et al. *Conservation Principles for Community Wildfire Protection in California's Sierra Nevada.* 2007. 8 pp.

[45] Access Roads: Roads that allow entrance into and out of a property.

B. Wildland Fire Safety at Home[1]

The general principle behind making an area fire safe (making it as safe as possible for when a fire might pass through) is to reduce the amount of fuel and modify the arrangement of fuel that a fire could consume. Three factors are required for fire, and are known as the fire triangle: fuel, oxygen, and heat. If any one of these elements is missing, a fire won't start or, should it start, it won't spread. In a wildland situation, the three factors that dictate the extent and severity of fire behavior are fuel, weather, and topography. Fuel is the one element of the three that we can significantly modify. When there is a lot of fuel, a fire can burn very hot and move very quickly. When there is little fuel present, fires tend to slow down and burn cooler. Cooler fires are much easier to control.

For example, in a forest environment, fires that stay on the forest floor—surface fires—tend to be cooler, and hence easier to put out. Ladder fuel (understory trees and brush) connect the *surface fuel*[2] to the *canopy*[3] and, once ignited, this combination can support a *crown fire*[4]. Crown fires can move very quickly, burn very hot, and are much harder to put out. They also generate the most *embers*,[5] and can create *spot fires*[6] from a few feet to miles away depending on conditions. Embers and spot fires are often why homes burn and fires are difficult to control. One of the main objectives of being fire safe and creating defensible space is to minimize the chance of a fire becoming a crown fire, which will threaten your home, neighborhood, and community. Clearly, it is in your best interest to reduce the amount, type, and arrangement of fuel near your home to reduce the risk of a wildfire consuming it.

B.1. Before the Fire

B.1.1. Defensible Space and Home Survivability

Defensible space means creating a space around your structure so it can be defended from a wildfire. The US Forest Service defines defensible space as "an area either natural or manmade where material capable of causing a fire to spread has been treated, cleared, reduced, or changed to act as a barrier between an advancing wildland fire and the loss of life, property, or resources. In practice, defensible space is defined (in California) as an area a minimum of (100) feet[7] around a structure that is cleared of flammable brush or vegetation."[8]

Firefighters sometimes use the terms "winners" and "losers" (preferable terms are "defendable" and "not defendable") to distinguish between those houses with defensible space versus those that do not have it. In a larger emergency situation (where many homes are threatened), homes without defensible space may get passed over in favor of protecting those with defensible space, which have a greater chance of survival and offer

[1] Most of this document was written by Tracy Katelman, ForEverGreen Forestry (www.forevergreenforestry.com) and Marko Bey, Lomakatsi Ecological Services, Inc. (www.lomakatsi.org). Please credit appropriately.

[2] Surface Fuels: Materials on the ground like needles or low-growing shrubs that provide the fuel for fires to spread on the ground. Surface fuels are generally considered all fuels within six feet of the ground.

[3] Canopy: The top layer of a forest or tree, which is formed by leaves, needles, and branches creating a continuous cover.

[4] Crown Fire: A fire that spreads from treetop to treetop, and is characteristic of hot fires and dry conditions. Crown fires are generally more complex to control than fires on the surface.

[5] Ember: A piece of wood or a coal that is hot and glowing from fire activity, often dispersed by wind ahead of a fire. Also called firebrands.

[6] Spot Fires: A smaller fire outside the boundary of the main fire, started by airborne sparks or embers

[7] California now requires one hundred feet defensible space around your home, or to your property line; it used to be thirty feet. It may be necessary (although not legally required) to extend this space up to two hundred feet, depending on local conditions.

[8] www.fs.fed.us/r2/fio/dict.htm.

firefighters a safer environment. (The safety of firefighters is critical in structure protection. Homeowners should provide an inviting condition, especially in the Sierra where many fire departments are volunteer based; firefighters may be your friends, neighbors, or family members.) If it is too dangerous for firefighters to get in and out of an area, they are instructed not to risk their lives and equipment to save a home that is not defensible.

The Plumas Fire Safe Council promotes the concept of home "survivability."[9] It's not just about "defending" your space or home, but being fire safe in such a way as to ensure its survivability from fire. This is the ultimate goal for conservation-based fuel reduction and fire safety efforts; living with wildfire.

Defensible Space and Fire-Resistant Landscaping Basics

There are many simple steps you can take to create your defensible space. Homes ignite because of the little things—things that are easily ignited by embers, even when the fire has not arrived, or has already passed. The basics include:

- Providing a minimum of thirty to one hundred feet of clearance of flammable materials around your home. As you'll see later in this document, clearance does not mean dirt or gravel, it's about flammability. If you live on a hill, you should extend this up to two hundred feet, depending upon the steepness of the slope and the presence of surrounding fuel. *See B.1.1.3, Zones Practices Table, for more information.*
- Landscape your defensible space zone with fire-safe plants. While no plant is immune to fire, certain plants do exhibit traits that can slow or reduce the spread of fire. Most deciduous trees and shrubs are fire resistant. They generally look green (not brown), healthy, and vibrant. In addition, fire-resistant plants have:
    - leaves that are moist and supple;
    - little dead wood, and they tend not to accumulate dry, dead material within the plant;
    - sap that is water-like (versus thicker or stickier) and does not have a strong odor.[10]
      For more information on fire safe landscaping, please see "Fire-Resistant Plants for Your Landscape"[11] and "El Dorado County Fire Resistant Landscaping"[12] in Background D.
- Keep your gutters and roofs clean of vegetation and debris, especially pine needles.
- Move all flammable materials—especially firewood, propane tanks, etc.—at least thirty feet away from your home and any structures.
- Think about your home in terms of flammability. When you start a fire in a woodstove, small pieces of wood and paper are required to ignite the logs. The same is true for your home. Anything around your home that will ignite easily will threaten your home. It can serve as kindling for your house in the event of a fire. Look at your home and surrounding land with a new perspective. Shortly after removing dead vegetation and other flammable materials that may be adjacent to your home, you will begin to view the area with a different perspective. Objects that you didn't notice before as being a threat to your home will jump out at you. Think about if you would be comfortable if someone threw a match at your house.
- Remember the other critters who share the land. Leave a vegetation buffer around streams and other wildlife corridors. *(See the Conservation Principles, section 1.3 for more information.)*
- Spend a few hours reviewing your home and property with the Homeowner's Checklist (Background D*)*. Identify where you are safe and what other steps you need to take to protect your home and family. You can get free help with identifying fire safety and defensible space issues around your home. Contact your local fire department [telephone number], California Dept. of Forestry and Fire Protection, CAL FIRE [telephone number], US Forest Service [telephone number], US Bureau of Land Management [telephone number], or local Fire Safe Council [telephone number]. Any of these groups will gladly help you obtain a free fire-safety inspection for your home.

[9] Hurley, Jerry. Personal communication, 2003.

[10] Fitzgerald, Stephen, Waldo, Amy J. "Fire-Resistant Plants for Oregon Home Landscapes," April 2002.

[11] Plumas National Forest, www.plumasfiresafe.org/Documents/PNF_BRD%20Fire%20Resistant%20Plants.pdf.

[12] El Dorado County Fire Safe Council, www.edcfiresafe.org/fire_safe_vegetation.htm

Background D contains more detailed information on defensible space and fire safety, including resources for further reading, and Public Resources Codes 4290 and 4291, which are explained below.

B.1.1.1. The Home Ignition Zone

The *Home Ignition Zone*[13] is a concept introduced by Dr. Jack Cohen of the US Forest Service Rocky Mountain Research Station. Dr. Cohen's research of fires from the 1960s to the present has revealed that more than eighty percent of homes with at least thirty feet of defensible space and a fire-resistant roof have survived wildfires.[14] His research indicates that:

> The potential for home ignitions during wildfires including those of high intensity principally depends on a home's fuel characteristics and the heat sources within 100 to 200 feet adjacent to a home…. This relatively limited area that determines home ignition potential can be called the home ignition zone.
>
> During a wildland-urban fire a home ignites from two possible sources: directly from flames (radiation and convection heating) and/or from firebrands accumulating directly on the home. Even the large flames of high-intensity crown fires do not directly ignite homes at distances beyond 200 feet. Given that fires adjacent to a home do not ignite it, firebrands can only ignite a home through contact. Thus, the home ignition zone becomes the focus for activities to reduce potential wildland-urban fire destruction. This has implications for reducing home ignition potential before a wildfire as well as implications for emergency wildland-urban fire response strategy and tactics.…
>
> Because of time constraints, most preparation has to come before a wildfire occurs. Major changes to the home ignition zone (the home and its immediate surroundings) such as replacing a flammable roof and removal of vegetation … cannot occur during the approach of a wildfire. Removal of firewood piles, dead leaves, conifer needles, dead grass, etc., from on and next to the home should also occur seasonally before severe fire conditions. The ignition potential of the home ignition zone largely influences the effectiveness of protection during a wildfire. Given low ignition potential and enough time, homeowners and/or wildland-urban suppression resources can make significant reductions in the little things that influence ignition potential before wildfire encroachment. Then, if possible, homeowners and/or wildland-urban firefighting resources can suppress small fires that threaten the structure during and after the wildfire approach.[15]

The concepts forwarded by Dr. Cohen about the Home Ignition Zone are important to keep in mind when designing your defensible space and fuel reduction prescriptions.

B.1.1.2. Fire Safety Zones for Your Property

We can take the Home Ignition Zone and break it into four sub-zones. You can think of your property in terms of this set of zones. Use them to help you develop the appropriate treatment for each area around your property. See the table that follows this section for sample treatments organized by the Conservation Principles.

The concept of zones around your home has become popular recently. Several organizations have developed there own set of zones, such as: the California Fire Safe Council (firesafecouncil.org/education/attachments/landscapingtimberland.pdf), Firewise (www.firewise.org/resources/files/fw_brochure.pdf), and the California Board of Forestry (www.bof.fire.ca.gov/pdfs/Copyof4291finalguidelines9_29_06.pdf). All of the these and the zones identified below follow the same basic concept of increasing the intensity of your fuel reduction efforts the closer you get to the home or other buildings. The following zones were developed to implement practices consistent with the Conservation Principles identified in Section 1.3.

[13] Jack Cohen, "Wildland-Urban Fire, A Different Approach," www.nps.gov/fire/download/pub_pub_wildlandurbanfire.pdf, 2000.

[14] Firewise, "Wildfire: Preventing Home Ignitions" video, 2001, 19 minutes, www.firewise.org.

[15] Cohen, 2000.

The **Fire-Free Zone** is your home and five feet beyond. This is the zone immediately surrounding your home and should be made of concrete, gravel, or some other non-flammable surface. It can include irrigated plants if they are low-growing, well watered, and not touching your house. Remove any and all flammable materials in this zone. Paramount objectives of this zone are homesite protection and thorough fuel reduction activities.

The **Structural Protection Zone** extends from the Fire-Free Zone out to thirty feet. This is what CAL FIRE calls the "lean and green" zone. Remove flammable materials here as well. Keep all vegetation healthy and green. The objective in this zone is to keep all flammable fuels away from your home to facilitate fire protection. Similar to the Fire-Free zone, the paramount objective is to reduce or remove all fuels that could threaten your home.

The **Defensible Space Zone** extends from the Structural Protection Zone out to a distance of one hundred feet or more, or to your property line, whichever is greater. In this zone you will encounter more wildland characteristics and will need to begin to balance your fire safety and conservation goals. This area is the secondary fuel reduction zone. Both fuel reduction and forest health are objectives for this zone. Practices for this zone include: mowing grasses to three inches or less, keeping shrubs low and widely spaced (eighteen inches or less in height), and removing lower limbs at least ten feet off the ground or one-third the height of the tree (use the latter measure if the tree is less than thirty feet tall).

Finally, the **Wildland Fuel-Reduction Zone** is the last zone, extending from the Defensible Space Zone out an additional one hundred to two hundred feet or even much further. This is the zone where you will carry out wildland fuel treatment prescriptions; the objective is to aid in the health and productivity of your wildland while conserving natural values. Within this zone forest restoration work can be coupled with fuel reduction efforts for the long-term health, resiliency, and productivity of the more remote areas of your property.

See the Sierra Nevada Conservation Fire Zones Table on the following pages for a list of practices to apply to each zone based on the Conservation Principles. See Background C: Wildland Fuel Reduction for more details on the prescriptions for the areas further away from you home.

B.1.1.3. Sierra Nevada Conservation Fire Zones Table

Once you learn some of the basic fire safe practices, you are ready to expand them to include the Conservation Principles. The table below will help you apply these principles to each of the four zones on your property as identified above. *See the following sections, and Background C: Wildland Fuel Hazard Reduction for more information on techniques and terminology.*

Figure 1. Sierra Nevada Conservation Fire Zones Practices

Conservation Principle	**Conservation Practices and Considerations for Each Zone**			
	Fire-Free Zone ***House + 5 feet***	**Structural Protection Zone** ***5-30 feet***	**Defensible Space Zone** ***30-100 feet***	**Wildland Fuel-Reduction Zone** ***100 feet to property boundary***
1. Remember the Native Trees and Other Plants				
1A. Discover and monitor your forest and vegetation's dynamic changes.			- Assess native tree and plant species types on site. - Identify plant community types within your defensible space zone. - Prior to treatments document the condition of the plant community. - Identify natural fire breaks within this zone.	- Learn the name and boundaries of your watershed. - Identify natural firebreaks on and nearby your property.
1B. Act conservatively.	- Rake leaves, clear roofs and gutters after windy days.	- Continually prune dead branches and leaves from all plants.	- Clear dead branches and leaves on the ground, especially after windy days. - Limb up or prune lower branches 1-2 times/year before fire season. - Perform regular or annual maintenance on stump-sprouting species, and invasive noxious weeds that may move into the site.	- Return to previously treated areas every spring and repeat treatments as necessary. - Monitor and observe the previous work you have performed and evaluate the health and conditions of the forest. - Use the information you have learned and apply the lessons to other locations you may treat on your property. - Calculate the slope of your property to identify your recommended treatment area. For moderate slopes of 20-40% treat 100-200 feet, for steeper slopes treat to 200 feet or beyond.
1C. Protect native species that share your home.		- Plant fire-resistant and drought-resistant native species.	- Learn what plants are on your property and how they would respond to fire.	- Learn what plants are in your watershed.

Conservation Principle	Conservation Practices and Considerations for Each Zone			
	Fire-Free Zone ***House + 5 feet***	**Structural Protection Zone** ***5-30 feet***	**Defensible Space Zone** ***30-100 feet***	**Wildland Fuel-Reduction Zone** ***100 feet to property boundary***
		- Make sure there is plenty of space between plants so fire cannot move from one plant to another.	- Inventory and identify the different types of native plants and trees on your property. - Look for and protect areas where native plant diversity is abundant and isolate these areas during thinning, while still reducing fire hazards. - Retain a diversity and representation of all native species, including herbaceous patches. - Design your fuel reduction work to take into consideration the plant and forest types where you are working. - Favor leaving the species that are best suited for each location. - Enhance or maintain productivity of understory shrub and herbaceous vegetation. - Promote a high ratio of native grasses to forbs, and a high ratio of native forbs and ferns to shrubs. - Retain lichen and moss species variety, some mistletoe-infected trees, and some live trees with heart rot (conks). - Retain a significant component of hardwoods. - Generally favor early seral hardwood and softwood.	
1D. Keep the oldest and biggest trees.	- Remove all flammable objects from this zone, including brooms, woodpiles, garbage, etc.	- Clear most understory vegetation nearest to your home (ladder fuels). - Retain the healthiest and biggest trees in this zone. Thin under these trees very thoroughly to reduce ladder fuels.	- Start by removing the least healthy trees and shrubs. Create space around the healthiest ones. Don't do too much too quickly. - Initial Treatment Entry: Begin work by removing the smaller trees and shrubs. - Retain a diversity of types of trees and plants. - Treat a small section of your property. Then assess the work you have done; evaluate the untreated areas and compare that to the work you have done. - Following the initial light-touch entry, select more plants and trees that may need to come out and mark them for removal. Follow up with a second entry to remove those.	
2. Remember the Wildlife				
2A. Provide local wildlife a place to live.		- Initiate fuel reduction treatments with sensitivity to the needs of wildlife. - Remove more fuels closer to the homesite. As you move further away wildlife considerations will be more paramount.	- Balance the needs for wildlife and homesite defensible space through a site-specific evaluation of both. If certain wildlife habitat is abundant throughout your property, favor defensible space. If wildlife habitat is	- Identify wildlife habitat areas and treat them as mini islands, maintaining the cover and protection they need. - Leave clumps of vegetation for wildlife, especially in brushy areas. - Retain vegetation with evidence of use by wildlife (e.g. bird or woodrat nests, burrows, cavities, and hollows, etc.).

Conservation Principle	Conservation Practices and Considerations for Each Zone			
	Fire-Free Zone ***House + 5 feet***	**Structural Protection Zone** ***5-30 feet***	**Defensible Space Zone** ***30-100 feet***	**Wildland Fuel-Reduction Zone** ***100 feet to property boundary***
		- Isolate patches of live vegetation into clumps while still greatly reducing fuel hazards. - Following fuels treatment in this zone, bird and bat houses can be put on leave-trees or other locations to increase habitat and wildlife use.	rarer, protect that area and reduce the fuel in a circumference around it. - Identify some wildlife habitat areas and treat them as mini islands, maintaining their cover and protection. - Provide defensible space around any known wildlife habitat.	- Leave green islands of tree or shrub thickets (e.g. doghair conifer patches) for wildlife habitat throughout the stand. - Create repeating gaps of varying sizes and shapes to retain and create a diversity of habitat types for wildlife. This is in line with the Precautionary Principle.
2B. Provide access to food and water.		- Keep food and other wildlife attractants away from your house.	- Provide pure, clean water in ponds or fountains. Don't add any chemicals that could injure birds or wildlife.	- Leave forest cover around riparian areas for 50-100 feet from the water. - Retain as much canopy closure and vegetative cover as possible for ephemeral and perennial stream gulches. - Leave healthy hardwood trees and fruit-producing shrubs for food for local wildlife. - Retain sheltered connectivity and major game trails between selected vegetation retention areas.
2C. Protect future generations of wildlife.		- Keep pets away from nests and other wildlife habitat.	- Avoid defensible space treatments during the nesting or breeding season of local birds and other wildlife. - Avoid the use of herbicides that are lethal to wildlife. - We recommend non-chemical methods for managing plants, but if you are to use herbicides, hire a certified professional who understands application ratios that may minimize impacts on newborn or young wildlife. (This may be suited for all zones.)	
2D. Value the standing dead trees.		- If you have snags around your home reduce the height of these standing dead trees by removing all dead branches, leave the main trunk intact, and top the tree down to 10 ft. above the ground.	- Look at the size and proximity of snags to your home or other structures that you want to protect (such as large, old, live trees or wildlife nesting areas). Generally, the bigger the snag, the less likely it will ignite. If the snag were to fall, where would it land? If	- Identify where snags are in the surrounding landscape to help you decide whether to keep or remove snags closer to your home. If there is an abundance of snags, remove the smallest, most decayed ones. For those you leave, create defensible space around them.

Conservation Principle	Conservation Practices and Considerations for Each Zone			
	Fire-Free Zone ***House + 5 feet***	**Structural Protection Zone** ***5-30 feet***	**Defensible Space Zone** ***30-100 feet***	**Wildland Fuel-Reduction Zone** ***100 feet to property boundary***
			it would land on your house, you may need to remove it. - For those snags you will leave, create defensible space around them so they have a less likely chance to ignite during a wildfire.	- Around certain snags, retain live trees and shrubs in a circle surrounding the snag to provide cover and protection around them. In such areas, thin away from your leave trees by separating the fuel connectivity between patches. - Retain a wide variety of age, size, and decay classes, including dead and dying vegetation; retain some deformed, non-commercial trees (e.g. pistol butts, forked tops, poor live crown %, etc.) for genetic diversity and wildlife. - In areas where there are few snags, consider creating them by girdling trees. - Retain a diversity of different species of snags throughout treatment areas. - Within the snag retention areas, leave vegetative cover to shelter habitat zones. This should be done in relationship to location and site-specific factors, (e.g. 50% of snags are thinned around the snag, 50% are left with vegetative cover around them). - Retain groupings of snags for wildlife habitat complexity.
		- Snag heights can be reduced to less than 12 feet by topping and retaining them. Short snags can still have a habitat benefit for some wildlife. The risk of a larger snag falling on your home or throwing sparks can be greatly reduced by this method.		
2E. Conserve rare and endangered species.		- Find out if there are rare or endangered species on your property and what precautions you need to take to protect them and their habitat.		
3. Remember the Soil				
3A. Maintain the life in your soil.	- Keep water drainage away from your house. Don't concentrate water flow in any one place. - Impervious surfaces (such as concrete) are great for fire but not great for water flow and erosion.	- Don't use pesticides or other poisons that will kill soil life.	- When burning to dispose of slash, leave unburned areas. Protect soil resources by retaining some leaf litter, needles, and organic materials. - Retain scattered areas of ground fuels. - Retain coarse woody debris in selected locations. - Retain the large, downed-wood component. - Follow burning with the sowing of native grasses in the mineral-rich ashes and disturbed soils to reduce colonization by non-native species.	

Conservation Principle	Conservation Practices and Considerations for Each Zone			
	Fire-Free Zone ***House + 5 feet***	**Structural Protection Zone** ***5-30 feet***	**Defensible Space Zone** ***30-100 feet***	**Wildland Fuel-Reduction Zone** ***100 feet to property boundary***
3B. Ensure that your soil cover is fire safe.		- Encourage the growth of native perennial grasses over tall annual grasses.		- Retain large down woody debris for moisture retention, mychorrizal inoculation sites, and wildlife habitat. If there is no large down wood within your treatment location, combine and group smaller logs that you have cut. - Larger downed wood is very important. It can be buffered and protected by reducing surface and ground fuels around it. In wildland fire fighting, downed wood can be a safety zone because it absorbs water. It is also critical for soils, slope stability, and minimizing erosion. - Use the "kick test"–if it falls apart when you kick it, spread it out and away from your leave-trees, as it could ignite easily.
3C. Minimize erosion.	- Construct terraced log-crib planting areas to hold soils in place. - Plant fire-friendly landscaping, preferably native plants that are low-growing, to help prevent erosion. - Plant shorter-needled native bunch grasses, which are good for holding the soil.		- Design treatments and removal based on aspect, elevation, and how steep your slope is. They will vary depending on the exposure, moisture, and vegetation due to aspect, elevation, and slope. - Burning should be kept off slopes greater than 55%, especially around draws, headwalls, or where loose boulders may be found. Coarse woody debris can be lopped and scattered in these locations to protect soil and enhance slope stability. - On steep slopes, thin conservatively to retain root mass for slope and soil stability. - When thinning on steep areas, leave stumps high to use as stakes or anchors for contour-felled logs that will be left on the slope and assist in stability. - Retain the majority of the live trees along the toe of steep slopes. - On head slumps, contour-fall some dead trees to serve as down wood and soil anchors. - In snag field areas where there is severe conifer die-off due to disease, reduce snags and contour-fall the trees to serve as future nurse logs, as well as stabilization anchors.	
3D. Protect your soil after a fire.		- Sow native grass seeds into burned soils		

Conservation Principle	Conservation Practices and Considerations for Each Zone			
	Fire-Free Zone ***House + 5 feet***	**Structural Protection Zone** ***5-30 feet***	**Defensible Space Zone** ***30-100 feet***	**Wildland Fuel-Reduction Zone** ***100 feet to property boundary***
		- Use bark-chipped, native species organic mulch to cover disturbed soil - Limit the use of non-native straw as it will introduce invasive annual grasses which over the long term will create a fire hazard. - Place coarse woody debris on the ground to protect soil. Small logs from 4 " – 8" diameter are best suited. - Use erosion control fabric (Jute cloth) to capture soil movement. - Plant native low growing creeping plants to anchor soils.		
4. Remember the People				
4A. Plan your actions with your neighbors.	- Let your neighbors know about the locations of water and gas shut offs, and the location of any domestic animals, in case of a wildfire.		- Cooperate on roadside fuels treatments where multiple neighbors share easement access routes. - Collaborate and plan contiguous strategic fuels treatments with your neighbors that will benefit multiple residences during a fire. - Collaborate with your neighbors on ecological considerations and conservation issues that cross property ownerships. As an example, you may share a stream course or animal trail, or sensitive habitat for plants or animals on multiple properties. Communicate about these issues and work together to perform responsible fuels management. - Plan actions with your neighbors who may be located above or below you on a steep slope. Consider erosion that may be caused and affect your neighbors from your fuels work. Work together for solutions.	
4B. Find experienced workers and treat them well.	- Research forestry contractors before hiring them. Ask your neighbors who they have used and like. Talk to local resource professional for references. Make sure the contractors know the site-specific ecological considerations for the vegetation type on your property. - When hiring a forestry contractor, some questions you might ask are: Do the workers have workers compensation insurance in the event of injury on the job? What are the wages they earn? Do the workers get the legal on-the-clock breaks they are due? Do the workers have safety gear? Has the contractor ever been cited for workforce abuse issues? - One method is to hire a crew for a one-day trial period to evaluate their work performance. Following the one-day contract, evaluate how they implemented the treatment. Did they leave enough vegetation? Was the thinning too heavy or too light? Were they sensitive to retaining diversity and conservation priorities? - There are many forestry contractors; only some understand both fuel reduction and ecology. Be selective about who you hire.			
4C. Work with your local fire department.	- Make sure local fire fighters know where your water and gas shut-offs are located. Take the time to show fire fighters around your property outside of fire season, when there is little to no threat of wildfire. - Keep important information such as emergency phone numbers and your location (latitude and longitude or township, range, section if you do not have a physical address), near the phone in case of wildfire.		- Let fire fighters know about the location of any domestic animals and other important locations in this zone.	- Inform the fire department of the layout of your property. Highlight fire-suppression anchor points, spur roads, skid trails, snag locations. If you have the capability, you can use a GPS to outline this, then overlay it onto a map of your property. Keep this map near the phone in case of wildfire. - Inform the local fire department about

Conservation Principle	Conservation Practices and Considerations for Each Zone			
	Fire-Free Zone ***House + 5 feet***	**Structural Protection Zone** ***5-30 feet***	**Defensible Space Zone** ***30-100 feet***	**Wildland Fuel-Reduction Zone** ***100 feet to property boundary***
				any completed fuel reduction work.

B.1.1.4. Creating Defensible Space

The Fire-Free Zone, Structural Protection Zone, and Defensible Space Zone comprise the immediate one-hundred-foot buffer around the homesite. While ecological considerations regarding vegetation types will be considered, fuel reduction will be the paramount management objective here. The intention regarding treatment in these zones is to create a defensible perimeter around the home where a fire would decrease in intensity. These zones provide better opportunities for fire-suppression activities, thus maximizing the chances for protecting the home. Fuel treatments begin by reducing both live and dead fuels closest to the homesite and gradually *feathering*[16] the treatment, by thinning less vegetation as you move away from the homesite. The reduction in surface and ground fuels is a key objective for this area. This can be accomplished by seasonal rotations of isolated *patch under-burns.*[17] *(See Background C.2.1 for more information on burning.)*

Much of what you need to do comes down to common sense and an awareness of your physical surroundings. An important thing to know about fire in forested rural areas is the concept of *fuel ladder*s,[18] defined as a continuous line of vegetation from the forest floor into the canopy (or upper branches) of the trees. The concept of *fuel continuity*[19] is similar and includes both vertical and horizontal directions. Vertical continuity is the fuel ladder concept; horizontal fuel continuity thus means a continuous horizontal line of fuel (usually on the ground). In the latter case, the fuel extends from something—like your house—continuously out into the forest. A good example of this is seen with decks on steep slopes, where the edge of the deck is next to the crowns or tops of the trees (forest canopy). If a fire started either at the house or in the forest, it would have a continuous line of fuel to spread from one to the other via the deck.

An example of a fuel ladder (and vertical continuity) in a forested setting is grass and/or brush on the ground climbing up or leading into smaller trees, especially via the dead limbs, which reach up into the canopy of the taller or dominant trees. With this continuous ladder of fuel into the forest canopy, it is easier for a fire to climb into the trees and spread quickly. To avoid this—especially near buildings and along roads—reduce or remove the fuel ladder. The same is true for non-forested landscapes, the main difference is the height of the different vegetation layers.

To reduce forest-type ladder fuels, start in the forests within one-hundred feet of your home and along your roads. Remove brush on the forest floor (but don't scrape it clean or you could have erosion problems when it rains). Removing ground fuels does not mean removing everything growing on the ground. Rather, you can leave clumps of vegetation. The objective is to leave vertical and horizontal space between fuels (in this case, plants). *Limb up*[20] or prune young trees (remove the lower limbs to create open space between the tree canopy and the forest floor) to a minimum of fifteen to thirty feet above ground, or at least six to ten feet above the nearest vegetation.

Young, short trees should be pruned higher incrementally to reduce the chance of shock. A rule of thumb when *limbing*[21] trees is to leave at least one-half to two-thirds of the tree's height in live canopy so you don't harm the tree's ability to grow. You can remove more later, do it in stages so the tree has a chance to adapt. If you leave clumps of shrubs, create at least three times the shrub height in space before the bottom branches of the trees. For example, if you have a three-foot-high bush, leave nine feet of open, clear space (no vegetation) below the bottom branches of the nearby trees. The table below shows how much space you need to have between your

[16] Feathering: A process that reduces the appearance of change between treated and untreated sites by gradually softening the transition.

[17] Patch Under-Burns: A designated area, or vegetation patch, where fire is utilized to consume surface fuels but not trees and shrubs.

[18] Fuel Ladder: A ladder of vegetation from the forest floor into the canopy (or upper branches) of the trees that allows fire to climb upwards.

[19] Fuel Continuity: The amount of continuous fuel materials in a fire's path that allows the fire to extend in a horizontal or vertical direction.

[20] Limb Up: To remove the lower branches from a woody plant to create a defined space between the forest floor and the canopy.

[21] Limbing: Removing selected branches of a standing or fallen tree.

trees in your defensible-space area. The clearance suggested in this table is often too much canopy opening for wildland areas (because it will likely increase the amount of sun on the ground and encourage more shrub and herbaceous understory growth, increasing these fuels). See Background C for more information on appropriate practices in the Wildland Fuel-Reduction Zone.

Figure 2: Plant Spacing Guidelines for Structural Protection and Defensible Space Zones[22]

Plant Spacing Guidelines Guidelines are designed to break the continuity of fuels and be used as a "rule of thumb" for achieving compliance with Regulation 14 CCR 1299.		
Trees	**Minimum horizontal space from edge of one tree canopy to the edge of the next**	
	Slope	Spacing
	0% to 20 %	10 feet
	20% to 40%	20 feet
	Greater than 40%	30 feet
Shrubs	**Minimum horizontal space between edges of shrub**	
	Slope	Spacing
	0% to 20 %	2 times the height of the shrub
	20% to 40%	4 times the height of the shrub
	Greater than 40%	6 times the height of the shrub
Vertical Space	**Minimum vertical space between top of shrub and bottom of lower tree branches:** 3 times the height of the shrub	

Adapted from: Gilmer, M. 1994. California Wildfire Landscaping

In some places it is adequate to only *brush*[23] or clear or clean up an area. *Brushing*[24] entails removing brush alongside a road or structure to keep the ground relatively open. Removal of all dead materials—shrubbery, branches, etc.—is especially important. The idea is to remove anything that is particularly flammable from anywhere near an ignition source, such as you, your kids, your car, or your house. When brushing or removing fuel ladders, focus on the fine or *flashy fuel*[25] such as small sticks that will burn quickly.

If you remove the "kindling" around your larger fuel sources, chances are much greater those fuels will not ignite. When you are in your forest, make sure there are no concentrations of small sticks or brush right up against the trunks of trees.

Remember, defensible space and clearing does not mean that you denude or clearcut your property. Rather, your goal is to remove the most flammable materials. Balance your fire safety actions with general ecosystem health. Don't disturb the ground around streams or you will cause erosion that will harm fish. If you have the good fortune to live along a stream or river with fish in it, make sure you stay at least 25 feet away from the stream in your clearing activities within these zones, further in the wildland zone. It's OK to remove some or most dead vegetation there (like pruning in your garden). Don't take out live vegetation, especially trees, near streams and rivers. Always maintain a dense shade canopy for the fish. Finally, many species of wildlife—such as bear, fox, bobcat, songbirds, and others—use streams as corridors in which to move from one area to another. Leave them some cover to be able to do this without disturbing you, or vice versa.

[22] California Board of Forestry, General Guidelines for Creating Defensible Space, May 8, 2006, www.bof.fire.ca.gov/pdfs/Copyof4291finalguidelines9_29_06.pdf.

[23] Brush: To control and/or clear small woody debris.

[24] Brushing: The act of removing brush such as dead materials, shrubbery, and branches.

[25] Flashy Fuel: AKA fine fuels, such as grass, leaves, pine needles, ferns, moss and some kinds of slash which ignite readily and are consumed rapidly when dry.

Defensible Space Fuel-Modification Treatment Prescription

- Increase the distance between the ground and the live crown of trees by limbing branches (both dead and live) on all *leave-trees*[26] (i.e. "leave this tree") within the circumference of the one-hundred foot defensible zone. For larger trees, limb the branches at least ten to fifteen feet up the tree. For smaller trees, don't remove more than 1/3 of the live crown.
- When limbing larger branches, cut the limb in half, and then continue by cutting the remaining portion of the limb closer to the tree. Be cautious not to damage the tree trunk by cutting into the cambium layer. It is OK to leave branch stubs out from the tree. In some cases where aesthetics are not an issue, it is OK to leave portions of the branches sticking out as perches for birds. *See pruning diagram in Background C.*
- Reduce fuel connectivity and density in between individual shrubs and smaller trees by a minimum of ten feet. Thin from below within the *drip-line*[27] areas of desired leave-trees to reduce ladder fuels.
- Reduce ground and surface fuels.
- In following all these steps, retain ecological integrity, and perform treatments in a manner that is sensitive to the landscape.

Much has been written on fire safety and defensible space issues. Several documents and/or references such as the Homeowner's Checklist are contained in Background D. Remember, these treatments are for closer to your home. As you move further away from your home, your management objectives and actions will change. *See Background C for more information on appropriate actions in the wildland.*

B.1.1.5. Legal Requirements

California State Regulations

There are many legal regulations relating to fire safety and defensible space. Following are some of the most relevant and current state regulations.

Public Resources Code 4290

Public Resources Code (PRC) 4290 is a good summary of the basics of roads, driveway width, clearance, turnouts, turnarounds, signing, and water regulations related to fire safety. 4290 is usually enacted in legislation at the county level. Mendocino County has a good summary of 4290 regulations at www.co.mendocino.ca.us/planning/PermitPlace/PermitPlace77.htm. The following summary from the Sierra County Fire Safe Council and Community Fire Plan summarizes important actions for residents to take to meet 4290 requirements:

> a) Have proper identification of your home (street names and addresses) readable from a vehicle on the road.
>
> b) Maintain good access to your house for fire apparatus (wide enough for two vehicles to pass, built to carry at least 40,000 lbs., less than 15% grade, room to turn around, etc.).
>
> c) Provide adequate and reliable water storage (at least 2,500 gallons) with access for fire equipment.
>
> d) Use fire-resistant materials (metal, tile, or composition) for roofing.
>
> e) Enclose the underside of decks and balconies with fire resistive materials.[28]

See Butte Fire Safe Council's link: buttefire.org/Fireprevention/protplan/PRC4290inlinspectmast.pdf for a good 4290 checklist.

Public Resources Code 4291

[26] Leave Trees: Trees that have been selected to remain standing in an area of thinning or harvesting.

[27] Drip-Line: The boundary of a tree's canopy, generally estimated by the extent of the tree's outermost limbs and the circular moisture line formed when rainfall drips from the limb tips.

[28] Sierra Economic Development District. (2002) "Fuel Treatment Recommendations." *Sierra County Fire Safe Council and Community Fire Safe Plan.* p. 7-1.

The State enforces basic fire prevention principles through PRC 4291. "4291" as it's referred, regulates the amount of fuel you can have around your property. It is a good summary of the basics of fire-safing. It is the law that requires a minimum of 30 feet of defensible space. It was updated in September 2004 to expand some of the 30-foot defensible requirements to 100 feet. It states:

> (a) Maintain around and adjacent to the building or structure a firebreak made by removing and clearing away, for a distance of not less than 30 feet on each side of the building or structure or to the property line, whichever is nearer, all flammable vegetation or other combustible growth….
>
> (b) Maintain around and adjacent to the building or structure additional fire protection or firebreak made by removing all brush, flammable vegetation, or combustible growth that is located within 100 feet from the building or structure or to the property line or at a greater distance if required by state law, or local ordinance, rule, or regulation.[29]

CAL FIRE is the agency that enforces 4290 and 4291. They have the legal authority to require you to meet these minimum standards. If you refuse to do so, they can do it for you and charge you for it. For many reasons, it is to your advantage to meet these minimum standards set forth in 4290 and 4291.

Government Code 51175

This code defines Very High Fire Hazard Severity Zones and discusses its implementation. This was a result of the 1991 Oakland Hills fire and the resultant "Bates Bill" (AB 337).

> The purpose of this chapter is to classify lands in the state in accordance with whether a very high fire hazard is present so that public officials are able to identify measures that will retard the rate of spread, and reduce the potential intensity, of uncontrolled fires that threaten to destroy resources, life, or property, and to require that those measures be taken.[30]

CAL FIRE's FRAP is now using this information to:

> "provide updated map zones, based on new data, science, and technology that will create more accurate zone designations such that mitigation strategies are implemented in areas where hazards warrant these investments. The zones will provide specific designation for application of defensible space and building standards consistent with known mechanisms of fire risk to people, property, and natural resources."[31]

Government Code 51189

This code is a result of AB 1216 (Vargas) and directs the Office of the State Fire Marshal to create building standards for wildland fire resistance.

> (a) The Legislature finds and declares that space and structure defensibility is essential to effective fire prevention. This defensibility extends beyond the vegetation management practices required by this chapter, and includes but is not limited to, measures that increase the likelihood of a structure to withstand intrusion by fire, such as building design and construction requirements that use fire-resistant building materials, and provide protection of structure projections, including, but not limited to, porches, decks, balconies and eaves, and structure openings, including, but not limited to, attic and eave vents and windows.[32]

Information about Chapter 7A of the California Building Code (the WUI Building Standards) can be found at osfm.fire.ca.gov/WUIBS.html.

Board of Forestry Regulations

[29] PRC 4291 www.leginfo.ca.gov/cgi-bin/waisgate?WAISdocID=32907529051+0+0+0&WAISaction=retrieve

[30] California Government Code 51176.

[31] frap.cdf.ca.gov/projects/hazard/fhz.html

[32] California Government Code 51189, section a.

The Board of Forestry sets forestry and fire policy (overseeing CAL FIRE) for the State. In 2006, they adopted new defensible space guidelines.[33] These guidelines implement PRC 4291 and are titled "General Guidelines for Creating Defensible Space."[34] A link to this document is found in Background D, or directly at: www.bof.fire.ca.gov/pdfs/Copyof4291finalguidelines9_29_06.pdf.

The Forest Fire Prevention Exemption (from AB 2420) allows exemption from Timber Harvesting Plans and other related permits for logging of *merchantable*[35] trees for purposes of fire safety when several conditions are met, including potential projects identified in this plan. The link to this regulation is also found in Background D.

> The harvesting of trees in compliance with PRC §4584(k), Forest Fire Prevention Exemption, is limited to those trees that eliminate the vertical continuity of vegetative fuels and the horizontal continuity of tree crowns, for the purpose of reducing the rate of fire spread, duration and intensity, fuel ignitability, or ignition of tree crowns….[36]

The Mattole Restoration Council has a great summary and comparison of fire hazard reduction exemptions you can use for your fire-hazard-related forestry operations. See their "Forest Practice Rules for Thinning Exemptions," at mattole.org/pdf/Exemption_thinning_requirements.pdf, and "Comparison of Thinning Exemptions," at mattole.org/pdf/fire_hzrd_exemption_comparisons.pdf. They have also developed a model cost-share program to facilitate fuel hazard reduction on non-industrial private forestlands. For more information on that program, see mattole.org/program_services/forestry/fuelsreduction.htm.

Local and County Regulations

Many Sierra counties have local defensible-space regulations. Talk to your local elected officials, fire agency personnel, and planning departments to get a copy of any relevant regulations. Then summarize those here for your readers.

B.1.1.6. Fire Safe Building and Reducing Structural Ignitability

How your house is constructed is equally important to creating defensible space. The law now requires fire-safe construction for new construction in communities in the wildland-urban interface.[37] If you have a shake roof, your house is more likely to burn down from embers even if they have fire retardant; thus one of your first actions is to replace your roof. The roof is the most vulnerable part of your home to wildfires, during which *firebrands*[38] can land in your roof's nooks and crannies and easily start a fire there. Once your roof covering ignites, chances are very good that the rest of your home will follow.[39] Listed below are key issues of fire-safe structures:

- Shake siding on your house is much more prone to ignite than stucco or fiber or cement siding.
- Decks sticking out from your house act as kindling to your house for fires. If you have a deck, enclose the underside of it and your house (if it's a post-and-pier foundation, but leaving screened ventilation). Do this either with solid building materials or with lattice and tight ¼" screen with green, fleshy, well-maintained plants. This will give you much more storage space as well, since it is unsafe to store anything (especially firewood or cardboard boxes) under your house if it's open to the outside.

[33] www.bof.fire.ca.gov/pdfs/DefensibleSpaceRegulationsfinal12992_17_06.pdf

[34] www.bof.fire.ca.gov/pdfs/Copyof4291finalguidelines9_29_06.pdf

[35] Merchantable: Timber that is viable for sale under the current economic situation. This is generally determined by the part of the stem (trunk) that is suitable for timber products.

[36] www.bof.fire.ca.gov/pdfs/AB242010_28_05.pdf

[37] California Health and Safety Code section 13108.5.

[38] Firebrands: A piece of wood or a coal that is hot and glowing from fire activity, often dispersed by wind ahead of a fire. Also called embers.

[39] Firewise, "Is Your Home Protected From Wildfire Disaster? A Homeowner's Guide to Wildfire Retrofit," 2001, page 9, http://www.firewise.org/pubs/is_your_home/WILDFR2.PDF.

- If you have vents in your attic, make sure they are screened with ¼ non-corrosive metal (not vinyl). Enclose eaves, fascia, and soffits with screens. Embers can get into these places if they are not screened and burn your house down from the inside out.
- Make sure you have a ¼-inch mesh screen on all chimneys.
- Use double-pane or safety (tempered) glass on all windows.

For more information on making your home safe from wildfire, check out the University of California's Homeowners Wildfire Mitigation Guide at groups.ucanr.org/HWMG/index.cfm, the new WUI regulations osfm.fire.ca.gov/WUIBS.html, and "Is Your Home Protected From Wildfire Disaster? A Homeowner's Guide to Wildfire Retrofit," at www.firewise.org/pubs/is_your_home/WILDFR2.PDF.

The following information is taken directly from "Wildland-Urban Interface Ignition-Resistant Building Construction Recommendations," generated by the 2004 Community Wildfire Protection Plan Workshops, the California Fire Alliance, and the California Fire Safe Council, compiled by Ethan Foote of CAL FIRE.

> "One of the major objectives of wildfire control in general, and pre-fire management hazard reduction in particular, is to reduce the loss of life and property. The historical pattern of building loss during Interface fires indicates that vegetation fuel management must go hand-in-glove with ignition-resistant building construction to maximize the effectiveness of fire loss mitigation measures.
>
> "Building loss and survival in the 1961 Bel Air fire, which destroyed 505 houses, was well documented. The report 'Decision Analysis of Fire Protection Strategy for the Santa Monica Mountains' found that 71% of the buildings with 26-50 feet of brush clearance survived the fire. However, the survival rate of buildings exposed to the fire increased to 95% for houses that had both brush clearance and ignition-resistant building construction (in this case non-wood roof covering). A similar pattern was seen on the 1990 Santa Barbara Paint fire…. (Source: California's I-Zone: Urban-Wildland Fire Prevention & Mitigation, p. 120).
>
> "On the Paint fire, which destroyed 479 houses and major buildings, the survival rate was 86% for houses with both non-flammable roofing and 30 feet of brush clearance. Only 4% of the 438 houses surveyed in the Paint fire survived where non-flammable roofing and 30 feet of brush clearance were absent. The modeling of structure loss and survival on the Paint fire revealed that brush clearance alone only 'explained' or accounted for 11% of the variation seen in the structure survival patterns. When brush clearance was combined with roof type in the model, and the effect of defensive actions was accounted for, the model explained 59% of the variability in structure loss.
>
> "This is strong evidence that vegetation management alone will not be able to fully explain, nor mitigate, building loss on wildfires. Hence the need for the comprehensive approach in this plan, using a combination of vegetation management and addressing recommendations for ignition-resistant building construction. There is also strong evidence that this comprehensive approach will work to significantly reduce Interface losses. The *Los Angeles Times* (1 April 2004) reporting on the Southern California conflagrations of October 2003 clearly revealed the need for, and effectiveness of, combining vegetation management and ignition-resistant building construction for reducing building loss in wildfires:
>
>> 'Amid the ashes of the most costly wildfires in California's history lies evidence of a crucial lesson: Fire-resistant construction and vigilant removal of flammable vegetation significantly improved the odds of a home's survival, according to a *Times* analysis of fire records from more than 2,300 destroyed structures.
>>
>> 'The impression left by an out-of-control fire racing through communities can be one of random destruction, with one house, or a whole block, burned to the ground and the next one spared for no apparent reason.
>>
>> 'In fact, according to the *Times* analysis—which covered homes destroyed by the deadliest of the blazes, San Diego County's Cedar fire—houses built since 1990 were far less likely to burn than those constructed in any previous decade. Houses built during the 1990s were damaged or destroyed at less than half the rate of houses built earlier.'

"The communities and homeowners covered by this plan have, for the past 40 years, had recommendations that can be (and have been) taken to reduce the ignitability of structures. An outcome of the 1961 Bel Air fire was publication of the 'Fire Safety Guides for California Watersheds' by the County Supervisors Association of California in 1965. These recommendations have been updated through the years. The current version of these 'Fire Safe Guides' is 'Structural Fire Prevention Field Guide for Mitigation of Wildfires' and can be found at osfm.fire.ca.gov/structural.html.

These recommendations for ignition-resistant building construction include:

- Roofing
- Eaves and Balconies
- Exterior Walls
- Rafters
- Windows
- Doors
- Attic Ventilation Openings
- Underfloor Areas

"In response to the persistent loss of life and property in wildfires, the most important of the recommendations is now a requirement. All new buildings, and significant re-roofing of existing buildings, in the communities covered by this plan are required to have ignition-resistant roofing (California Building Code §1503). The State of California is also in the process of promulgating changes to the state building code expanding the interface roof requirements and including new requirements addressing exterior wall construction, vents, and ancillary structures."[40]

These recommendations became law in 2003, work on the related Wildland-Urban Interface Building Standards have been completed and have recently been adopted by the California Building Standards Commission. For the latest information on these Standards, see osfm.fire.ca.gov/WUIBS.html.

B.1.2. Water Supply

The amount of water you have stored will have a significant impact on the ability to fight a fire at your home. 2,500 gallons of water storage for fire fighting is the minimum required for new construction. Storing water in the winter for use in the summer and fall and conserving water are both critical in this Mediterranean climate. There are many options available in terms of water tanks. Ideally, you should have a dedicated fire-fighting water tank, with a fire-ready standpipe, and a separate tank for domestic use. If you cannot do this, put your domestic water line out of your water tank in the middle of the tank, so you don't accidentally drain your tank into the garden or elsewhere, keeping the bottom half for emergency use. Combined water storage is allowed as long as the minimum 2,500 gallons for fire department use is always maintained. Typically, this requires plumbing the domestic water flow line above the 2,500-gallon mark of your tank.

Check with your local fire department, and other firefighting agencies (e.g. CAL FIRE, FS, BLM, NPS, etc.) re: their preferred hose thread size. You will also find this information from the surveys of fire agencies done for Appendix 6.

Your fire water line should be a two- or four-inch line, buried 12-18 inches below ground. An above-ground plastic water line will likely burn in a fire, but a full plastic water tank probably will not. Put a metal standpipe at the end of the water line with a [2 ½-inch] fire hose threaded adapter so firefighters can quickly attach to your water source. Fire hose thread is known as national thread, national standard, NST, NSFH, NH, or FHT. The [fire agency name] prefers [thread size] fire hose.

Your water tank can be located anywhere on your property. However, the fire department connection must be located no closer than four feet and no further than twelve feet from the roadway. Make sure that your standpipe is somewhere a fire truck can access it and turn around to leave. If it's not accessible, it's not going to be very useful. The roadway must be wide enough to accommodate the fire apparatus without blocking it. Fire engines generally need 12 feet wide by 15 feet high clearance, and a 60-foot T or 40-foot circle to turn around for safe retreat. Finally, make sure your local firefighters know where your tank is exactly located, before any fires.

[40] Foote, Ethan. (August 2004). "Wildland-Urban Interface Ignition-Resistant Building Construction Recommendations." Community Wildfire Protection Plan Workshops. California Fire Alliance and the California Fire Safe Council.

In an emergency, swimming pools and ponds provide a great source of water. Firefighters can *draft* [41] directly from these sources if they can get close to them. If you are going to depend on this water as your first response to a fire, you will need a pump and a generator for back-up. Often when there is a large fire the power will go out. Therefore, the generator will be needed to pump water from your pool or pond.

While ponds are ideal for storing large amounts of water for fire fighting, they must be properly sited to avoid erosion. Ponds built on unstable ground can give way, leading to large washouts and gullying, choking streams with sedimentation, in turn harming fish habitat. Ponds should be built on stable ground, have adequate overflow protection, and should not be built across seasonal or perennial creeks. Also, please remember that ponds can breed nuisance species such as bullfrogs, mosquitoes, and non-native fish that can harm native salmon and steelhead.

Confirm your local regulations regarding water storage and gray water and describe those in the following paragraphs.

There are more and more options for inexpensively storing water. Cisterns—a catchment to collect rainwater—are becoming increasingly popular. Several websites describe how to make one yourself—start with a search for "cistern." Low-cost water tanks are also available. The easily transported Pioneer Tanks from Australia are now seen throughout the US (www.pioneertanks.com.au).

The use of gray-water systems is an alternative method for watering yards and vegetation to conserve your water. A gray-water system is where water is collected after a non-contaminating use such as the kitchen sink or washing machine, and stored and used for irrigation. For more information on safe and sanitary gray-water systems, see www.oasisdesign.net/greywater/ or www.greywater.com/.

B.1.3. Roads and Access

Roads are critical components in the fire equation. They are a great place for a *fuelbreak*.[42] They are also critical for evacuation and for firefighters to reach your home. As mentioned above, minimum clearance requirements along your roads for a fire engine to safely pass are 12 feet wide by 15 feet high, in addition to fuel reduction treatments of at least 15 feet on both sides of the road. You also need plenty of places on the road where vehicles can pass each other, i.e., adequate turnouts properly designed and spaced along your access road or driveway. If a wildfire is threatening and a fire engine is trying to get to your residence or business while you're trying to evacuate, there need to be areas in the road wide enough to accommodate traffic from both directions. Remember, when a wildfire is threatening, chances are it will be very dark and smoky, thus very disorienting. Take the time now to make it easier on yourself should that event actually occur.

A fire engine needs to be able to turn around to leave. If they cannot safely get the engine in and out, that makes your home less defensible, as most firefighters will not and should not unnecessarily risk their equipment or lives to protect your property. Firefighters will almost always turn around immediately when they arrive to a fire for safer and quicker escape.

This is good advice for you too. Get in the habit of parking your vehicle(s) facing out at home so you can leave quickly if necessary. If you have locked gates, they will very likely be cut by firefighters. If you don't want that to happen, make sure you leave your gates unlocked. If you have electric gates, make sure they have a back-up power source or other way to open when the power is out, which is likely during a large wildfire. Additionally, bridges need to be evaluated for safe fire truck passage as per PRC 4290. Generally, if a propane or other fuel or water truck can make it across the bridge, then a fire truck can. If you have a bridge that will not safely carry a fire engine, you must contact your local fire department and let them know. Don't make their job any more dangerous than it already is. Instead, help them to help you.

Finally, many private dirt roads can become nearly impassable after a rough winter. Maintaining your dirt and gravel roads is important for many reasons, including not only keeping dirt out of streams, but ensuring a safe evacuation in an emergency. If several households share the same road, consider rotating the responsibility for

[41] Draft: Using the forces of suction to draw water from ponds, swimming pools, or other bodies of water. This technique utilizes a partial vacuum formed by a suction pump and atmospheric pressure. The water is then moved where it is needed.

[42] Fuelbreak: A strategic area where fuel volumes have been intentionally reduced to slow down a fire and reduce its flame lengths and intensity; as distinguished from fire breaks where all fuels are removed to bare mineral soil for fire suppression.

coordinating road maintenance every few years. The identified coordinator can collect an agreed-upon annual assessment from all those who regularly use the road, and organize the maintenance.

Fuel Treatments along Roads and Driveways

Fuel treatments along driveways and road systems should be considered a strategic high priority. While ecological concerns regarding vegetation types will be considered, fuel reduction will be the primary management objective. The main objective for *ingress-egress*[43] corridors is to create a defensible perimeter along and adjacent to all roads and driveways. These access routes are also where a fire would decrease in intensity and provide safer access opportunities for fire-suppression activities by firefighters.

Roads can be a potential ignition source for wildfires (from vehicles and people). When treated, they serve important functions as natural fuelbreaks, and also *anchor points*[44] for tactical fire-suppression activities. Thus, treatment of these areas is a top priority in any fuel management strategy. Treatments along these driveways and road corridors will also benefit multiple landowners in the event of a wildfire; thus they provide an opportunity for community planning and collaboration. The neighbors who use these travel routes to access their homes can also be educated on the importance of fuel-reduction activities in the event of a wildfire evacuation scenario.

Roads and Driveways Fuel Modification Treatment Prescription

- Retain larger trees while aggressively thinning understory vegetation in the area 100 feet from roads and driveways.
- *High-Prune*[45] all branches that are hanging over the road up to 15 feet above the ground.
- Reduce standing dead trees (snags) directly along roadways. Some dead standing trees may be retained by reducing the height of the snag to 12 feet, through tree surgery work; accomplished by climbing, topping, and chunking-down sections.

B.1.3.1. Signage and Addressing

Check into county and local regulations regarding road signage and house addressing. Talk to your local fire department to see if they have any signage programs. Describe any such local regulations or programs here.

Chances are firefighters are not going to know where you live, especially in the case of a large fire where out-of-town firefighters are present. Make sure you have a visible road and address sign. If you have a visible address sign on your house and/or driveway and a road sign at the street, emergency service personnel (fire, ambulance, police) will likely find it. If not, they may not. Work with your local fire department if you have specific questions regarding how to do this most effectively and to their standards. Your sign should be of reflective material so that it is visible at night and non-flammable (metal on metal post). If you want emergency personnel to be able to find you, do your part. In a medical emergency a few minutes may be the difference between life and death.

Not only is this a smart practice, it's the law. In the California Code of Regulations, Section 1270 Title 14: SRA Fire Safe Regulations, Subsection 1274 states:

> To facilitate locating a fire and to avoid delays in response, all newly constructed or approved roads, streets, and buildings shall be designated by names or numbers, posted on signs clearly visible and legible from the roadway. This section shall not restrict the size of letters or numbers appearing on street signs for other purposes.

It goes on to further say that the letters must be at least 3" high and 3/8 stroke, reflective, and of a contrasting color to the sign background. Additionally, they need to be visible from both directions for at least 100 feet.[46]

[43] Ingress-Egress: Roads and other avenues to enter and leave your property. The act or right to come in, or go through as in entering a property (ingress). The act or right to, depart or go out as in exiting a property (egress).

[44] Anchor Points: The point at which firefighters begin fire line construction, usually blocked from the spreading fire to protect firefighters from harm.

[45] High-Prunning: Cutting of both the dead and live branches ten to fifteen feet from the base of the tree (height to live crown). This is done on larger trees to separate the fuel connectivity from the ground to the crown of a tree.

[46] osfm.fire.ca.gov/pdf/fireengineering/structural/AppendixL.pdf, pp. 15-16.

A number of Sierra communities have already accomplished this easy, inexpensive, task to fix an existing problem. Often local fire departments buy the supplies and make the signs to sells to homeowners.

B.2. During the Fire

Fire can be extremely frightening. However, taking steps now to prepare you, your family, and your home will make it easier to survive a fire, and it will likely reduce panic and help you to effectively deal with the situation. Even the most organized of us will forget something when a crisis moment arrives. Create easy-to-follow checklists for your family to use to safely survive a wildfire.

Figure 3 on the following page, from "Living with Wildfire," Pacific Northwest Wildfire Consulting Group (pnwfireprevention.com/LWF/Livingwithfire.pdf), can be copied and posted somewhere prominent in your home or with your emergency preparedness kit. It is a great summary of what to do when fire strikes.

Figure 3. When Wildfire Approaches Checklist[47] (next page)

[47] Living with Wildfire, Pacific Northwest Wildfire Consulting Group, pnwfireprevention.com/LWF/Livingwithfire.pdf.

WHEN WILDFIRE APPROACHES

Should homes be threatened by wildfire, occupants may be advised to evacuate to protect them from life-threatening situations. Homeowners, however, do have the right to stay on their properties if they so desire and so long as their activities do not hinder fire-fighting efforts. If occupants are not contacted in time to evacuate or if owners decide to stay with their homes, these suggestions will help them protect their properties and families.

- ☐ Evacuate, if possible, all family members not essential to protecting the house. Evacuate pets as well.
- ☐ Contact a friend or relative and relay your plans.
- ☐ Make sure family members are aware of a prearranged meeting place.
- ☐ Tune into a local radio station and listen for instructions.
- ☐ Place vehicles in the garage, have them pointing out, and roll up windows.
- ☐ Place valuable papers and mementos in the car.
- ☐ Close the garage door but leave it unlocked. If applicable, disconnect the electric garage door opener so that the door can be opened manually.
- ☐ Place combustible patio furniture in the house or garage.
- ☐ Shut off propane at the tank or natural gas at the meter.
- ☐ Wear only cotton or wool clothes. Proper attire includes long pants, long-sleeved shirt or jacket, and boots. Carry gloves, a handkerchief to cover face, water to drink, and goggles.
- ☐ Close all exterior vents.
- ☐ Place a ladder near[48] the house so firefighters have easy access to the roof.
- ☐ Make sure that all garden hoses are connected to faucets and attach a nozzle set on "spray."
- ☐ Soak rags, towels, or small rugs with water to use in beating out embers or small fires.
- ☐ Inside, fill bathtubs, sinks, and other containers with water. Outside, do the same with garbage cans and buckets. Remember that the water heater and toilet tank are available sources of water.
- ☐ Close all exterior doors and windows.
- ☐ Close all interior doors.
- ☐ Open the fireplace damper, but place the screen over the hearth to prevent sparks and embers from entering the house.
- ☐ Leave a light on in each room.
- ☐ Remove lightweight and/or non-fire-resistant curtains and other combustible materials from around windows.
- ☐ If available, close fire-resistant drapes, shutters, or Venetian blinds. Attach pre-cut plywood panels to the exterior of windows and glass doors.
- ☐ Turn off all pilot lights.
- ☐ Move overstuffed furniture (e.g. couches, easy chairs, etc.) to the center of the room.
- ☐ Keep wood shake or shingle roofs moist by spraying water. Do not waste water. Consider placing a lawn sprinkler on the roof if water pressure is adequate. Do not turn on until burning embers begin to fall on the roof.
- ☐ Continually check the roof and attic for embers, smoke, or fire.

If a fire should occur within the house, contact the fire department immediately. Continue to inspect your house and property for embers and smoke.

Most importantly, STAY CALM!

[48] Not a wooden ladder! Put it on the ground near the house so it does not act as a fuel ladder for the fire to climb up your house.

Conserve your water. Save it for when the fire is at your house, or the fire has passed. This is when you may need it to put out any embers or sparks. Remember that if the power goes out and you use a well system with a pump, you won't have water unless you have a backup generator. Therefore, fill bathtubs and any available containers to store water. Make sure that all backup generators have an approved crossover switch, installed by a Licensed Electrician so that when the power company is fixing downed lines, you don't kill a lineman with your generator.

If you have any experience or training in fighting fire, create a fire-fighting tool area that is easily accessible. Keep this in a non-flammable structure, such as a metal shed or your garage. Your collection should include tools such as shovels, hoes, Pulaskis, McLeods, etc. Keep a set of fire-fighting clothes there as well, including heavy cotton or wool clothing and leather boots and gloves. Put a fire hose at your water source and mark it well so you, your neighbors, and/or firefighters can easily find and use it.

Another very important thing you can do to protect your property in the case of a fire is to be fully prepared for the eventuality of fighting a fire at your home. Create a map of your property that shows where the most valuable structures and other resources are. Mark on your map the location of your water sources, where your gas/propane/diesel tanks and shut-offs are located, and any other highly flammable or explosive materials. Include locations of any locked gates and the combinations to those gates. Also include locations of any pets or livestock. Put your name, phone number (and/or CB handle), street address, and parcel number or *GPS*[49] coordinates on this map. Put a copy on the wall by a phone (or CB radio), with the number of your local fire department so you can use it in case of an emergency. If you desire, put it up somewhere near the entrance to your property where firefighters can see it, perhaps with your visible fire-fighting tools. Check with your local fire department to see if they want a copy. Or better yet, invite them out to your property (not during fire season) to review this and show them where everything is. This will help them effectively protect your property in case of fire. If you are concerned about security issues, you can talk to your local fire department to work out a compromise that will meet your confidentiality needs while making their job easier to defend your property if and when the day comes.

Remember to call 911. In the midst of the excitement and panic of a fire, and attempts to extinguish it, it is possible to forget to call 911, which alerts firefighters. Should the time come that you do have to call 911, give your address (which must be visibly marked on the road so firefighters can find your home) or GPS coordinates if you have them. If you live in a remote area, tell the dispatcher at 911 the name of the closest local fire department, if you are absolutely certain of it, as dispatchers are often located in more urban areas and may not know your local geography.

After you call 911, go to the bottom of your road, and either have someone stand there or put up a non-flammable flag or some sign to let firefighters know where the emergency is and the way to your house. The easier you can make it for the firefighters, the greater your chance of surviving a fire.

B.2.1. Evacuation

Be ready if you need to evacuate. Have everything you need packed beforehand. Some residents in high fire-risk areas move their valuables to a safer location during fire season. Identify alternate evacuation routes and drive them now so you know them well. Do this in the dark too so you will be comfortable during a large fire, where visibility can be very low. Know at least two ways out. Make sure you are comfortable with both routes. Have keys or combinations to locked gates in your vehicle. Turn on your headlights, and drive SLOWLY and carefully. There could be many people trying to leave and/or firefighters and other emergency service personnel trying to enter to protect you and your house. Sometimes your safest or quickest evacuation may be on foot. Know those routes too; make sure your friends, family, and local firefighters know that you may be on foot during a wildfire. *For more information on evacuation, see CAL FIRE's evacuation information in Background D.*

B.2.2. Shelter in Place

The safest place to be in a fire may be in your house. In Australia and New Zealand, people are recommended to stay at home. Their motto is "Prepare, Stay, Defend." Their fire protection strategies are developed around this plan. Many people die trying to evacuate, far more than die from the fire itself. As well, if you are at your home, you can put out any small fires that start around your property from embers and sparks, which can travel over a

[49] Global Positioning System: A hand held navigational device that uses satellites to determine positions on the earth.

mile from a large fire. This is the concept of "Shelter in Place." You should only shelter in place at your home if you have good defensible space there and are prepared to stay for whatever length of time necessary.

Often an area is designated for evacuation days before the fire actually gets there due to the potential for a rapid fire advance. If you decide to shelter in place and then (for example) leave for provisions two days into the evacuation order (because the fire is still not there), you may not be able to return. Law enforcement often closes an area for entry once an evacuation has been ordered. Therefore, to shelter in place you must also consider logistical issues such as water, sewer, electricity, etc., for the duration of your stay.

Don't be surprised if fire fighters are hesitant to let you shelter in place. Residents often do not have the proper equipment or training to do this and liability issues can arise. It is often very difficult to know what the right thing to do is as the fire approaches. Be prepared. Talk to your local fire fighters now to develop a plan.

B.2.3. Safety Zones

If you are unable to evacuate by road, know where your nearest "safe or safety zones" are. (Safe zones are identified on each community map in Project File 2). A safe zone is where you can go (other than your house) to shelter in place. These are locations where you and your family can survive a fire without any special equipment or clothing if your home is not safe (although your home is often your safest place). Safe zones are also used as staging areas but usually do not provide any services. Steep creek channels are not a good place to seek refuge, as fire travels faster in steep canyons. The fire will consume the oxygen there ahead of the flames and you could suffocate before the fire arrives. Instead look for big open fields, large river bars, wide-open graveled or paved roads, or an open area that has already burned. This area should be four times wider than the fire's flame lengths *(see the fuel models for various vegetation types in Appendix 3 for typical flame lengths).* Talk to your local fire department about potential safe zones, and see the map for each community in Project File 2, so that you are familiar with the area now.

Safe zones for residents are different than those for firefighters. Do not attempt to shelter in a firefighter safety zone if you are not actively fighting the fire.

If an evacuation is ordered or you are sent to a safe zone, you will be notified of where to go by local law enforcement. Some safe zones may be used as the Emergency Operations Center and hence should be avoided so as not to interfere with the success of fire-suppression efforts.

B.2.4. Preparing Pets and Livestock

If you have pets and/or livestock, take the time now to plan for how best to ensure their survival. The following text of a brochure, "Disaster Preparedness for Dog and Cat Owners," is from the California Department of Food and Agriculture. Similar brochures are available regarding birds, horses, and livestock. These can all be found at: www.cdfa.ca.gov/ahfss/ah/disaster_prep_Brochures.htm.

> **With a little advance planning, you can save your pet's life in a disaster.**
>
> **Before**
>
> PLAN AHEAD. In the event of an evacuation, pets may not be allowed inside human emergency shelters. Determine the best place to leave your pet in case of a disaster. Identify an off-site location as well as a place in your home.
>
> IDENTIFICATION AND PHOTOGRAPHS. Dogs and cats should always wear properly fitting collars, personal identification, rabies, and license tags. Make sure all the information on the tags is current. Keep a current photo of each pet. Make sure any distinguishing markings are visible. You will need proof of ownership to retrieve your pet from a shelter.
>
> DISASTER KIT. Maintain a disaster preparedness supply kit for each of your pets.
>
> PAPERWORK AND RECORDS. Store important animal documents in a zip-lock or waterproof plastic bag. These should include vaccination and medical records.
>
> VACCINATIONS. Your pets need to be current on vaccinations. You will be required to show proof of vaccination if you need to board your pet.
>
> TRANSPORTATION. Each animal should have their own pet carrier. Familiarize your pet with the carrier or cage before an emergency.

LEASHES AND COLLARS. Keep a leash handy for each dog and cat in your home. Consider using a harness.

BUDDY SYSTEM. In case you are not home when disaster strikes, ask a trusted neighbor to check on your animals. Exchange veterinary information and file a permission slip with your veterinarian authorizing them to get emergency treatment for your pet if you can't be located.

During

IF YOU TAKE YOUR PET:

Evacuate your pet early, if possible.

Take your disaster preparedness kit, including the pet's vaccination and medical records, as well as identification photographs.

IF YOU CAN'T TAKE YOUR PET WITH YOU:

Bring your pet indoors. Do not leave pets chained outdoors.

Prepare a pre-selected site indoors for your pet. Use a room with no windows but adequate ventilation, such as a utility room, garage, bathroom, or other area that can be easily cleaned. Do not tie them up.

Leave only dry foods and fresh water in non-spill containers. If possible, open a faucet to let water drip into a large container or partially fill a bathtub with water.

Do not leave vitamin treats, which could be fatal if over-eaten.

House cats and dogs separately, even if they normally get along.

<u>What about pets other than dogs and cats?</u>

Plans for birds and reptiles can be found in the brochure: Disaster Preparedness for Bird and Reptile Owners

Small mammals, or pocket pets, should be transported in carriers suitable for maintaining the animals while sheltered. Remember to take bedding materials. Keep animals in a quiet, safe place.

After

Pet behavior may change after an emergency. Monitor your pets closely and keep them leashed. Familiar scents and landmarks may be altered, causing confusion and abnormal behavior.

Be aware of downed power lines, fallen trees, debris, and local wildlife.

If you find a pet, call animal control or any emergency phone numbers set up after the disaster. Isolate it from your animals until it is returned to its owner, or can be examined by a veterinarian.

IF YOU'VE LOST YOUR PET:

Visit each shelter in your area at least once every other day. You must check the shelter in person; you are the only person who can truly identify your animal. Keep a current photo of your pet showing or describing any distinctive markings.

Create a flyer with your pet's photo and description, pet's name, your name and phone numbers where you can be reached.

When you do find your pet, immediately examine it for illness or injuries. Obtain medical attention from your veterinarian if needed. Use caution when handling animals. Panicky or injured animals may bite.

Practice Your Plan!

Disaster Preparedness Kit

- Pet carrier or cage for each pet
- Two-week supply of food and water
- Non-spill food and water bowls

- Medications and dosing instructions
- Pet first-aid kit
- Vaccination and medical records
- Your veterinarian's information
- Cat litter box and litter
- Newspaper
- Plastic bags for waste disposal
- Paper towels
- Disinfectants
- Leash and collar/harness
- Blankets
- Toys and treats

Be sure to provide your pets with as many amenities as possible.

Remember, they are counting on you for their survival and support!

Emergency Contact Information

You will need to have your emergency contact information in one easily accessible place. This information is different in every county.

By filling in the information below, you will be prepared to reach the key animal disaster resources in your county.

Office of Emergency Services County Animal Coordinator:

County Animal Control: [50]

B.3. After the Fire

As a landowner living in the Sierra Nevada—where the ecosystems are naturally prone and dependant on frequent wildfires—there is a good possibility that a fire may eventually occur on your property. If fuel modification measures have been taken prior to the fire, the intensity of the fire will likely be less severe. Regardless of whether you have performed fuel hazard treatments or not, varying degrees of land restoration and post-fire impact mitigation measures may need to be taken. After the fires are finally put out or have burned out, the important step of healing the land will need to take place.

If a fire does occur on your land the first post-fire step is to assess how severe the fire burned. Did the fire burn at a low, moderate, mixed, or high severity? In certain situations, such as with low fire intensity, wildfire may have achieved very positive results to reducing your fuel loads and benefiting natural processes. This includes burning through the understory and occasionally scorching individual trees, but not becoming a crown fire. In addition to reduced fuel loads, the wildfire may have performed a great service by increasing the structural diversity on your land and achieving great benefits to the local ecology and wildlife habitat through snag creation.

> "Fire-killed snags and logs serve vital roles in the structure and function of healthy forest ecosystems in general, and are especially important for natural recovery processes following fire events. They provide food and shelter to wildlife, fish, and numerous insects, microbes, and fungi that are vital to post-fire recovery and long-term site productivity, they help retard surface water runoff and help retain and build soil, they help cycle nutrients and water to plants and soil, and snags that fall across streams provide links between terrestrial and aquatic ecosystems."[51]

Wildfires that burn at high intensity can negatively affect soils and kill all of the overstory trees. This is known as a stand replacement fire. Moderate and mixed severity fires will burn hot in certain locations and these locations may need some restoration. Often, post-fire restoration efforts will focus on mitigating the impacts of fire suppression activities such as back burns and the firebreaks created by heavy equipment during emergency fire fighting. If a wildfire has burned through your property without fire suppression activities having taking place, the end result of that fire may be a positive one; nature may accomplish its own healing process with a little bit of assistance from you.

[50] "Disaster Preparedness for Dog and Cat Owners," Animal Health and Food Safety Services, Animal Health Branch, 1220 N Street, Room A-107, Sacramento, CA 95814, (916) 654-1447. www.cdfa.ca.gov/ahfss/ah/disaster_prepared_dogs_cats_owners.htm, October, 1998.

[51] Salvaging Timber; Scuttling Forests, The Ecological Effects of Post-Fire Salvage Logging, Timothy Ingalsbee, Ph.D. 2003. Western Fire Ecology Center, American Lands Alliance, www.fire-ecology.org/research/salvage_impacts.html.

Wildfires that have burned at high severity may have dangerous adverse effects to watershed health and pose extreme safety issues to local communities. Water erosion is one of the main concerns. Mountainsides that are completely burned, with all of the trees and vegetation gone, will not have the ability to hold back or absorb water (e.g. rain). Burned up hillsides may turn hydrophobic, where the ground is sealed and repels water instead of absorbing it. In these situations the potential for catastrophic events like landslides—where entire hillsides can turn to liquid and move downslope—are possible.

In addition to slope instability, invasive species can take hold after fire, changing the ecological balance for decades. Areas in the eastern Sierra are more prone to this type of weed invasion. Species like cheatgrass, an annual weed, will take over and out compete native grasses and plants. Once established, cheatgrass increases future fire risk as it is highly flammable and carries fire very well; this increases the likelihood of more fires and in turn more weeds to perpetuate this cycle long into the future.

One techniques for rehabilitating soils after a fire is to break up hydrophobic soils by raking or mulching charcoal into the ground to help soak up water. Other activities include native grass seeding to mitigate against invasive weed invasion, planting trees and shrubs, and other short and long term erosion control efforts.

Following a fire on your land it is recommended that you consult with trained resource professionals. Sometimes a team of specialists including hydrologists, geologists, soils scientists, botanists, foresters, and engineers may need to be consulted to asses the impacts the fire may have caused and give you direction regarding how to develop a restoration plan to start the healing process. In addition to their advice, it is also good to consult with an ecologist to review your restoration plan. Often activities such as *salvage logging*[52] that some natural resource professionals consider to be restoration can actually set the cycle of ecological recovery back by inflicting more damage on the land.

Directly following a fire the land is at its most sensitive, and in an unstable state. Therefore, very careful consideration will need to be taken to ensure your actions will benefit its recovery.

For more information, see "After the Burn," www.cnr.uidaho.edu/extforest/AftertheBurnFINAL.pdf.

B.3.1. Assess Your Situation

In the 2004 summer fires in Shasta County, some homes were threatened that had burned only a few years before. Just because you live through a fire does not mean it couldn't happen again. Learn from the experience to be better prepared next time. The following article from *Forestland Steward* was published after the 2003 Southern California firestorms.

"Post-fire response: assess your situation

"Although we all know that the California landscape is adapted to burn, we are seldom prepared for the reality of a large wildfire. The effects of a fire will have consequences for years. Approach the post-fire period thoughtfully. After a fire, there are important decisions to be made. What should you be concerned about and what needs to be done? The wrong choices could lead to problems down the road, so take some time to assess your situation before taking any action.

Areas of concern:

The homesite

- Damage to the home or other structures
- Loss of landscaping
- Hazardous trees or vegetation
- Danger of flooding, on-site sedimentation
- Drinking water quality and other environmental impacts

The landscape

- Safety hazards—trees, power lines, etc.
- Regeneration and recovery
- Wildlife habitat

[52] Salvage logging: Logging and removing merchantable trees after a fire to capture economic potential. This is a very controversial subject.

- Watershed functions
- Erosion concerns
- Condition of remaining vegetation

Streams

- Proximity to home, roads, other facilities
- Hydrologic connectivity of existing drainage facilities
- Potential of increased woody debris load, streamflow, flooding, debris flow
- Need for treatments to upper watershed to minimize downstream impacts, impacts to property

Roads

- Existing problems that may be exacerbated by wildfire effects
- Damage to stream crossings, culverts
- Gullies, potholes, fillslope failure, cutslope failure, sediment deposits, wet spots
- Potential for culvert obstruction and diversion."[53]

Furthermore, if you are in the unfortunate situation of losing your home to fire, learn from the fire in terms of what areas burned around your property versus those that didn't. Design your new fire-safe landscaping with this in mind. Perhaps most importantly, build or rebuild your home with fire-resistant materials, as described in section B.1.1.6 Above.

B.3.2. Developing and Implementing a Restoration Plan

After a wildfire has burned through your property you will need to perform an assessment of the impacts the fire caused and what measures you will need to take to restore and mitigate the damage. Similar to developing a fuel treatment prescription you will need to develop a Post Wildfire Recovery Plan which will outline the priority areas on your property to begin work, and the sequence, schedule and timing that work will follow. Post fire restoration activities are aimed to focus on mitigating increased ecological damage and safety concerns for your homesite, and road infrastructure.

Where to Begin?

Immediate and Long Term Needs

In the development of your restoration plan, prioritize both immediate needs and longer term actions. Immediate needs relate to seasonal time lines and activities that need to occur right away for both human safety and the mitigation of ecological impacts. Following a wildfire you will need to be thinking about the fall rains or snow that are on the horizon. In an effort to mitigate slope slides and erosion issues your first step will be to stabilize these areas. Roadway infrastructure, homesite, and riparian areas are other immediate areas restoration.

Long-term actions are the recovery work you will do over time. Restoration is a process and not a one-time occurrence. Planting trees, shrubs, and native grasses can happen immediately, but are part of long-term restoration activities. Maintaining fuels by limiting resprouting is another long-term effort.

Restoration Plan Mapping and Layout

Following the fire, consult with natural resource professionals to help you assess the damage. Get an aerial photograph of your property and designate zones for restoration priorities (try Google Earth for a free aerial picture, earth.google.com/). With this photo and subsequent map you can define the areas that burned the hottest, need immediate restoration, need long-term restoration, and project locations of greatest concern. This map will relate to a written plan that describes the restoration activities that will take place. Using GIS/ GPS tools and technology can be extremely helpful to accomplish this activity.

Developing a Restoration Priority List

Priority #1: Roads, Driveways, Homesite, and Steep Areas

[53] California Forest Stewardship Program, *Forestland Steward*, Spring 2004, p. 1.

In order to undertake restoration work you will need access to your property. Following a wildfire, weakened trees can fall across roads and may threaten driveways and road systems. Ensure the safety of ingress and egress by removing these trees.

Slope movement from a high intensity fire followed by rains can cause slides above and below roads. Stabilize these areas with erosion control methods. Trees that have burned and been scorched can pose safety issues along roads. These trees can be used to stabilize road banks by contour falling them (see Background C for descriptions). You can accomplish several goals with one activity. In restoration we call this *stacking functions.*[54] In this situation you can increase the safety for travel along your driveway and in turn use the trees to hold the slopes in place.

If the fire burned hot within one hundred feet of your home you will need to take measures in this area for increased safety. If you have steep slopes below or above your house, perform safety mitigation work and erosion control. If your homesite is directly above your neighbors on a steep slope, prioritize developing a mitigation plan for these areas.

Priority #2: Streams, Riparian Areas, and Sensitive Habitat Areas

After you have ensured safety and access is available to perform restoration activities, focus on mitigating impacts to any streams. In an effort to prevent sedimentation from erosion into streams, it is critical for your efforts to focus attention on these locations. In addition to riparian areas and streams you will want to be thinking about the upland slopes above stream corridors.

If you have identified important wildlife corridors, sensitive habitat zones, and ecologically significant locations, you will want to focus your attention on these places.

Priority #3: Remaining Wildlands

Following restoration treatments of the priority areas described above, focus the rest of your restoration activities on the long-term recovery of the wildlands you are fortunate enough to steward.

It is important when planning your post fire restoration efforts that you focus your attention on areas that most need it. Following the fire some areas on your property may be fine left alone for natural recovery. Ultimately the natural world will heal itself; what we are attempting to do is assist that recovery and mitigate further damage without causing additional problems. When developing your restoration plan take into account each location and what its specific needs are. Directly after a fire things look charred and heavily impacted, however new life is on the horizon and will rise from the ashes.

B.3.3. Make a Plan to Be Better Prepared Next Time

Living through a wildfire can be a life altering experience. There is no other wake-up call quite like a wildfire. You will likely learn many new things about where you live and probably about who you are.

When replacing structures and/or landscaping after wildfire, use defensible space concepts like those outlined in this document to help you design a more fire-safe home. If you have to start from scratch, think about siting possibilities. Where are those places on your property that burned less or not at all? What about putting your house there now? Look at the places on your property or in your neighborhood that survived and try to understand why. Talk to your neighbors about how their places survived and what they learned. Mimic those features that lead to survivability in the other places on your property that did not fare so well. If you improve your understanding of your local landscape and how it reacts to fire, you can improve the survivability of your home and your ability to plan for future fires.

Homes don’t have to burn in a wildfire. We know what causes a fire to spread and homes to ignite. We have the knowledge to make them survivable, even in the absence of structure protection (fire fighting) resources.

Finally, a few closing words from Dr. David Horne. David has been active with the Greater Laguna Fire Safe Council since he lost his home to wildfire:

> "Though it may be difficult, try to avoid spending energy on blaming someone or group or agency or fate that "caused" the wildfire to happen. Distance yourself from the doom-and-gloom

[54] Stacking Functions: The act of accomplishing several goals with one activity.

personalities that will emerge to spread their message of sorrow. You only have so much personal strength and you will need it for the recovery phase in a post-incident situation. Think positively, talk positively, and act positively about the future. Concentrate on regeneration prospects and rebuilding your homes, neighborhoods and community to be even better than before. Be a positive example of the incredible resiliency of the human spirit that will inspire your loved ones and others to pitch in to move forward with confidence and assurance. You can do it!"[55]

[55] Horne, Dr. David. Personal communication, March 15, 2007.

C. Wildland Fuel Hazard Reduction[1]

The landscape known today as the "natural" Sierra Nevada is a result of *plant succession*[2] that responded for more than a century to the human practices of fire suppression, road building, logging, the introduction of non-native plants, and vegetation conversion for agriculture and livestock. Ecological consequences of these practices include: increased *forest stand density*[3] with low-level *growth or vigor*[4]; increased susceptibility of forest *stands*[5] to bark beetle attacks and pathogens; changed species composition and structure of forestlands, grasslands, shrublands, and oak woodlands; and habitat alteration of forestlands, shrublands, oak woodlands, and savannahs. These changes have caused an increase in fire hazard, as well as a shift in the intensity and effects of wildfire. Current trends in *silvicultural*[6] and *prescribed fire*[7] practices focus on restoring and maintaining vegetative communities to a more *fire-resilient*,[8] native vegetation condition.

In an effort to *modify fire behavior*[9] and reduce the potential for *crown fire*[10] in the Sierra, federal and state agencies, local fire districts, and private landowners have been taking a proactive approach to reducing extreme fuel hazards. Incorporating ecological considerations into planning and implementing these fuel hazard reduction treatments can be an innovative and exciting task for landowners and land managers.

Fuel reduction activities can give land stewards the opportunity to increase fire safety on their own property, with positive impacts to their neighborhood. Fuel reduction assists in initiating and enhancing the process of restoring health to the forestlands, woodlands, shrublands, and grasslands. Fuel hazard reduction work guided by conservation principles and designed with ecological treatment prescriptions will facilitate long-term positive environmental outcomes.

C.1. What Is Ecological Fuel Reduction?

Ecological fuel reduction seeks to reduce *surface fuels*,[11] *ladder fuels*,[12] and *crown density*[13] while implementing treatments that work to enhance plant community health and *biodiversity*.[14] Ecological fuel reduction techniques assist the natural environment in becoming healthier and more *productive*.[15]

[1] Much of this section was written by Marko Bey and is based on his work with Lomakatsi Ecological Services. (www.lomakatsi.org).

[2] Plant Succession: In ecology, progressive change of the plant and animal life of an area in response to environmental conditions.

[3] Forest Stand Density: The amount of trees in a forest per unit area. Can be measured in terms of basal area and crown cover.

[4] Growth or Vigor: The ability of plants to exhibit healthy natural growth and survival.

[5] Stand: A group of trees with similar species composition, age, and condition that makes the group distinguishable from other trees in the area.

[6] Silvicultural: The practice of caring for forest trees in a way that meets management objectives. For example, foresters may control the composition and quality of a forest stand for goods such as timber and/or benefits to an ecosystem.

[7] Prescribed Fire: A forest management practice that uses fire to improve habitat or reduce hazardous fuels. A plan for the prescribed burn must be written out and approved, and specific requirements must be met.

[8] Fire-Resilient Landscape: A natural landscape featuring plants that have adapted to local wildlife conditions, or a domestic outdoor space where appropriate actions have been taken to make it less vulnerable to wildfire and certainly less prone to causing one.

[9] Modify Fire Behavior: Using fire-safe practices such as fuel treatments, thinning, creating firebreaks, etc., to change the way a fire will behave, with a goal of slowing it down and/or suppressing it more easily.

[10] Crown Fire: A fire that spreads from treetop to treetop, and is characteristic of hot fires and dry conditions. Crown fires are generally more complex to control than fires on the surface.

[11] Surface Fuels: Materials on the ground like needles or low-growing shrubs that provide the fuel for fires to spread on the ground. Surface fuels are generally considered all fuels within six feet of the ground.

[12] Ladder Fuels: Materials such as shrubs or small trees connecting the ground to the tree canopy or uppermost vegetation layer. In forests, this allows fire to climb upward into trees.

Treatments are designed to be *site-specific*,[16] taking into consideration vegetation, *soil types*,[17] slope, aspect, forest health needs, and individual landowner objectives. Fuel reduction objectives are best accomplished with an emphasis on ecological treatments that incorporate *forest stand enhancement*[18] and restoration forestry techniques. The implementation of ecologically restorative fuel reduction treatments is guided by the Conservation Principles *(see Section 1.3)*.

Goals and methods for ecological fuel reduction seek to strike a balance among the following:

Goals

- To make the forest less susceptible to crown fire.
- To reduce the intensity of wildfire through activities that separate surface and ladder *fuel continuity*[19] and volume.
- To manage and modify fuels and configurations of trees and plants, to reintroduce low-intensity fire (cool-burning), and to contribute in a positive manner to the ecological processes upon which the forest and plant communities of the Sierra depend.
- To make fire-suppression efforts safer and more effective as a result of reduced fuel loads in the vicinity of roads, homesites, and strategic landscape areas.
- To improve the health of the trees most suited to the site.
- To emulate a plant regime similar to what occurred with natural fire.
- To maintain and enhance native species diversity.
- To maintain and enhance wildlife habitat.
- To control problematic, invasive, non-native species.
- To provide erosion control where appropriate (e.g. *lop and scatter*[20] and *contour falling*[21]) with materials from fuel reduction activities.
- To utilize byproducts of fuel reduction activities (firewood, poles, saw logs) where ecologically appropriate and economically feasible to help offset costs.

Methods

We are choosing methods that emulate lightning and *anthropogenic*[22] low-intensity fires that have helped shape the local landscape for thousands of years. These methods include:

- Thinning portions of the understory.

[13] Crown Density: A measurement of the thickness or density of the foliage of the tree crown in a stand.

[14] Biodiversity: The abundant variety of plant, fungi, and animal species found in an ecosystem, including the diversity of genetics, species, and ecological type.

[15] Productive: A term used for land or forests that are growing efficiently and in a vigorous manner.

[16] Site-Specific: Applicable to a specific piece of land and its associated attributes and conditions (e.g. microclimate, soils, vegetation).

[17] Soil Types: Refers to the different combinations of soil particles and soil composition. Soil can vary greatly within short distances.

[18] Forest Stand Enhancement: A combination of both silvicultural thinning practices and other forest restoration activities such as prescribed fire, which aim to increase the health, resiliency, and vigor of tree communities within a forest ecosystem.

[19] Fuel Continuity: The amount of continuous fuel materials in a fire's path that allows the fire to extend vertically toward the crowns of trees or horizontally into the forest or other fuels.

[20] Lop and Scatter: The act of cutting and evenly spreading branches over the ground to reduce fire hazard and erosion potential while promoting the decomposition of branches via their close proximity to the ground.

[21] Contour Falling: Cutting and placing trees along the slope contour. This is a treatment that utilizes positioned logs to control erosion from water flow. Logs are offset on the slope contour to slow water by creating a meandering travel path.

[22] Anthropogenic: The result of human activities or the influence of humans on nature.

- Selectively reducing crown density where it is ecologically appropriate.
- Favoring and retaining the largest, most fire-resilient, and healthiest trees adapted to the location.
- Burning or chipping the smaller fuel loads.

C.1.1. What Is a Treatment Prescription?

Excessive fuel loads can indicate poor health of the tree, plant and/or natural community on your property. A treatment prescription as it relates to fuel hazard reduction and ecosystem health is a sequence of steps to bring the forestland, woodland, shrubland, or grassland back to a healthier state. These efforts will ideally increase the area's resiliency to fire as a *natural disturbance*[23] that can occur occasionally without burning the entire landscape to the ground. This is similar to the recovery of a sick person—the doctor will prescribe medicine and a series of steps that a person will follow to return to health.

Prior to beginning work, the first step is an assessment of the property, including fuel hazards and health conditions. This is called an *initial site assessment,*[24] where you walk the property and take a closer look to gather information about present conditions. Using the answers to a series of questions outlined below, you will accumulate the data that will enable you to plan your fuel hazard reduction treatments for homesite safety, community wildfire protection, and the ecological enhancement of the property.

When planning fuel reduction prescriptions, it is important to remember that you are attempting to manage a natural, living system. Whatever your actions, the natural ecosystem will generate a response that will either favor its health and recovery or have negative impacts. Three very important concepts to consider and/or research for planning your prescription are 1)*Present Condition,*[25] 2) *Historic Natural Condition,*[26] and 3) *Future Desired Condition*[27] of the property. In an effort to reduce fuel hazards without creating additional environmental problems, it is important to use these three concepts when planning a treatment prescription.

Site Assessment—Present Condition

Present Condition will describe what conditions occur on your property now. During the planning of fuel treatments, the present condition will enable you to outline the activities you wish to undertake, based on today's starting condition. It will facilitate gathering your initial assessment data for planning your treatments.

The following is a list of questions that will help you plan a prescription for an ecological fuel hazard reduction project.

Site Evaluation Information and Questions

1) What is the elevation of the treatment area? List the variety of elevations from low to high.

2) What are the aspects of the treatment area? What direction does your property face? Explain in some detail.

3) Give a brief synopsis of the topography of the site. Highlight *draws,*[28] ravines, rock outcroppings, and special landscape features.

4) What are the vegetation types and plant associations of the site? What are the *dominant*[29] and *codominant*[30] species on the property?

[23] Natural Disturbance: Disturbances, like fire and floods, which occur in the environment without the intervention of humans.

[24] Initial Site Assessment: The preliminary steps of an evaluation of a piece of property to determine fuel hazards and health conditions. Information is gathered to help plan a fuel hazard reduction treatment.

[25] Present Condition: The environmental conditions that occur on a property at the present time.

[26] Historic Natural Conditions: The natural condition of a property or area that occurred in the past, before fire suppression and industrial activities. Old photos, settler's journals, elders' oral history, and clues on the property such as old stumps may be helpful in identifying the historical natural condition of an area.

[27] Future Desired Condition: The short-term and long-term goals desired from management activities on a property. It is important to keep the Conservation Principles in mind when designing these.

[28] Draw: A topographic channel that is generally shallower than a ravine.

5) What are the estimated *age classes*[31] of the forest stands on the site? What is the variability (and range) of sizes of the trees? What are the DBHs (diameters at breast height)?

6) Explain the *fuel load conditions*[32] on the site. Describe the density of vegetation and the variety of fuel types. Assess the *ground fuels*,[33] surface fuels, ladder fuels, dead standing wood (snags), widow-makers (large trees with lots of dead limbs), etc.

7) Give an estimate of the number of snags per acre on the site. What species of snags are present? What is the DBH of these snags? Which snag classes are present? Snags are categorized into three structural classes—characterized by the amount of bark and branches, condition of the treetop, and condition of the wood—and these features determine wildlife use. Document snag height. What may be causing tree mortality? Is there beetle activity present?

- Structural Class 1 represents those trees that have died recently and retain most of their bark and most of their branches; the top is intact. Very little decay has occurred in the wood, unless the tree had heart-rot decay when living. Class 1 snags are typically used primarily for foraging by woodpeckers on bark beetles in and under the bark. Once the bark loosens, bats can roost under the bark.
- Structural Class 2 represents those snags that have been dead for several years and have lost some branches and bark (except grand fir and Douglas fir, which tend to retain their bark after death); tops are often broken; there is some evidence of decay. Woodpeckers use these for nesting, foraging in the bark, and foraging in the interior for carpenter ants.
- Structural Class 3 represents those snags that have been dead a long time and lack branches and bark (except grand fir and Douglas fir). Tops are broken off and the sapwood and heartwood are extensively decayed. The primary use of these trees is by woodpeckers foraging on carpenter ants and wood-boring beetle larvae. Most of these trees are too decayed for woodpeckers to excavate a cavity in them, although secondary nesters may use existing cavities.

8) Describe fuel loads in relationship to homesite, driveway, and other *egress*[34]/access routes on the property.

9) List and explain any special details about this site that should be considered for fuel mitigation and forest stand enhancement treatments. Include information about sensitive zones for plants, wildlife, *slope stability*,[35] etc.

Historic Natural Condition

The Historic Natural Condition will give you the baseline data on how the ecosystem in question functioned prior to fire suppression and industrial activities that may have occurred there. Questions include:

- What trees and plants were dominant on the property and historically present?
- How frequently did fire occur?
- What plant communities were present prior to European settlement that are now gone?

Some of these questions can be answered from the vegetation type descriptions in Appendix 4. You can also acquire this information from old or historic photos of your property, old settler's journals, the traditional oral descriptions of Native American elders who may be living in your area, or by visiting neighboring lands in your

[29] Dominant: The species that is the most abundant or influential in an ecosystem. For example, a dominant tree is one that stands taller than the rest and receives full sun.

[30] Codominant: Species that share dominance or are of equal importance. For example, a codominant fir-pine forest would be dominated by both firs and pines.

[31] Age Classes: A way of classifying the age range of trees or forests, usually divided into 20-year units, e.g. 0-20 years.

[32] Fuel Load Conditions: The amount of combustible material (both dead and live fuels). It relates to the site's fuel model *(see Appendix 3)*, slope, and aspect, and the fuel moisture content.

[33] Ground Fuels: The layer of combustible material that exists below the surface litter. This layer includes plant roots, duff, etc. These materials can burn when embers drop from above.

[34] Egress: The act of going out, or right to leave or exit a property.

[35] Slope Stability: The degree to which a slope is susceptible to erosion and slides, or the measure of its overall stability.

watershed that have not been greatly altered. Additional ways to learn this information are from reading your land and looking at older tree stumps and their configuration, or by talking to an ecosystem restoration professional.

The site-specific information for your property will create a closer-to-home level that will help in planning your treatment prescription. "Site-specific" is a key concept that will enable you to tailor your treatment prescription to your property, using general guidelines as a basis while taking into consideration detailed site conditions. "Site-specific" describes the unique place and its conditions, and should be considered in the overall plan.

Future Desired Conditions

Future Desired Conditions will outline both the short-term and long-term goals you wish to accomplish with your activities. For example, future desired conditions for fuel mitigation efforts along a driveway might be outlined as follows:

> Will be an area with little to no surface fuels, no ladder fuels, and fire-resistant, shade-casting trees without low-hanging branches. There will be larger, well-spaced trees with wide spreading crowns. Any shrub or brush patches will be small and isolated. The grasses on the site will be converted over time, from tall, annual grasses that carry longer flame lengths to shorter, native grasses with shorter, flashier flame spread.

Create your concept for a future desired condition based on the Conservation Principles (Section 1.3) and other information in this plan.

C.1.2. Strategic Landscape Fuel Treatments

Strategic Landscape Fuel Treatments emphasize the creation of *shaded fuelbreaks*[36] to increase community wildfire protection. These treatments typically occur along ridge tops that divide sub-watersheds, on slopes above high-ignition sources (such as railroads or dividing ravines), and adjacent to secondary logging roads that will serve as anchor points for this and future work. Fuel reduction activities will aim to create safer and more effective anchor points for fire-suppression efforts, and contribute to the creation of effective *ignition zones*[37] for future prescribed fire activities. The introduction of prescribed fire can contribute to the long-term maintenance of forest fuels and overall ecosystem health.

Strategic landscape treatments, including shaded fuelbreaks, can be creatively designed into an ecological *Variable-Density Thinning*[38] regime that will reduce fuels and maximize structural and species diversity.

Wildland Fuel Reduction Zone Ecological Fuel Reduction Practices

The Wildland Fuel Reduction Zone is the area one hundred feet or more from a house or other structure. This is the place where innovative, ecologically savvy fuel reduction treatments can be accomplished, in an effort to begin the restoration process for previously impacted and degraded landscapes.

Although vegetation types vary greatly in the Sierra, and site-specific treatments will need to be developed to take into account this variation, certain silvicultural practices are applicable throughout the different vegetation zones. *For examples of treatment prescriptions for the wildland zone, see the Fuel Modification descriptions for each vegetation type in Appendix 4.*

Shaded Fuelbreaks

When you remove fuel ladders around your property and leave the tree canopy in place, you are creating a shaded fuelbreak. This break in fuel continuity—a result of treating both surface and ladder fuel—gives firefighters a chance to slow down and perhaps even stop a fire. Shaded fuelbreaks are effective because you 1)

[36] Shaded Fuelbreaks: A fuel-reduction technique for forested areas. Vegetation is reduced and/or modified to reduce fire hazard, but an adequate amount of crown canopy remains intact, thus inhibiting weedy undergrowth.

[37] Ignition Zone: The place where combustion is initiated.

[38] Variable-Density Thinning: Thinning or selectively cutting trees in a manner to restore repeating variability or redundancy in a forest. This technique ensures diversity in stand density and canopy cover.

reduce the amount of fuel, 2) modify the types of fuel, and 3) improve their arrangement. It is called "shaded" because you leave most of the forest canopy intact. Some of the canopy may need to be removed, however, if conditions are high for a crown fire.

A shaded fuelbreak differs from a firebreak where a bulldozer or other equipment is used to create a bare-ground break with no vegetation. Firebreaks tend to regenerate quickly with flashy fuel and require a lot of maintenance. By contrast, the shade cast by the forest canopy helps to reduce the regeneration of plants on the forest floor, thus keeping the amount of fuel low in these fuelbreaks and requiring less maintenance. Shaded fuelbreaks also improve your evacuation routes, as they provide a place where a fire might slow down or decrease in intensity, making it safer for you to get out (and firefighters to get in).

Their purpose is to reduce the amount of combustible material available so when a fire reaches the shaded fuelbreak, it will decrease in intensity and drop from the canopy to the ground. It is very important that shaded fuelbreaks are created in strategic locations to provide the most benefit. Favorable locations are along ridges and *benches*[39] and other areas of flatter terrain. Shaded fuelbreaks can also be constructed along roads and around WUI communities; however, it is important that these efforts be coordinated with multiple landowners to achieve increased community wildfire safety objectives. Shaded fuelbreaks located at mid slopes can sometimes be dangerous because fire can preheat an area from below, and burning materials from above can roll downhill and ignite fires.

The exact prescription for a shaded fuelbreak depends on your objectives and local (present) conditions. Some landowners want to create as much cleared space (and their perception of fire safety) as possible. Others want to maintain as much privacy as possible, sometimes compromising but almost always still improving fire safety. Treatment prescriptions will also vary according to the vegetation type and the aspect in which you are working. Determine your vegetation type and reference its Fuel Modification Prescription in Appendix 4 for site-specific treatments to incorporate into your design

Typically trees are spaced so their crowns no longer touch. Lower branches are pruned. Shrubs and dead and downed material are removed to reduce surface fuel. Not all small trees need to be removed; care should be taken to create horizontal space between small trees and nearby larger trees. Heavy underbrush and fallen limbs are generally removed, leaving mature trees that are more fire-resistant. In forested areas, between sixty and eighty-five percent of the overstory canopy can be left intact, depending on the forest type.[40] Ponderosa pine stands, for example, which are typically less dense forests, tend to be located on arid aspects and resemble more of an open savannah plant community type. Historical canopy percentages for pine were less than sixty and closer to thirty percent on average. However, it is important to recognize that historic canopy percentages were representative of a long-term landscape with larger trees and broad crown ratios. Act cautiously within pine locations by retaining enough canopy to prevent adverse effects from opening things up too much, too fast. Moving any forest stand toward historic conditions can be achieved in intervals over a five- to ten-year period. The method of *sequential entries*[41] can be an effective, cautious way both to reduce fire hazard and restore the stand and associated ecological conditions. Monitoring the response of the forest and ecological community will be the guiding influence on what time intervals to use for further thinning entries. Ecological monitoring can be accomplished by a visual assessment of the stand's response, *photo-point monitoring,*[42] or by establishing permanent monitoring plots to closely measure ecological benefits or impacts.

Shaded fuelbreaks can be constructed creatively to blend both fuel modification and forest stand enhancement objectives to achieve multiple positive outcomes. Variable-density thinning prescriptions can be incorporated into

[39] Benches: Flat landscape areas that occur along foothill and mountainous slopes. They can be the result of natural land formations through slope movement and sluffing, or land alteration by previous resource extraction activities such as logging.

[40] Salmon River Fire Safe Council, www.srrc.org/, Fuel Reduction Plans and Maps; Dennis Martinez, "Canopy Retention for Fuel Modification Treatment in Douglas Fir Stands," Boulder Dumont Late Successional Reserve (LSR) Vegetation Management Project. Tiller Ranger District, Umpqua National Forest.

[41] Sequential Entries: Entering a forest stand or other vegetation type several times over the course of years to spread out the impacts of treatments.

[42] Photo-Point Monitoring: Using a specific, identifiable point on a property from where photos are taken over time using the same view to compare and monitor changes.

such treatments. It is important to consider the long-term health of each site, as well as potential adverse impacts on soils, understory plant communities, and forest stands. Species diversity can be retained within shaded fuelbreaks while still achieving fuel reduction objectives, especially if you don't try to do it all at once.

In Douglas fir stands the canopy can be left more intact to accommodate the desired conditions for plants associated with this forest type. Douglas fir and red fir forests tend to grow on north and east aspects or in shaded draws with the appropriate microclimate. Shaded fuelbreaks in fir stands can still be very effective in reducing fire severity while leaving an average of seventy to eighty-five percent canopy closure.

In chaparral stands, shrub groupings can be left in patches that are spaced apart to greatly reduce fuels while sufficient shade is cast to prevent the ground from drying out and invasive species from getting a foothold.

Varying levels of light on the forest floor will generate different resprouting responses; therefore creating shaded fuelbreaks requires the commitment to maintain them. As in all fuel reduction treatments, regular annual or bi-annual maintenance is often necessary as stump-sprouting plants, invasive species and/or shrubs begin to colonize the understory (although this is theoretically minimized with the shade provided by the intact canopy). Maintenance can be accomplished either by pruning and cutting back regrowth or through use of prescribed fire techniques. Established shaded fuelbreaks provide a good opportunity for prescribed fire applications.

Following thinning and prescribed fire application, restoring and establishing native grasses and forbs along shaded fuelbreaks is a long-term objective for the prevention of non-native species invasion. In situations where private lands border federal lands or wilderness areas, invasive species can travel into these neighboring public lands and "spread like wildfire"; hence it is critical that long-term stewardship be a priority for maintaining these sites.

Basic Prescription for First Entry[43]

For the first entry, cut as much of the *one-hour*[44] (0–0.24 inches in diameter) and ten-hour fuel (0.25–1.0 inch in diameter) as possible, i.e., the finer fuel. Remove trees that look brushy (versus a more tree-like form), unhealthy, are lacking in vigor, or are overtopped by larger and/or more vigorous trees that block access to open spaces in the canopy. Eliminate dead vegetation of all sizes. Shade will inhibit the regrowth of the sprouting species, which will not resprout vigorously enough to be a major maintenance problem. Prune up all trees you leave behind as high as you can reach safely, with a chainsaw or pole saw.

Start low in the area and work gradually uphill. Also start with the lowest-growing plants and work up the fuel ladder. This will help keep you from burying your work, and the result will be cleaner and more thorough.

When implementing shaded fuelbreaks, work in teams with a sawyer and a brush hauler. This can result in a more thorough job with less effort once safety and logistical issues have been worked out. The sawyer can make a small to moderate mess in one spot and then move to the next spot while the brush hauler cleans up the mess in the first spot. They then flip-flop and the sawyer returns to the first spot to expand upon what's been done, while the brush hauler cleans up the mess in the second spot. While this method requires teamwork and awareness, it will enable the sawyer to cut with more ease. Meanwhile the brush hauler is cleaning things up but is not in danger from falling trees and limbs because the cutting occurs in a separate area.

Second Entry, or Advanced First Entry

Go to those trees and shrubs that you weren't sure about on the first pass. Look at the leader (the new growth at the top of the tree) and the overall health and vigor of the tree in relation to other trees of the same species. The leader reveals the annual growth. How is the tree growing in relation to other trees? Is the leader longer or

[43] This prescription is based on the work of Dave Kahan, Full Circle Forestry, Redway, CA.

[44] One-hour timelag fuels are less than ¼ inch in diameter and respond very quickly to changes in their environment. These fuels will only take about an hour to lose or gain two-thirds of the equilibrium moisture content of their environment … Moving up in size, a fuel will lose or gain moisture less rapidly through time. Ten-hour fuels range in diameter from ¼ inch to 1 inch, 100-hour fuels from 1 inch to 3 inches, and 1,000-hour fuels from 3 inches to 8 inches. 10,000-hour fuels are greater than 8 inches in diameter. Obviously, the 1,000- and 10,000-hour fuels do not burn easily. However, if they do burn, these fuels will generate extreme heat, often causing extreme fire behavior conditions. From: National Weather Service, Fire Weather Definitions, Dead and Live Fuel Moisture, www.crh.noaa.gov/fsd/firedef.htm.

shorter? Does it look healthy? Leave the healthiest trees. Is there space for them to grow in the upper canopy? If not, can you create that space by removing the less healthy or suppressed trees? If not, the tree is a good candidate for removal regardless of health and vigor. Imagine the same place in ten or twenty years. Will there be room for all the trees you have left? If not, remove some of the unhealthiest and smallest ones, or those in the way of your largest and most dominant trees. Keep in mind that the denser the canopy, the less regeneration (maintenance) you will have to address next year.

Think about species composition. You will generally want to favor rarer species. The type of forest you have on your property will determine what species to leave, and the appropriate percentage of canopy and understory density. For example, certain mixed-conifer forest types and their associated plants require more of a *closed-canopy*[45] forest with a woody shrub understory plant community. These forest types are usually located on north or east aspects, along riparian areas, and dominated by Douglas fir at lower to mid elevations and red fir at higher elevations. Other forest types such as ponderosa pine, pine-oak woodland, or mixed-pine forests will generally have less canopy percentage and be located in drier sites on south- or west-facing aspects; they have more herbaceous plants consisting of native grasses and forbs, with an average of thirty percent woody shrubs present in the understory.

The Sierra Nevada region is quite diverse with many different forest and vegetation communities present. Determine what plant community exists on the property and make allowances for the varying percentages of canopy and understory thinning needed for fire behavior modification. This is explained in further detail in Appendix 4. Think about what you are leaving behind more than what you are removing. You can deviate from these general guidelines if you are doing so consciously, keeping in mind the overall principles mentioned above, foremost being the creation of breaks in fuel continuity and the Conservation Principles identified in Section 1.3.

How to Decide which Trees to Leave or Take

First look for the vigorous, healthy trees. One way to decide which trees to cut is to look at how much crown is on a tree. Trees with less than twenty-five percent live crown may be candidates for removal because they will have a hard time being *released*.[46] Choose trees with healthy crowns as the trees to leave. Create space around them by removing less vigorous trees. Look for existing space in the canopy. Is there space for the tree to grow into the upper canopy? If so, leave it. If not, consider removing it. There may be trees that you will eventually want to remove—often intermediate trees—that are not cost-effective on the initial entry, but could be on subsequent entry. Some of the intermediate trees may have enough size or volume for lumber production. Therefore, if your removal costs are not high you may be able to offset some of the expense with lumber for personal use. *(See Section C.2 below for details.)*

After you've created your shaded fuelbreak, take a final pass through the area. How does it look? Do you need to remove any branches or small fuels that were left behind? Did you miss some trees or shrubs that obviously can be taken out now? Remember, you don't need to remove everything. You can leave clumps of vegetation for wildlife habitat.

Pruning Individual Trees

Prune as high as you safely can with a chainsaw or a pole saw, given your available time and financial resources. The more you prune, the more slash you will have to remove. Costs for this will vary widely, depending on the size of pruned limbs. Leave at least one-half of the tree height in live crown. Only remove one-third of the total foliage at one time. Don't bother pruning anything that is shorter than you (unless it's right next to your house, then it should probably just be removed). Make sure to follow proper pruning techniques or you will create health problems in your landscape. Pruning is one of the most difficult skills to master but it is also one of the most important. For tips on proper pruning techniques, see the following table and the text entitled "Prune

[45] Closed-Canopy: Occurs when the canopies of trees touch and blend together enough so that light does not reach the floor of the forest

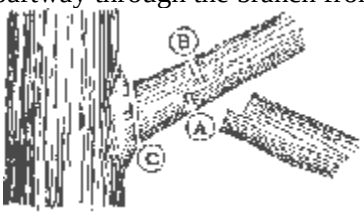
[46] Release: Using thinning techniques to free a tree or group of trees from competition for nutrients, sunlight, and water by removing the competing small trees and shrubs.

trees for better health and higher value," by the California Forest Stewardship Program, ceres.ca.gov/foreststeward/html/prune2.html.

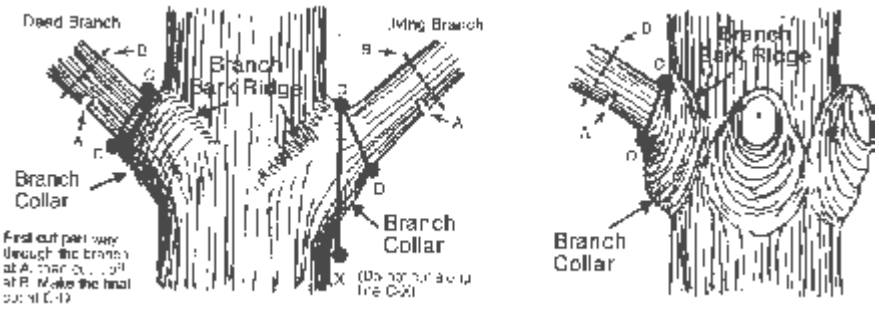
Figure 1. Proper Pruning Techniques[47]

Prune correctly. The object of the operation is to remove the branches as close to the tree stem as possible without leaving any stubs.

A. Cut partway through the branch from beneath at a point one or two inches from the trunk.



B. Make a second cut on the top of the branch, at a distance of 1/3 to 1/2 the diameter of the limb from the first cut. This should allow the length of the limb to fall from its own weight and be safely removed.
C. Complete the job by making a final cut next to the trunk, just outside the branch collar, with the lower edge farther away from the trunk than at the top.



Using the illustrations above, final cuts should be made from points C to D. Do not cut along C–X, which is an imaginary vertical line to help you locate C–D. First cut partway through the branch at A, then cut it off at B. Make the final cut at C–D.

Drip-Line Thinning

In forests and woodlands, the technique of drip-line thinning can be used to reduce ladder fuels and release desired leave-trees from competition for nutrients, sunlight, and water by removing the nearby small trees and shrubs.

The drip line is the area at the end of the longest branches of a tree or shrub where water drips vertically to the forest floor. The technique for drip-line thinning is accomplished by clearing away the ladder fuels within the drip-line circumference around the desired leave-tree. The best place to begin is by picking out your healthiest, largest, desired leave-trees and drip-line thinning around them. Following this technique, you can reevaluate what vegetation is left and plan how you will shape the remaining plants and stands of trees. For example, trees may be left more isolated as individual specimens, or standing in groups.

Mosaic Thinning and Adaptive Management

To accomplish fuel reduction objectives and provide ecologically sound treatment results such as enhancing site biodiversity, a *Mosaic Thinning*[48] approach can be used. Mosaic thinning regimes work to emulate the

[47] California Forest Stewardship Program, *Forestland Steward* Newsletter, "Prune trees for better health and higher value," Winter 2002, ceres.ca.gov/foreststeward/html/prune2.html.

structural composition created by wildfire. Although thinning will not achieve the same ecological results as a natural fire, the openings and patches of vegetation that are created can increase the potential for a variety of habitat types. Mosaic thinning takes into consideration the site-specific conditions of the plant community type in order to choose the best prescription for a given area, and to make allowances for a variety of ecological concerns that may arise during treatments where on-site direct *adaptive management*[49] will need to be practiced. For example, in certain portions of a treatment area, thicker vegetation and tree cover may be left to provide *thermal cover*[50] for deer and other wildlife, while in other locations canopy cover may be reduced to provide sunlight to the forest floor in order to favor struggling native grasses and associated herbaceous understory vegetation.

Mosaic thinning consists of treatments that reduce the abundance of dense vegetation, thus encouraging herbaceous understory and overstory growth. Such thinning results in a diversity of habitat types beneficial to wildlife by creating islands, corridors, thickets, open understory forest stands, and small grassy openings of random shape, size, and occurrence.

Variable-Density Thinning Practices: Reducing Fuels and Creating Diversity

In an effort to meet the desired outcomes for maintaining and enhancing plant communities and to reduce fuel loads and the threat of catastrophic wildfire, a Variable-Density Thinning, or *uneven-aged treatment,*[51] may be considered.

Variable-density thinning regimes are an integrated approach to the management of forest stands and vegetative communities of different sizes and densities. The silvicultural practice of variable-density thinning can be applied to the diversity of vegetation types throughout the Sierra, with site-specific adjustments made to accommodate the favored species historically suited for each plant community location.

The main goal of variable-density thinning is to restore maximum repeating variability or redundancy to a forested landscape.[52] Since we do not know exactly how much of what kind of habitat to restore or maintain, it is good to vary the treatments and apply them in small areas. This is in line with the *Precautionary Principle.*[53]

This kind of thinning will reduce crown fire hazard and can be combined with biomass utilization, surface fuel treatments, and prescribed fire activities. Low- to moderate-severity fire (the kind experienced historically in the Sierra) will then tend to naturally select for fire-resistant species.

Variable-Density Thinning to Create Structural Heterogeneity

> "Variable-density thinning regimes in which thinning intensity and tree marking rules are varied within the stand of interest (Carey and Johnson 1995; Carey and Curtis 1996) are a useful approach to increasing heterogeneity in stand density and canopy cover. Variable-density thinning is sometimes referred to as a 'skips and gaps'" approach. In such a prescription, some portions of a stand are left lightly or completely unthinned ('skips'), providing areas with high stem density, heavy shade and freedom from disturbance, while other parts of the stand are heavily harvested ('gaps'), including removal of some dominant trees, providing more light for

[48] Mosaic Thinning: A style of thinning that creates openings and patches of vegetation to increase the potential variety of habitat types.

[49] Adaptive Management: An approach to managing the environment that is based on a "learn by doing" technique. Adjustments in management change over time as new information is learned.

[50] Thermal Cover: Vegetative cover that modifies unfavorable effects of weather for animals. For example, elk may move to a fir forest with trees at least forty feet tall and with seventy percent crown closure to protect themselves from harsh weather.

[51] Uneven-Aged Treatment: A treatment that deals with three or more age classes of trees.

[52] Lindenmayer, David B., and Jerry F. Franklin (2002). *Conserving Forest Biodiversity: A Comprehensive Multi-Scaled Approach.* Island Press. Washington, D.C. See in particular the "Risk Spreading" chapter.

[53] Precautionary Principle: A principle that promotes a careful approach to developing and managing the environment when information is uncertain or unreliable. Erring on the side of caution and conservation is encouraged, along with a "better safe than sorry" attitude.

subdominant trees and understory plants (Carey et al. 1996). Intermediate levels of thinning are also applied in a typical variable-density prescription."[54]

These goals can be accomplished by the following practices: creating and maintaining variable or uneven spacing, with clumps of trees and canopy gaps; maintaining the largest trees of the stand; reducing the density of *ingrowth*[55]; maintaining early-seral species on the landscape; and reducing the fuel loading by removing ladder fuels.

In addition to providing fire safety, ecological fuel reduction provides many other benefits. Some of these are:

- Improved forest health and productivity. There will be less stress and mortality from reduced competition, and this translates into lower fire intensity. Also, by removing the lower branches of your trees, you will have higher-quality lumber (less knots) should you ever choose to harvest those trees for wood products.
- Improved wildlife habitat. Opening up the lower canopy and forest floor provides habitat for some of the species that prefer to dwell in larger trees or older forests.
- Improved aesthetics. Many landowners comment on how much nicer their view is after doing fire hazard reduction, as they can see out into the forest again.
- Creation of firewood.

For additional information on fuel hazard reduction, please see Background D, Fire Safety Information.

C.2. What to Do with Thinned Materials

As a result of your fire safety work, you will likely accumulate a lot of branches and other materials that you have cut. There are a few main options for dealing with thinned materials: burning, chipping, lop and scatter, some combination of these, small-diameter wood products, and biomass.

You can only use commercial wood products from your forestry operations on your own property. To sell most commercial wood products from a forest operation requires a Timber Harvest Plan (THP) approved by the California Department of Forestry and Fire Protection (CAL FIRE). THPs are generally too cost-prohibitive for fuel hazard reduction in most young forests. However, the Forest Fire Prevention Exemption provides an alternative; see Section B.1.1.5 for more information. The Mattole Restoration Council has a great summary and comparison of fire hazard reduction exemptions you can use for your fire-hazard-related forestry operations. See their "Forest Practice Rules for Thinning Exemptions," at mattole.org/pdf/Exemption_thinning_requirements.pdf, and "Comparison of Thinning Exemptions," at mattole.org/pdf/fire_hzrd_exemption_comparisons.pdf. They have also developed a model cost-share program to facilitate fuel hazard reduction on non-industrial private forestlands. For more information on that program, see mattole.org/program_services/forestry/fuelsreduction.htm.

Firewood is also a great by-product of fuel hazard reduction. To sell firewood, you need a firewood exemption from CAL FIRE.

C.2.1. Burning

Burning is the cheapest and usually the easiest method to remove thinned materials, as long as it is done safely. Following is a list of suggestions for safe burning adopted from the California Forest Stewardship Program:

- Arrange the material to be burned so that it emits minimum smoke. Place material of various sizes in the pile for adequate airflow.
- Burn Permits from CAL FIRE may be required from May 1st until the end of fire season, depending on local Ranger Unit. Air Quality requires burn permits for most open burning. Check with CAL FIRE, your local fire department, and Air Quality Management District regarding necessary permits while planning—and before starting—any burning.

[54] Lindenmayer and Franklin, 2002, p. 184.

[55] Ingrowth: Trees that grow large enough in a season to be considered a sapling or pole timber.

- Except for large trees (six inches DBH or greater), ignite only the amount that can reasonably be expected to completely burn within the following 24 hours.
- Only ignite outdoor fires with ignition devices approved by the local Air Quality district and CAL FIRE.
- Ignite material to be burned as rapidly as practical within applicable fire control restrictions.
- Curtail, mitigate, or extinguish burning when smoke is drifting into a nearby populated area or creating a public nuisance.
- Don't burn material unless it is free of tires, rubbish, tar paper, and construction debris; is reasonably free of dirt, soil, and moisture; and is loosely stacked in such a manner as to promote drying and ensure combustion with a minimum of smoke.
- Some air districts and/or counties may limit the amount of needles and leaves within a pile, as well as enforce burning hours throughout the day.[56]

As of January 2004, most Air Quality Management Districts (AQMD) requires burn permits.

Find out to which AQMD your community belongs at: www.arb.ca.gov/capcoa/dismap.htm?362,53. Click on the map for your area and check out your local Burn Regulations. Summarize them here in terms of local permitting requirements (costs, where to get the permit, how long it lasts, etc.). See El Dorado Fire Safe Council air quality and burning article in Background D, and CAL FIRE's www.fire.ca.gov/education_burnpermits.php for more information on local burning regulations.

Getting a group of friends together in the winter to thin and burn can be an enjoyable or at least satisfying way to spend a day outside.

Prescribed Burning and Slash Disposal

Prescribed Burning is the controlled application of fire to forest and woodland fuels in either their natural or modified state. It is done within site-specific environmental conditions to confine the fire to a predetermined area. The objective is to produce the fire behavior and characteristics required to attain fire treatment, ecological restoration, and resource management objectives. *For more information, see El Dorado County Fire Safe Council, Prescribed Burning, www.edcfiresafe.org/prescribed_burning.htm.*

Prescribed fire methods vary and include *hand pile burning,*[57] *swamper burning,*[58] *broadcast underburning,*[59] and *patch burning.*[60] All of these methods can be used to reduce fuel hazards and improve the ecological health of Sierra Nevada wildlands.

When choosing the right prescribed fire activity for your property it is very important that you consult fuel management and forestry professionals, especially when considering broadcast underburning. Prescribed fire methods are very site-specific. Not all methods are appropriate for every location. Prescribed fire prescriptions must be determined on a unit-by-unit or section-by-section basis. The details you will need for burning will develop as on-the-ground work progresses along with your knowledge of site conditions.

C.2.1.1. Prescribed Burning Methods and Treatments

Swamper Burning

Swamper burning is a prescribed fire method in which fuels are gradually and continually added (usually over the course of a day) to a hand or machine pile. In Sierra Nevada areas with a high concentration of homes,

[56] California Forest Stewardship Program, "How to Burn Piles Properly," www.ceres.ca.gov/foresteward/html/burnpiles.html

[57] Hand Pile Burning: Hazardous fuels piled by hand for burning in a manner that will not damage surrounding trees or soil.

[58] Swamper Burning: A method of prescribed fire where fuel is added gradually and continually to a burning pile over the course of a day.

[59] Broadcast Underburning: A method of burning where a prescribed fire is allowed to burn in the understory of a designated area to reduce fuel hazards and/or as a silvicultural treatment.

[60] Patch Burning: A method of prescribed burning where patches are burned to prepare an area for planting or to reduce fuels.

swamper burning for slash treatments may be a good option. This method is highly recommended within denser vegetation zones, following an initial *first-entry thinning treatment*[61] where high concentrations of slash will be generated. Swamper burning is also a first step of preparation prior to broadcast underburning activities.

Since 1993, Lomakatsi Restoration Project[62] (a restoration forestry contracting organization based in Southern Oregon) has used the swamper burning method on thousands of acres of private, state, and federal land throughout Southern Oregon and Northern California for fuel reduction. Lomakatsi believes the swamper burning method not only accomplishes fuel reduction goals, it also provides an extra degree of protection for nearby residences. This method is favored for the following reasons:

1. There is less smoke at any given time when you drag and burn downed slash than when lighting many hand piles at once.
2. More fuels are consumed as a result of this method. There is little opportunity for piles that are lit to extinguish in the center.
3. Swamper burning minimizes the scorching of leave-trees and sensitive vegetation zones. Slash can be dragged away from leave-trees and transported to burning piles in more open locations.
4. The danger level of crown scorching and the potential for runaway fire is lessened because piles are more manageable in a swamper burn situation than in a larger *touch-off*[63] hand pile burn.
5. The visual appearance of hundreds of hand piles burning at one time can be frightening for residents. Swamper burning is a good tool to educate landowners about working with and becoming more comfortable with fire, and the fire-adapted landscape in which they live.
6. Swamper burning methods are safer and more manageable, both in appearance and execution. In light of recent prescribed-fire disasters in the Southwest, this factor cannot be overstated in terms of developing and maintaining community trust for landowners, contractors, and agencies involved in the application of prescribed fire.
7. In a swamper-burning situation, materials for special forest products and small-diameter utilization can be more efficiently sorted by hand crews than during the standard industrial forestry approach of stacking larger hand piles where good materials are wasted during burning.

The swamper burn method is site-specific; one size does not fit all. For prescribed fire activities in montane chaparral, sagebrush-bitterbrush, and foothill woodland where fuels burn hotter than conifer forests, the swamper burning approach will achieve positive end results, provide a safer burn, and prepare site conditions for the future reintroduction of low-intensity fire.

Swamper Burning Prescription

- Burn-pile locations will be placed at a minimum of ten feet outside the drip zones of the largest overstory leave-trees.
- Place burn piles in the most open areas to avoid damage to surrounding trees.
- Construct small piles (comprised of mainly smaller fine fuels such as live and dead branches) approximately every fifteen to twenty-five feet to serve as *pilot ignition piles*.[64] These piles can be constructed roughly three feet high and covered with *slash paper*.[65] After stacking enough material for the base of the pile, place a sheet over the material then stack about 1/3 more on top to hold down the protection sheet—this will keep things dry for when you come back to light the pile.

[61] First-Entry Thinning Treatment: The first stage of tree thinning performed in a fuel reduction treatment.

[62] www.lomakatsi.org

[63] Touch-Off: A prescribed fire operation performed by a forestry or fire crew where large quantities of slash in hand piles are ignited simultaneously with drip torches.

[64] Pilot Ignition Piles: Small piles made up primarily of small fine fuels such as branches.

[65] Slash Paper: Paper used to cover slash piles before ignition with the intention of keeping or allowing the slash dry. Paper is considered more environmentally appropriate than plastic.

- Leave the remainder of slash on the ground until you burn. Swamper burning will likely need to be conducted prior to fire season, so check with your local fire department or CAL FIRE for permitting details. Desired sub-merchantable materials will be sorted for special forest products, small-diameter poles, and firewood. *(See section C.2.4 below for more information on these options*.) These products will be yarded to roadside locations.
- When the burning is executed, ignite pilot piles in smaller sections (ten piles at a time), with the remaining slash dragged to the burning piles in a rotational fashion. Add slash to the piles while keeping flame lengths reasonable. When those piles have become manageable, crew members with hand-carried *drip torches*[66] can move ahead to ignite other piles, while a mop-up crew will stay behind and clean up the remaining slash and burn out the surrounding slash in the piles.
- Depending on the time of year, a *scratch line*[67] or *scalping*[68] down to *bare mineral soil*[69] may need to be placed around the piles in an effort to prevent the fire from burning outside the pile ring.
- After visible flames have burned down, hot embers will remain in the burn ring. Depending on what fuel type you are burning, these hot embers may remain for several days. It is important to inspect the area where you were burning several times throughout the following days until the fires are dead out. In regions like the Sierra, fuels on the ground can dry out rapidly even after several days of rain. Pay close attention to this to prevent fire from escaping.

Following burning, a good restoration practice is to sow native grass seed into the mineral-rich ashes of some of the burn locations in an effort to restore the native grass community. Native grass can establish itself well in disturbed locations like burn spots. It may be possible to acquire native grass seed for your specific location from the US Forest Service or a local nursery in your area. You can sow these seeds by hand and experiment with how much seed to sow. Seeding rates will vary, so check where you buy the seed as to how much to use per location. The best time to sow native grass seeds is November thru March during their dormant time, depending on elevation. Sowing native grasses not only restores herbaceous plant communities to your site, it is a good preventative measure for noxious weed mitigation.

Remember: don't strip the ground of all woody material in your burning operations. Be sure to leave some coarse woody debris. Don't burn every stick. Decide what to leave on the site based on slope percentage, aspect, and location.

Hand Pile and Burn

Following thinning operations you may consider the method of *hand pile and burn,*[70] whereby slash can be gathered into piles located in open areas and burned. Slash is piled soon after it is cut, then covered with slash paper. Some people use plastic to keep piles dry and then burn the plastic. However, burning plastic is toxic, especially for those doing the burning. If you decide to use plastic in your preparations, be sure to remove the plastic sheets before burning.

Slash piles are usually burned in the fall and winter during moist days. At this time, the piles will be relatively dry while surrounding vegetation will be damp, minimizing the spread of fire beyond the pile.

Slash Piling Specifications

- Pile debris ranging from two to eight inches in diameter, at least two feet or more in length. On slopes greater than 55%, small-diameter (greater than eight inches) coarse woody debris may be left for soil stability. Some

[66] Drip Torch: A hand-held device used to ignite fires by dripping flaming liquid fuel on the materials to be burned.

[67] Scratch Line: An incomplete control line in the beginning stages that is constructed as an emergency backup for spreading fires.

[68] Scalping: The act of removing the surface layer to expose the bare mineral soil.

[69] Bare Mineral Soil: The layer of inorganic earth below the litter and duff layer that is composed of sand, silt, and clay and has little to no combustible materials.

[70] Hand Pile and Burn: The act of gathering slash into piles by hand and then burning the pile.

favorable small-diameter materials may be yarded for special forest product utilization (see section C.2.4 for more information).

- Piles should be placed away from old stumps and fallen logs to minimize their ignition. In an effort to prevent holdover fire potential (i.e., a fire not burning out completely), make sure that piles aren't located on top of old stump holes or decomposing logs. Be sure to place piles a sufficient distance from the drip lines of trees to prevent scorch.
- Construct piles up and down slopes and create a secure base to prevent the rolling of materials.
- Smaller fuels form the initial core for later ignition, with larger fuels placed on the top and sides.
- Piles ideally range from a minimal size of three feet high by five feet in diameter to a maximum size of five feet high by seven feet in diameter, except when insufficient slash is available in the area.
- Make piles as compact as possible. Limbing, aligning the material, and placing heavier material on top of the pile will obtain compaction. Air space between logs and limbs is not to exceed three inches in cross dimension after piling.
- Place slash paper on the piles such that the covering does not go beyond half the length of each side of the piles, as measured from the top (or center/mid-point). Your goal is to have the center core of the pile covered (not the entire pile) for successful ignition when lighting the pile at a later time.
- Secure slash paper on piles by placing heavy materials on top of the paper. Place it to provide the best protection from rain and snow, in order to enable later ignition.

For piles that may cause unavoidable scorch to residual trees upon combustion, burn them during periods of rain or snow to minimize damage. Each pile should be *chunked*[71] at least once during burning operations. Include any creep in the chunk to keep the fire confined to the piled area. Chunk piles after they have had sufficient time to burn down. Check piles daily, and more often in windy conditions. Escaped burn piles are responsible for numerous wildfires in the Sierra**.**

Broadcast Underburning

Broadcast underburning is a method that allows a prescribed fire to burn in the understory over a designated area within well-defined boundaries. It is done to reduce fuel hazards and/or as a silvicultural restoration treatment.

In order to effectively and responsibly reintroduce fire (i.e., to ensure it will burn on the ground and not in crowns), thinning and brushing must first take place. These actions reduce stand densities, ladder fuels, and the build-up of brush and excessive surface fuels.

Before burning in forested stands, a few preventative measures should be taken to ensure the survival of overstory trees. Often a thick layer of duff or thatch will accumulate beneath mature trees. In many cases, feeder roots will grow into the duff layer close to the surface of the ground. The loss of these roots due to extreme heat and/or fire can cause tree mortality. Thus duff should be raked back several feet with a McLeod to prevent unwanted impacts. Such treatments are especially important beneath large pines, which often accumulate thick mounds of debris, colonized by sensitive roots.

Favorable conditions for igniting fires include low winds, moderate humidity, fairly moderate temperatures, and a small amount of soil moisture to protect soils from baking. Aboveground fine fuels should be dry enough to ignite and carry fires. The idea is to reduce fine fuels in the form of duff or grasses without compromising or impacting soils, fungal associates, sensitive tree roots, etc. Burn intensities will vary depending on the vegetation type, the amount of ground and surface fuels, and the restoration objectives on the site.

In certain locations flashy underburns are the desired outcome where surface fuels are less and grasses persist in the understory (e.g. oak woodlands and savannahs). Flashy underburns are best accomplished in the fall and enable safer broadcast burning of a larger area. This can be achieved usually the second dry day following a rain. You want the top several inches of the surface of the fine fuels to be dry, and the moisture content below

[71] Chunk: To complete the pile-burning process by turning in or placing the unburned woody material ends into the fire ring.

sufficient to safely carry the fire quickly (flashy) and consume the top layer of the surface fuels leaving some organic material to protect the soil.

In other locations where surface fuels consist of deep, heavier leaf litter mixed with duff (e.g. Ponderosa pine and mixed conifer forests), a slower-creeping fire may be more appropriate. During Sierra Nevada mid-winter periods, an annual window of an extended dry period often occurs following heavier periods of earlier winter rain. This is a good time to accomplish this type of underburning to consume more of these abundant surface fuels. The slow creeping fire will consume more depth of surface and ground fuels. The native people of northern California and southern Oregon referred to this type of burning as 'cool burning'; the fire creeps along and consumes fuels without getting hot and out of control.[72]

Prior to execution of any broadcast underburning activities it is recommended that a *burn plan*[73] be drafted on a unit-by-unit basis. During any underburn operation it is necessary that a fire engine and a certified *ignition specialist*[74] and wildland firefighters be present to carry it out. If you decide to execute a broadcast burn you will need to work with the local fire department and CAL FIRE in the development of the burn plan. A burn plan will describe the layout of the property and determine locations for firebreaks (skid roads, spur roads, and main access roads), *fire ignition,*[75] *escape routes*[76] (in case the fire becomes a wildfire, a reality to consider in all levels of prescribed fire activities), water *pump chance,*[77] and adjacent properties. Prior to considering broadcast burning be sure to contact CAL FIRE to obtain all the necessary permits and legal requirements.

For ecosystem health and the long-term maintenance of fuel levels, broadcast burning is an important and recommended activity. Although there are many risks involved, it is critical that landowners, agencies, and communities not only learn to live with fire, but also become accustomed to using it.

Broadcast Burn Fire Preparation Example

- Thin and remove ladder fuels and *jackpots,*[78] and prune to head height. Separate ground-to-crown and crown-to-crown live and dead fuels.
- Lop and scatter tree branches and tops; cut to twelve- to eighteen-inch lengths on the ground for broadcast burn.
- Pile all other slash three to four feet high, five to six feet at base.
- Use flagging to mark all desired leave-species like seedlings and native shrubs, and create a *blackline*[79] around them (slowly burning out from desired leave-species so they will be retained when the main broadcast burn is initiated).
- Blackline (backburn) all retained doghair thickets and gulches before broadcast burning.
- Pull back heavy duff from leave-trees to prevent root steaming and possible mortality. Use a McLeod tool for this task.
- Leave slash less than two to three inches in diameter on the forest floor.

[72] Pilgrim, Agnes Baker. Confederated Tribe of Siletz, Takelma Tribe of the Rogue Valley, Southern Oregon. Personal communication.

[73] Burn Plan: Detailed document with specific information on prescribed burns. Used by the burn boss for implementing specific prescribed-burn projects.

[74] Ignition Specialist: A trained professional who specializes in ignition, prescribed fire techniques, and management. Ignition specialists are certified through the National Wildfire Coordinating Group and have years of experience in wildland fire suppression and prescribed fire use. They have met all necessary requirements to perform firing applications.

[75] Fire Ignition: The act of setting on fire or igniting a fire.

[76] Escape Route: A path or road that has been preplanned to get out of harm's way in a fire situation. The route should be well understood by all participants. If there is any unclear direction, the path should be marked.

[77] Pump Chance: An area where water can be pumped from a pond or creek for fire-suppression purposes.

[78] Jackpots: Generally, small pockets of dense fuels which could allow a fire to flare up and burn more intensely.

[79] Blackline: Preburning of fuels adjacent to a control line before igniting a prescribed burn.

- Put slash of two to three to eight inches in diameter in piles or near roads for firewood.
- Leave slash greater than eight inches diameter on the forest floor.

Patch Burning

Following initial thinning and slash treatment by either hand pile burning or swamper burning, patch burning may be used in site-specific locations. Patch burning is performed by defining and isolating a small area of fuels that you want to burn and applying fire only to that area. This method is sometimes used in the management of invasive blackberries where the area around the patch is thinned, a scratch line is created around the thinned area, then the inside patch is ignited.

This method can also be used to burn surface fuels within a variable-density treatment where unthinned areas are retained but you want to achieve the diversity of mosaic burn conditions.

If performed properly, patch burning can be a very effective method of reducing fuels and reducing costs. In the right conditions it works well in chaparral and sagebrush, as these plant types often have lots of dead fuel, and patches can be isolated and burned.

Similar to all prescribed fire methods, only perform the activities by consulting and hiring skilled fire or forestry professionals.

Considerations for Burning Activities Within Riparian Corridors

Some variation may occur during burning operations due to the change in vegetation, slope, and aspect.

- Burning should be carried out carefully along slopes above riparian draws, especially in *headwalls*,[80] or where loose boulders may be found. Lop and scatter coarse woody debris in these locations to protect the soil and enhance slope stability.
- Burn on stable benches within upland riparian areas. Thinned slash may need to be transported by hand crews to these locations.
- Take extra care while burning is being conducted to protect vegetative diversity. Burn slash away from *mesic*[81] vegetation.
- Underburn in a patch burn fashion.

C.2.2. Chipping

Chipping is another method for treating thinned materials, and like all options it has both advantages and disadvantages.

Advantages to chipping are:

- You can work on days when burning is prohibited.
- The chips created can be used for landscaping on paths around your homesite.
- Chips spread along roadsides will suppress the growth of vegetation, thereby keeping down fire hazards.

Disadvantages to chipping are:

- Chipping can be expensive.
- Chippers break down and need to be serviced.
- Chippers require use of fossil fuels to operate.
- Production levels for slash disposal are slower.
- Chippers have limitations to where they can be staged to accomplish fuels work.

If you don't have a chipper of your own, contact your local Fire Safe Council (FSC) or CAL FIRE unit. Many FSCs have community chipping programs or funding to help you chip instead of burn, especially in areas where air quality grants are available. If these programs are not available, you can either hire a forestry contractor who has a chipper or rent one. The chipper should be able to process material up to ten inches in diameter. Even if the

[80] Headwall: Steep upper sides of a drainage where fire can move quickly.

[81] Mesic: The condition of being normally moist, as in vegetation or ecosystems.

material you are chipping is six inches, having a ten-inch chipper will make things go faster because sometimes you will want to put three branches (each three inches in diameter) in the chipper simultaneously. With a chipper that takes larger-diameter material you will prevent the potential problem of jamming the machine. Two good chipper brand names are Morbark and Vameer. There are other good brands as well, so do some research and ask around. It is very important that you get a good chipper, since it can be frustrating to rent a chipper that does not serve your needs.

Chippers are best suited for use close to roads, landings, or where access to your thinning slash is convenient. The best fuel types to use in a chipper are softwood conifer species. Chippers can be used on hardwood and chaparral, but you will need to pre-process these materials before putting them into the chipper. Broad, branchy fuels like chaparral (e.g. manzanita or buck brush) can cause a chipper to jam if you do not first limb the branches with a chainsaw. These fuel types are time-consuming but workable. Limit dirt from getting into the chipper, as this will quickly dull the blades. Remember to stack all your branches in the same direction so you can easily feed the chipper.

Use extreme caution when operating a chipper; always wear safety glasses and ear protection. Pay special attention to the feed control; watch that your clothes (especially shirtsleeves) are not caught on branches as they are pulled into the chipper. Many counties have roadside chipping programs where the service is free. Contact CAL FIRE for further information on this. Be safe, be cautious, and happy chipping!

C.2.3. Lop and Scatter

Lop and scatter is a method whereby thinned materials are spread about to rot on the forest floor—taking care not to form large piles (jackpots) of slash. Lop and scatter can be very cost-effective but is definitely a site-specific treatment.[82] This is the best method for improving the soil fertility of the forest and hence the forest's long-term productivity. By removing the ladder fuels and scattering them low to the ground, you are improving the chances of your forest surviving a wildfire. However, because of short-term increased hazard this is not a method to do near structures within the Defensible Space Zone. Rather, it is more appropriate in the forested landscape, in the Wildland Fuel Reduction Zone (see Background B for Zone definitions).

Material should be cut down to an ideal height of one foot above the ground. However, lopping to less than or equal to twelve inches above ground is likely beyond the skills of most, so eighteen inches is sufficient to strive towards. Remove all large pieces of wood (makes for great firewood). Dedicate some larger, heavier pieces to sit on top of the slash and weigh it down. Conifer slash "lies down" much easier with much less lopping than most hardwood slash due to its growth habit. Green slash of all species lies down easier than dry slash (if you're thinking of coming back later to lop). Make sure none of your material on the ground is touching the base of any trees or shrubs you have left standing (your leave-trees). Think about this in terms of creating defensible space around leave trees just as you would around structures.

The risk with the lop and scatter method is that fire may occur within your treated area before the fine fuel falls to the ground and decomposes. Even so, lop and scatter does reduce your fuel hazard because the fuel is no longer part of the fuel ladder, and there is vertical clearance between the surface fuel and the bottom branches of the trees (ideally a minimum of eight feet of space). However, your surface fuel hazard may increase in the short term—from three to ten years—depending on the forest types on your property and the length of time it takes for the fuel to decompose.

C.2.4. Small-Diameter Wood Products

Much effort has been made in California and throughout the Pacific Northwest to develop markets for small-diameter wood products, especially hardwoods. It is possible to use these materials commercially, and they often produce beautiful lumber. Small, suppressed Douglas fir—a softwood—often has a tight grain that makes for attractive trim and tongue-and-grove flooring. Local hardwoods such as tanoak and madrone are used by woodworkers to create stunning furniture, cabinets, and floors. To be merchantable, the logs need to be straight and between six to ten inches in diameter. Two great sources for more information on this subject are the Institute

[82] Jones, Tim. Fire Management Officer, Arcata Bureau of Land Management. Personal communication, July 12, 2004.

for Sustainable Forestry (www.sustainablehardwoods.net) and the Watershed Center (www.thewatershedcenter.org).

The principal issues limiting small-diameter wood products are lack of infrastructure and marketing. The following text from *Small-Diameter Wood Utilization in Sierra Nevada Forests, A Situation Analysis and Assessment of Opportunities for Expanding Existing Markets* (a study commissioned by the Sierra Forest Legacy), summarizes existing small-diameter wood product market issues in the Sierra:

- Stronger markets for small-diameter wood would help reduce the net cost of restoration treatments, thus encouraging more landowners to undertake restoration work.
- Throughout the Sierra, small-diameter wood is underutilized when compared to other regions in the US. A large volume of small-diameter wood is piled and burned, a costly treatment that exacerbates air quality issues, particularly in the southern Sierra.
- The existing infrastructure for small-diameter log utilization in the Sierra is relatively weak as compared with other regions in the US. Exceptions to this exist in areas in close proximity to a sawmill capable of processing small-diameter material, or a biomass energy facility, as well as the relatively robust market for small-diameter incense cedar.
- Beyond that, a handful of examples of small-scale, small-diameter wood utilization facilities exist or are in development. Most of these are in need of outside funding or political support in order to truly thrive.
- Strong potential exists to develop new markets based on the amount of material potentially available, but many barriers exist to creating sustainable markets. Among the most vexing barriers is the lack of consistent and stable supply of small-diameter material. The long-term nature of stewardship contracts makes that tool a potentially attractive avenue for addressing supply issues.

Current small-log utilization in the Sierra

What is the fate of small-diameter logs that are harvested in the Sierra today? The vast majority of small logs will move down one of three primary chains:

Several Sierra sawmills have the capacity to process logs down to six inches and, depending on haul distances, will purchase some proportion of the small-diameter logs generated from traditional timber sales or from hazardous-fuel reduction projects. Incense cedar logs, in particular, have a high value for use in outdoor applications such as fencing and garden stakes, and several of the region's mills are actively seeking out more supply.

In locations near a biomass energy-generating facility, a proportion of the small-diameter log stream is chipped in the woods and hauled to the biomass plant. The rule of thumb is that costs begin to outweigh return about fifty miles' haul distance from such a facility.

Finally, another percentage of small-diameter logs is left in the woods, either scattered or piled and burned. Such treatments are frequently seen along roads throughout the range where the Forest Service and private landowners have increased the number of hazardous-fuel reduction projects in response to greatly increased federal and state funding in recent years….

The infrastructure for distributed, small- and medium-sized wood utilization that currently exists in the Rocky Mountain states (MT, ID, CO) and the Southwest (AZ, NM) does not exist in the Sierra. These states have lost much of their large-scale industrial infrastructure and long ago began the transition to a new forest economy based on smaller-scale operations. Fledgling efforts to develop such an infrastructure in the Sierra will be described in further detail later in the report, but perhaps the most important finding of this study is that after an extensive search for small-diameter wood utilization efforts in the Sierra, only a handful were found. Throughout most of the range, small logs continue to be underutilized compared to other forested regions in the West,

and significant value continues to literally go up in smoke as small logs are piled and burned rather than converted into lumber products or energy.[83]

C.2.5. Biomass

Due to policies to suppress fire, the forests of the Sierra Nevada have accumulated an unnatural amount of forest biomass that we need to remove by both mechanical means and by returning controlled prescribed burning to the landscape.

> Biomass refers to organic material from living things such as trees, shrubs, grasses and other plants. The temperate forests of the Pacific Northwest contain the highest amounts of biomass per acre of any forests in the world, far exceeding tropical forests. Biomass is commonly used as lumber, firewood, and paper. Biomass can also be used for energy production.[84]

In its simplest form, biomass is used to create heat. One of the most efficient ways is through a process called gasification. This technology is increasingly being used in schools in rural areas (see www.fuelsforschools.org for more information). Gasification uses woody materials as a source of energy to produce methane and hydrogen gases. These gases are then used to create additional heat or as fuel to power an engine that creates electricity. Biomass can even be used to replace our dependence on fossil fuel, and can be significantly better for the environment, assuming the production and collection of the original biomass is done in an ecologically appropriate and sustainable manner.

One of the noteworthy challenges associated with biomass as a source of energy is transportation costs. In order for biomass utilization to be economically feasible, the distance for the biomass to travel should not exceed twenty-five to fifty miles. In some of the remote communities in the Sierra Nevada some transport routes [[?]] could present trucking challenges. However, solutions are being developed as woody biomass utilization is becoming more of a federally mandated emphasis for public land management agencies. The alternative is to bring the biomass plant to the woods. Portable biomass facilities are being developed but are not yet commercially viable. Community-scale biomass alternatives that distribute the benefits (and the risks, such as over-exploitation of forests and air pollution) while reducing transportation costs and limiting large-scale impacts are most desirable and advantageous for the Sierra Nevada.

There is a host of creative possibilities for using biomass, including combining community fire hazard reduction and electricity generation using a mobile generator on-site. The University of Washington has invented a process that converts small trees to methanol. They have found that even the smallest trees and branches can be utilized as a power source for fuel cells. Funding is available for biomass projects from the USFS and BLM under Title II of the Healthy Forests Initiative and Healthy Forests Restoration Act. Title II authorizes these agencies to overcome barriers to the production and use of biomass and to help communities and businesses create economic opportunities. Funding is available for research.

A number of promising biomass-related projects are moving forward in the Sierra. These include:

- The Cedar Mills Eco-Farm, where a wood-fired boiler provides heat for a greenhouse on an abandoned sawmill site.
- The South Lake Tahoe High School is working to site a biomass boiler as the first Fuels-to-Schools project in California.
- Placer County has embarked on an innovative biomass strategy to reduce catastrophic fire risks, reduce energy dependence on fossil fuels, and promote local economic activity.
- The city of Truckee demonstrated small-scale heat and power from biomass. Their demonstration concluded that there is a need to scale up to a slightly larger output system.

The California Forest Biomass Working Group, which includes numerous agencies, consultants, and conservation organizations, has developed the following mission statement:

[83] Holst, Eric (2006). *Small-Diameter Wood Utilization in Sierra Nevada Forests,* A Situation Analysis and Assessment of Opportunities for Expanding Existing Markets.

[84] Institute for Sustainable Forestry, *Safeguarding Rural Communities: Fire Hazard Reduction and Fuels Utilization, Final Report,* September 2001 to December 2002, p. 23.

"Every forest community in California has the capacity to address and utilize the excess biomass in their area that is appropriately scaled to be economically and ecologically sustainable so that local jobs are created that help restore the environment and reduce fire risk."

To learn more about the Working Group, contact Bruce Goines, US Forest Service Region 5, 707-562-8910.

Background D—Fire Safety Information

The following list of internet links provided for additional fire safety information. See forevergreenforestry.com/SierraConservationCWPP.html for live links.

- Board of Forestry, Defensible Space Guidelines
  www.bof.fire.ca.gov/pdfs/Copyof4291finalguidelines9_29_06.pdf
- Board of Forestry, Forest Fire Prevention Exemption Language:
  www.bof.fire.ca.gov/pdfs/AB242010_28_05.pdf
- CAL FIRE, Home Page:
  www.fire.ca.gov/index.php
- CAL FIRE, Before, During, and After Wildfire:
  www.fire.ca.gov/education_content/downloads/Beforeduringandafter2005.pdf
- CAL FIRE, Evacuation Handout:
  fire.ca.gov/about_content/downloads/Evacuation2006.pdf
- CAL FIRE, Why 100 Feet?:
  www.fire.ca.gov/education_100foot.php
- CAL FIRE, Homeowner's Responsibility:
  www.fire.ca.gov/education_homeowner.php
- California Fire Safe Council (CFSC), Home Page:
  firesafecouncil.org/
- CFSC, Homeowner's Checklist:
  firesafecouncil.org/education/attachments/Homeownerchecklist.pdf
- CFSC, Landscape Guides:
  Brushland: firesafecouncil.org/education/attachments/landscapingbrushland.pdf
  Grassland: firesafecouncil.org/education/attachments/landscapinggrassland.pdf
  Timberland: firesafecouncil.org/education/attachments/landscapingtimberland.pdf
- EL Dorado County Fire Safe Council, Air Quality Burning Regulations
  www.edcfiresafe.org/documents/edc_firesafe_news_spring_2006.pdf
- EL Dorado County Fire Safe Council, Fire Resistant Landscaping
  www.edcfiresafe.org/fire_safe_vegetation.htm
- Firewise, Resources for the Homeowner:
  www.firewise.org/resources/homeowner.htm
- Homeowner's Wildfire Mitigation Guide:
  groups.ucanr.org/HWMG/index.cfm
- Plumas National Forest, Fire Resistant Landscaping:
  www.plumasfiresafe.org/Documents/PNF_BRD Fire Resistant Plants.pdf
- Public Resource Codes 4290 and 4291:
  www.leginfo.ca.gov/cgi-bin/waisgate?WAISdocID=4051777136+0+0+0&WAISaction=retrieve
  www.leginfo.ca.gov/cgi-bin/waisgate?WAISdocID=4052207349+0+0+0&WAISaction=retrieve
- Summary of California WUI Codes:
  osfm.fire.ca.gov/pdf/regulations/summareofwuicodes.pdf
- The Role of Registered Professional Foresters (RPF), RPF Law:
  www.fire.ca.gov/CDFBOFDB/pdfs/RoleofRPF_2005version.pdf

Instructions A—How to Organize Community Fire Safety Meetings

If you have ever organized a community meeting for your local school or church, organizing a community fire-planning meeting is similar. Here are a few basic concepts and steps.

1. Identify the purpose and outcomes of your meeting. Why are you calling the meeting? What do you want to have accomplished at the end of the meeting. Your Planning Committee can help you decide this. If you want to develop community priorities for fire safe activities, this is mostly already decided.
2. Develop an agenda for the meeting. We've created one that you can customize for you use on the following page.
3. Identify who you want to attend the meeting, your audience. For these community fire meetings it will probably be your neighbors, the fellow residents of your community.
4. Identify who will make presentations. Often your local fire chief, and representatives from CAL FIRE and federal land management agency fire prevention programs will appreciate the opportunity to explain their work to community members.
5. Decide where you want to have the meeting. Make it centrally located for everyone invited, with plenty of parking and seating, good lighting, and ideally a kitchen (having food and drink helps to ensure a good turnout!). If your meetings are at the neighborhood scale, consider having the meetings at someone's house. There are usually regular meeting spots in most communities. Use those places where people are already comfortable going.
6. Set up a committee to oversee the meeting logistics. You can use the checklist that follows the agenda to help you organize it.
7. Discuss and decide the best ways to invite the audience, then contact everyone you want to attend. You may want to employ several ways of contacting people, including letting them know a month or more in advance to "save the date," posting announcements the two weeks prior, and then doing follow up reminders the day or two before the event. The turn out at your meeting will often be the most important factor in its success. This can be through a variety of means, such as:
    a. Flyers of the meeting posted around town.
    b. Announcements through existing networks whether that is an email list, PTA or church meetings, the local fire department. There are also informal networks like groups of friends. Invite the movers and shakers in your community and ask them to spread the word.
    c. Advertising in local media: newspapers, radio, tv, internet. You can often do this for free through Public Service Announcements (PSAs) and community calendars.
    d. Door to door canvassing, actually knocking on people's doors and telling them about it.
    e. Phone trees, calling and inviting people. Make sure to do this not too early or too late. Some communities have existing emergency phone trees. While you don't want to activate an emergency notice, you can often use the same phone numbers to share community information such as these fire meetings.
8. Identify a meeting facilitator or leader. This should be someone who is comfortable as a public speaker and has a general understanding of the meeting's purpose and outcomes.

The following is the agenda template used in Appendix 2. Customize to meet your needs, then print and copy it to share with meeting participants.

[Plan Name] Fire Plan
Community Fire Safe Planning Meeting Agenda

1. Introductions (20 minutes)

- Everyone introduce themselves. Please state: 1) Name, 2) where you live, and 3) any experience or history you have with fire, fire suppression, or fire prevention.
- [Plan Name] Plan and Process, National Fire Plan, CWPPs
- [ ] Fire Safe Council—What does it do? How can it benefit local residents?

2. Fire safety and defensible space (50 minutes; fire agency and/or FSC representative)

Why bother? What are the benefits? What do you think it means?
"winners and losers" (defendable/non-defendable)

- "winners and losers" (defendable/non-defendable)
- clearance around homes, landscaping
- zones concept
- building materials, UC Forest Products Lab
- access, road conditions, and fire engines
- clearance along roads
- shaded fuelbreaks
- what to do with thinned materials
- water sources
- safe zones
- what to do in case of a wildfire

3. Neighborhood fire history (10 minutes; facilitator, all)

- What are your memories and real experiences of fire here?
- How did the fire start? Where was it? What happened? How big was it? When was it? What did you do?

4. Identify values and assets at risk (10 minutes; facilitator, all)

Where are the places of most concern to you, the ones you would least want to be lost in a wildfire, such as businesses, historical areas, ecologically significant areas, etc.? Mark this information on the maps and record it on flip charts.

5. Identify high-risk and high-hazard areas (10 minutes; facilitator, all)

Where do you think a fire would start and why? Where are the areas that would be difficult to control if a fire started or reached there? In which direction have fires historically burned? Mark this information on the maps and record it on flip charts.

6. Developing projects to reduce identified risks (30 minutes; facilitator, all)

- Can we reduce the probability of ignitions? If so, how and where?
- Can we remove fuel in high fire hazard areas? If so, how and where? ID roads to brush, shaded fuelbreaks.
- Do we need more water storage in specific places? If so, where?
- Can we improve access (road/house signing, clearance)?
- Are there things you can do to improve evacuation planning?
- Are revisions of the county or municipal plan or codes necessary?
- What projects can be done without outside funds?
- Are there other priority projects, e.g. related to the local economy, education, or ecosystem recovery?

Identify projects and mark them on the map, including:
• fuel reduction work • shaded fuelbreaks • additional water storage • restoration • fire-safe development
• economic development • road improvements • education • any other relevant projects
Which of these projects is your highest priority?

7. [ ] Fire Safe Council (5 minutes; FSC representative, if applicable)

Provide an introduction to the local FSC and what they do. Identify how interested people can get involved.

8. Local Fire-Fighting Atlas (15 minutes)

Mark and identify on maps locations of:
• roads (with local names) • road outages/slides/problem areas • power lines • homes
• domestic animals • gates, water tanks • important outbuildings • etc.
Take copies of maps and handouts to your neighbors who could not attend the meeting to include their input.

Community Fire Meeting Task List
Community Meeting Location:
Date:

Logistics:
__ Confirm location, parking
__ Confirm availability of chairs, seating
__ Confirm kitchen: ability to boil water/teapot/large pots, coffeemaker, cups, plates, etc
__ Contact neighbors, others to bring baked goods
__ Bring coffee, tea, sweetener, snacks, napkins, cups if necessary
__ Post signs day of meeting in community & at meeting location/driveway
__ Confirm agency speakers
__ Confirm fire department speakers
__ Confirm other speakers
__ Set up chairs, beverages, snacks before [6:30 p.m].

Outreach:
__ Collect phone numbers at least two weeks prior
__ Call neighbors one week prior
__ Put up posters in community 2 weeks prior
__ Put up posters at community centers/post office/stores 2 weeks prior
__ Notices in local papers, if appropriate

Materials:
__ Bring handouts, card table if necessary
__ Bring large map of community (produced by [map producer] for each community)
__ Bring fire history map, fire protection district map, other maps
__ Bring nametags for presenters folks
__ Supplies: tape, tacks, large markers of assorted colors, yellow/orange/pink/blue highlighters, blue and black sharpies, pens, pencils, clipboard
__ Bring laptop for taking notes, with extension cord. Notebook backup.
__ Easel paper and stand or chalkboard, if possible
__ Bring sign-in sheet for each meeting with clipboard

Follow Up, within one week:
__ Type/edit notes and send to [meeting organizer]
__ Copy sign-in sheet and send to [meeting organizer], enter names into database
__ Thank you notes to hosts
__ Review handouts and make more copies as necessary for future meetings
__ Follow up to agreements made at meeting, including updating website

Instructions B—Community Meeting Outreach Mailing and Survey

1. Outreach Mailing – Sample Letter[1]

[Date]

Dear Neighbors,

We are writing to you today on behalf of the [ ] Fire Safe Council in regard to a current opportunity we have as [planning area] residents to improve our chances of surviving wildfires. The Fire Safe Council is developing a Conservation-Based Community Fire Plan for [planning area]. In that plan, we are identifying what we as community members want to do to reduce our risks from wildfire and in turn increase our fire safety here.

Our reason for writing you is two-fold. First, we want to share with you information to help you prepare for and survive a wildfire. The enclosed "Homeowner's Checklist" is a great first step towards making your home fire safe and creating your "defensible space" — the space (usually 30 to 100 feet) around your home to allow firefighters to safely and effectively defend your home in case of wildfire. Please spend a few hours this weekend reviewing your home and property with this checklist. Identify where you are safe and what other steps you need to take to protect your home and family. If you would like more help with identifying fire safety and defensible space issues around your home, you can contact your local **Fire Department ([phone number]), California Dept. of Forestry and Fire Protection, a.k.a. CAL FIRE ([phone number]), US Forest Service ([phone number]), or the Fire Safe Council ([phone number]).** Any of these groups will gladly help you in obtaining a free fire safety inspection for your home.

Second, we want to hear what you think is most important to do here to prepare our community for eventual wildfires. The plan that we are developing will identify community priorities for wildfire protection. That means we want and need to hear from you! You know the area where you live better than most anyone else. **Please use the enclosed survey and map to let us know by [date]: 1) What areas you think are most important to protect if there is a wildfire (e.g. schools, historical sites, etc.); 2) Where you think a fire might start in your neighborhood and why; 3) Where if a fire started in your neighborhood it would be difficult to control; and 4) Where you think any fuel reduction or other projects should be undertaken in your neighborhood to reduce fire risks and hazards there.**

Examples of fuel reduction projects include putting in "shaded fuelbreaks" (where the highest tree canopy is left intact, but most of the lower vegetation is removed to help slow down a fire), removing brush and dead vegetation along roads, and educational projects such as signs, school projects, etc. Please take about a half hour to fill out the survey and map and return it to us by [date] in the enclosed envelope. If you want another copy of the map to keep, let us know and we'll send you another.

Finally, we welcome you to get involved in the [ ] Fire Safe Council. The [ ] FSC is a volunteer organization that meets monthly to make the [planning area] a more fire-safe place to live. Meetings are held [when] at the [where]. For more information on the Fire Safe Council, please contact us at [phone number] or [email address].

If you have any questions regarding the Fire Plan, please contact [fire plan contact person] at [phone number]. Thank you for taking the time to make your home and our community fire safe. We look forward to seeing your ideas on [date].

Sincerely,

[Name]	[Name]	[Name]
Director, [ ]FSC	[Affiliation]	[Fire Plan Coordinator]
	Chair, Fire Planning Committee	

Enclosures: Homeowner's Checklist, Map and Survey, Return Envelope

[1] This sample letter is taken from one used by the Del Norte Fire Safe Council in May 2004.

2. Resident Outreach Survey

Your Name:

Your Address:

Your Phone Number:

Your Email Address:

Date you filled out this survey:

1. **What do you consider the most important areas in your neighborhood (other than homes) to protect in the case of a wildfire?** (For example, schools, cultural or historical sites, ecologically significant areas, businesses, power stations, etc.) Please list those areas here. Please also mark these on the map with XXXX, and if possible, in green.

2. **Where do you think a fire would start in your neighborhood? Why do you think it would start there?** Please describe those places here. Please also mark these on the map with ////////, and if possible, in red.

3. **Which places do you think in your neighborhood would be most difficult to control if a fire stared there? Why those places?** Please describe here. Please also mark these on the map with ^^^^^^^^^^, and if possible, in orange.

4. **What steps do you think need to be taken to protect you and your neighbors from a wildfire?** Please describe those steps in as much detail as possible here.

5. **What projects would you like to see done in your neighborhood to improve fire safety?** Please describe here. Please also mark the location of these projects on the map with \\\\\\\\, and if possible, in yellow.

6. **Where are there sources of water in your neighborhood that can be used for fire-fighting (such as water tanks, pools, or ponds)?** Please list those here with the approximate capacity in 1,000 gallons (for example, 5,000 gallons would be listed at 5). Please identify those spots on the map with a dot • (if possible in blue) and write the capacity next to the dots.

Use additional sheets if necessary.

3. Outreach Mailing – Sample Map

This is a sample map from the Del Norte Fire Safe Plan. Use a simple black and white map of your local area for residents to mark and return with the survey.

Instructions C— Community Meeting Mapping Exercise Instructions[1]

Use the following questions to create your maps at your community fire safety meeting. Prepare for the meeting by printing or copying large-format maps of your planning area. You may need to make several maps to cover the entire planning area. The scale should be such that locations along roads and in neighborhoods are easily recognizable. Provide highlighters and markers for participants to mark up the maps (see recommended colors next to each item below). This can later be digitized into a GIS and used as is in creating your assessment, prioritization, and action plan.

Community Values at Risk (Green Highlighter)

- Where are the places and things you most value and want to see protected from wildfire? Examples include:
  - Hospitals and health care facilities
  - Businesses
  - Schools, Churches, and Stores
  - Community centers
  - Rare and endangered species habitat; ecologically significant areas
  - Recreation areas
  - Culturally or historically significant areas
- What critical infrastructure needs to be protected from wildfire? Examples include:
  - Power substations and corridors
  - Communication sites and facilities
  - Landfills and treatment facilities

Wildfires Causes, Risk, and Hazards (Orange Highlighter, Red Marker, Pink Highlighter)

- What is the local fire weather scenario? What kinds of conditions have started wildfires in the past? Where have they started?
- What are the causes of wildfire in your community?
- Where do you think a wildfire would start in your community and why?
- What are other wildfire hazards in your community?
  - Dead trees (insect or disease)
  - Slash from logging or thinning
  - Fuel storage
  - Abandoned wooden structures
  - Power lines
  - Road systems – blocked, brushed over, or dead-end roads
- What kind of road or structural conditions might increase fire risk? (Red marker)
  - Road maintenance needs (outages, slides, etc.)
  - Bridges and/or locked gates, especially bridges too small or weak to carry a fire truck
- Where have fuel reduction projects already occurred? Identify defensible space and fuel reduction treatments. (Pink highlighter)

- **Protection Capabilities (Blue Highlighter and Marker, Black Marker,)** Where are there resources for fighting fires? What information needs updating?
  - Municipal watersheds
  - Water storage: tanks, ponds, pools (Blue marker dot w/# 1,000 gallons (e.g. 5 =5000)
  - Equipment (**Black marker**)
  - Access routes/evacuation

Instructions C— Community Meeting Mapping Exercise Instructions[1]

- Safe Zones
- Updated road conditions: roads that do not exist on the maps, or are on the maps and do not exist on the ground. (**Black marker**)

Priorities for Action (**Yellow Highlighter**)

- Where do you most want to see fuel treatments occur? What types of treatments?
  - Shaded fuelbreaks
  - Road brushing
  - Other?
- What other wildfire protection activities would you like to see implemented?
  - Access route/evacuations
  - Education
  - Equipment
  - Ignition reduction
  - Water storage: tanks, ponds, pools (Blue dot w/yellow circle)
- Which projects are your highest priority and why? (Number on flip chart in red. One method for prioritizing is to take the total number of identified projects, divide it by 3, and give each participant that many sticky dots. Instruct participants to place one dot (only one vote per item) on each of their priority projects. The result will be a J-curve of the group's prioritization preferences.)

Instructions D—Creating Maps with Fire Planning and Mapping Tools

Using the California Fire Planning and Mapping Tools Website

1. Go to http://wildfire.cr.usgs.gov/fireplanning/ (this generally only works with a high-speed Internet connection).
2. Select "Run the *Fire Planning and Mapping Tools Viewer*," and a new window will open with the viewer.
3. Select your county in "Zoom to County," then wait for the map to refresh with a view of your county.
4. Zoom to the planning area you want to use for your final map by selecting "Zoom In" and drawing a box around your general area.
5. Choose the data layers you want to display from the selection on the right. Select the blue triangle next to the layer topics to see the data layers contained in each section. Use the scroll bar to the right to see the entire list of available layers.
    a. To display a layer, select the "visible" box to the left of the layer name.
    b. Choose all the layers you want to display by making them visible. Remember that too many layers will make your map hard to read.
    c. Select "Refresh Map" for the map to redraw with your layers visible.
6. Decide which layers you will want to use in your base map. For instance, this might include the following layers: States, Counties; Cities, Large Cities, Communities at Risk; Roads 100k, Road Shields; Streams NHD (best when zoomed into the community scale), Water Bodies; Shaded Relief. Several of these layers are automatically activated when you open the map viewer, including 2006 fire perimeters. To make your maps consistent, you will likely want to display the same base information (layers), in the same view, for every map you create. You can then add overlay layers to display different attributes for creating individual maps (e.g. fire history, fuel hazard, etc.).
7. To review the legend (layer information and metadata) for any layer, click on the layer name. A new window will appear with the layer legend.
8. To display the legend on the map viewer, select "Legend" at the top right under the scale bar (the default is "Layer").
9. To identify a polygon, point, or line within a specific layer:
    a. Select the "Active" button next to the layer.
    b. Click on "Identify" on the left.
    c. Position your cursor over the item for which you want information and click. If you are looking at data within the active layer, a new screen will appear with the data for your item. If not, check to make sure you have the correct layer active.
10. Once you have finalized your map, select "Print" from the buttons on the left. This will take you to a print preview screen. You then print by selecting "Print" from your web browser's file menu (Note: Mozilla Firefox does not work with this feature; you must use another browser such as Internet Explorer to print your maps.)
11. You can also download the data you have displayed in a map by selecting the "Download" button. This will download only the layers you have visible for the area you have visible. You can then use this data in a GIS program such as ArcView/ArcGIS.
12. More information can be found by selecting the "Help" button from the bottom of the scroll-down menu along the left.

Fire Planning and Mapping Tools

User Instructions

The main page of the web application depicts general information at the state level. From this point you can zoom in, out, or move around, using the buttons on the toolbar (see below for details on the buttons). You can also customize the view by turning layers on or off using the ***Visible*** check box next to the layer name. The ***Active*** radio button sets the layer for the ***Identify*** or ***Hyperlink*** function.

Information and metadata for a layer can be retrieved by clicking on the layer name in the layer list to the right of the map.

Locator On	Use the Locator button to display/undisplay the locator map in the upper left-hand corner of the map.
Full Extent	Click to zoom to the full extent of the map.
Zoom In	Click then click and drag an area in the map frame to zoom.
Zoom Out	Click and then click in the map frame to zoom out.
Back	Click to zoom to the last extent
Pan	Click and then click and drag in the map frame to pan to a new location. Alternatively, the arrows surrounding the map frame will pan in the direction of the arrow.
Hyperlink	Click the Active radio button next to the layer that contains hyperlinks, then click on the Hyperlink button. Choose the feature on the map frame to do a hyperlink to.
Identify	Click the Active radio button next to the layer of interest, then click the Identify button. Select the feature on the map frame to identify. The information will be displayed in a box below the map frame.
Download	Download vector data that is in the current window as well as relevant fire plan files.
Print	Click the Print button to print the data currently in the map frame. Enter a title in the box below the map frame and click "Create Print Page" to open a new Browser window with the map displayed. Then click the File/Print menu item to print.
Jump to Lat, Long	Click to zoom to a location using latitude and longitude coordinates.
Display Lat, Long	Click on a point on the map, and an alert will pop up displaying the lat/long of that point. The datum is NAD83.
Zoom To	Click to bring up another window that will provide several Zoom-To options.

Instructions D—Creating Maps with Fire Planning and Mapping Tools

Reload	Click to reload the map in the window.
Help	Click to bring up the Help menu.
Layer	Click to view the layers that are currently available in the map frame.
Legend	Click to view the legend for the layers that are currently visible in the map frame. Note: Only vector layer's legends are displayed.
Refresh Map	Click to refresh the map after changing the visibility of a layer.

Instructions E—Fire Protection Survey

The following surveys are to be used to assess fire agencies for completing Appendix 6. Modify this survey to meet your local needs. You can include copies of the completed surveys in your plan if you want to share the raw data with your readers.

PRIVATE/LOCAL AGENCY SURVEY

A. Organization:

Fire Agency:

Contact Person:

Mailing Address:

Main Fire Station Address (if different):

Other Fire Station Addresses:

Phone, Emergency:

Phone, Non-Emergency:
(can we publish this # in the fire plan?)

FAX:

Email:

Website:

Alternate Contact Name:

Alternate Contact Phone:

B. Department

1. How many volunteer fire fighters are involved with your department?

2. How many of those are active volunteers?

3. How many other volunteers (non-fire fighters) are involved with your department?

4. Do you have any paid staff?

5. What are the titles of your paid staff positions?

6. What is your approximate annual budget?

7. From where do you receive the funds to meet your budget?

8. Approximately what percentage of your budget, if any, is met by a benefit assessment or other local taxing structure?

C. <u>Service Area Information</u>

9. What is the geographic area you serve?

9.1. How do you define your service are?

9.2. What communities does it include?

9.3. What is the approximate area in square miles?

9.4. Do you have a map of your service area? If so, please fax it to us at [xxx-xxxx].

9.5. Do you respond to calls outside of your service area?

9.5.1. If so, what percentage of your calls are outside your service area?

9.5.2. Where outside of your service area do you respond?

9.6. With which other fire departments do you have <u>mutual aid</u> agreements?

9.7. Do you have any <u>auto aid</u> agreements? YES NO If so, with which departments?

10. What is the total population of the area you serve?

11. Response Times:

11.1. What percent of your area do you serve within 3 minutes?

11.2. What percent of your area do you serve within 5 minutes?

11.3. What percent of your area do you serve within 10 minutes?

11.4. What percent of your area do you serve within 15+ minutes?

Instructions E—Fire Protection Survey

12. Emergency Calls:

12.1. Approximately how many total emergency calls did you receive last year?

12.1.1. How many were structure fires?

12.1.2. How many were wildland fires?

12.1.3. How many were non-vehicular medical?

12.1.4. How many were vehicle accidents?

12.1.5. How many were other emergency response?

13. What is/are the ISO rating(s) of your fire protection area?

13.1. Do you have a map of your ISO ratings? If so, please fax it to us at [xxx-xxxx].

A. Equipment

14. How many structural fire engines do you have?

Engine	Age	# Gallons Water Capacity

15. How many wildland fire engines do you have?

Engine	Age	# Gallons Water Capacity

16. How many water tenders do you have?

Tender	Age	# Gallons Water Capacity

17. What other equipment do you have?

Equipment	Age

18. What equipment, if any, do you have that needs to be replaced?

19. What equipment, if any, do you need in addition to your existing equipment?

20. What size fire hose thread do you prefer on local water sources (such as stand pipes from domestic water tanks)?

21. What is the minimum clearance you need (width by height) for your trucks to access private homes?

22. What is the minimum turn-around space you need to bring your equipment to a private home?

B. Training

23. Have any of your fire fighters had special trainings or have special expertise?

24. What training needs to do you have?

C. Needs

25. What do you need most to be able to continue to provide the services you provide?

26. What do you need most to improve the services you provide?

STATE/FEDERAL AGENCY SURVEY

A. <u>Organization:</u>

Fire Agency:

Contact Person:

Mailing Address:

Main Fire Station Address (if different):

Other Fire Station Addresses:

Phone, Emergency:

Phone, Non-Emergency:
(can we publish this # in the fire plan?)

FAX:

Email:

Website:

Alternate Contact Name:

Alternate Contact Phone:

B. <u>Department</u>

1. How many fire fighters are involved with your department?

2. What are the different titles of those fire fighters, and how many people serve each position?

3. Are any of these volunteers? If so, how many of those are volunteers?

C. <u>Service Area Information</u>

4. What is the geographic area you serve?

4.1. How do you define your service are?

4.2. What communities does it include?

4.3. What is the approximate area in square miles?

4.4. Do you have a map of your service area? If so, please fax it to us at [xxx-xxxx].

4.5. Do you respond to calls outside of your service area?

4.5.1 If so, what percentage of your calls are outside your service area?

4.5.2 Where outside of your service area do you respond?

4.6. With which other fire departments do you have mutual aid agreements?

4.7. Do you have any auto aid agreements? YES NO

If so, with which departments?

5. What is the total population of the area you serve?

6. Response Times:

6.1. What percent of your area do you serve within 3 minutes?

6.2. What percent of your area do you serve within 5 minutes?

6.3. What percent of your area do you serve within 10 minutes?

6.4. What percent of your area do you serve within 15+ minutes?

7. Emergency Calls:

7.1. Do you respond to calls other than wildland fire protection?

7.2. If so, approximately how many total emergency calls did you receive last year?

7.2.1 How many (or %) were structure fires?

7.2.2 How many (or %) were wildland fires?

7.2.3 How many (or %) were non-vehicular medical?

7.2.4 How many (or %) were vehicle accidents?

7.2.5 How many (or %) were other emergency response?

D. Equipment

8. How many structural fire engines do you have?

Engine	Age	# Gallons Water Capacity

9. How many wildland fire engines do you have?

Engine	Age	# Gallons Water Capacity

10. How many water tenders do you have?

Tender	Age	# Gallons Water Capacity

11. What other equipment do you have?

Equipment	Age

12. What equipment, if any, do you have that needs to be replaced?

13. What equipment, if any, do you need in addition to your existing equipment?

14. What are your plans to replace, upgrade, or purchase this additional equipment?

15. What size fire hose thread do you prefer on local water sources (such as stand pipes from domestic water tanks)?

16. What is the minimum clearance you need (width by height) for your trucks to access private homes?

17. What is the minimum turn-around space you need to bring your equipment to a private home?

E. Training

18. Have any of your fire fighters had special trainings or have special expertise?

If so, which trainings/expertise?

19. What training needs to do you have?

F. Needs

20. What do you need most to be able to continue to provide the services you provide?

21. What do you need most to improve the services you provide?

Instructions F—Updated Project List and Plan Update Signature Page

Updated Project List
2007

Federal agencies and private landowners of the vegetation surrounding the identified communities, structure, or areas of concern were invited to submit projects that provide protection and reduce risk. The following table displays a list of projects submitted and the community recommendations. (The community may also consider and add projects of its own development.)

Community, structure or area at risk	**Project**	**Agency/ Landowner**	**Funding Needs**	**Time Table**	**Community Recommendation**
[ ]	(name)	[ ]	Agency budget	2006	Yes
[ ]	(name)	[ ]	Agency budget	2006	Yes
[ ]	(name)	[ ]	Agency budget	2006	Yes
[ ]	(name)	[ ]	Agency budget	2006	Yes
[ ]	(name)	[ ]	Agency budget	2006	Yes
[ ]	(name)	[ ]	Agency budget	2006	Yes
[ ]	(name)	[ ]	Agency budget	2006	Yes
[ ]	(name)	[ ]	Agency budget	2006	Yes
[ ]	(name)	[ ]	Agency budget	2006	Yes
[ ]	(name)	[ ]	Agency budget	2006	Yes
[ ]	(name)	[ ]	Agency budget	2006	Yes
[ ]	(name)	[ ]	Agency budget	2006	Yes
[ ]	(name)	[ ]	Agency budget	2006	Yes
[ ]	(name)	[ ]	Agency budget	2006	Yes
[ ]	(name)	[ ]	Agency budget	2006	Yes
[ ]	(name)	[ ]	Agency budget	2006	Yes
[ ]	(name)	[ ]	Agency budget	2006	Yes
[ ]	(name)	[ ]	Agency budget	2006	Yes
[ ]	(name)	[ ]	Agency budget	2006	Yes
[ ]	(name)	[ ]	Agency budget	2006	Yes

Instructions F—Updated Project List and Plan Update Signature Page

The following entities mutually agree with the contents of this Community Wildfire Protection Plan update:

[insert a name and identify the applicable local government here– add as many lines as necessary]

[insert a name and identify the applicable local fire department here – add as many lines as necessary]

[insert Unit Chief's name here], Unit Chief
California Department of Forestry and Fire Protection

Instructions G—Sierra Fire Safe Councils

Alpine Fire Safe Council, www.alpinefiresafe.org/, (530) 694-2791 or (530) 694-2767

Alta Fire Safe Council, www.firesafecouncil.org/find/view_council.cfm?c=3, (530) 389-2676

Amador Fire Safe Council, www.amadorfiresafe.org/about.html, (209) 296-6220

Auburn Lake Trails Fire Safe Council, www.edcfiresafe.org/auburn_lake_trails/index.htm, (530) 888-1002

Butte County Fire Safe Council, http://www.buttefiresafe.org/, (530) 877-0984

Calaveras Foothills Fire Safe Council, www.firesafecouncil.org/find/view_council.cfm?c=80, (209) 728-8785

Eastern Madera County Fire Safe Council, maderafsc.org/html/main/about.html, (559) 877-3772

Eastern Sierra Regional Fire Safe Council, www.easternsierrafirecouncil.org/, (760) 872-3004

El Dorado County Fire Safe Council, www.edcfiresafe.org/index.php, (530) 647-1098

Foresthill Area Fire Safe Council, www.firesafeforesthill.org/ (530) 367-2465

Greater Auburn Area Fire Safe Council, www.firesafecouncil.org/find/view_council.cfm?c=106, (530)-823-4211

Greater Colfax Area Fire Safe Council, www.firesafecouncil.org/find/view_council.cfm?c=26, (530) 346-6037

Highway 108 Fire Safe Council, www.tuolumnefiresafe.org/, (209) 928-1886

Iowa Hill Fire Safe Council, www.firesafeforesthill.org/, (530) 367-2465

Kern River Valley Fire Safe Council, www.krvfiresafecouncil.com/, 760 379-2844

Mariposa County Fire Safe Council, www.mariposafiresafe.org/homepage.html, (209) 966-7700

Fire Safe Council of Nevada County, www.firesafecouncilnevco.com/, (530) 272-1122

Placer County Fire Safe Alliance, www.placerfirealliance.org/, (530) 823-5687 x116

Placer Hills Fire Safe Council, www.firesafecouncil.org/find/view_council.cfm?c=53, (530) 878-0405

Placer Sierra Fire Safe Council, www.firesafecouncil.org/find/view_council.cfm?c=200, (530) 878-0405

Plumas Fire Safe Council, www.plumasfiresafe.org/, (530) 832-4705

Ponderosa Fire Safe Council, www.firesafecouncil.org/find/view_council.cfm?c=172, (530) 346-6037

Sierra County Fire Safe and Watershed Council, firesafecouncil.org/find/view_council.cfm?c=102, (530) 862-1004

Sierra Highway 4 Fire Safe Council, www.firesafecouncil.org/find/view_council.cfm?c=109, (760) 458-0914

Tahoe Basin Fire Safe Council, firesafecouncil.org/find/view_council.cfm?c=116, (530) 573-0515

Yosemite Foothills Fire Safe Council, firesafecouncil.org/find/view_council.cfm?c=110, (209) 575-0818

Yosemite West Property & Homeowners Inc, www.yosemitewest.org/firesafe.htm, (209) 372-4325

Yuba Watershed Protection and Fire Safe Council, www.co.yuba.ca.us/firesafe/default.htm, (530) 692-0245

Instructions H—Sierra Community Fire Plans

This list does not include all CAL FIRE unit plans in the Sierra. To look up a unit plan, go to: cdfdata.fire.ca.gov/fire_er/fpp_planning_plans, and search either by unit or county.

Alpine County Community Fire Plan, www.alpinefiresafe.org/pages/cwpp.htm

Amador County Fire Hazard Reduction Plan, www.amadorfiresafe.org/AFSC_Final_Report.pdf

Auburn Lake Trails Fire Safe and Fuels Reduction Plan, www.edcfiresafe.org/auburn_lake_trails/index.htm

Butte County CWPP, www.buttefire.org/Index/BTUFireplan2005.pdf

El Dorado County Wildfire Protection Plan, www.edcfiresafe.org/edc_wildfire_protection/

Fallen Leaf Fire Dept./Tahoe Basin CWPP, www.trpa.org/documents/docdwnlds/Fire_Plan/fallen_leaf.pdf

Fresno-Kings CAL FIRE Unit Plan, cdfdata.fire.ca.gov/fire_er/fpp_planning_plans_details?plan_id=76

Highway 108 Fire Plan, www.tuolumnefiresafe.org/fire_plan_info.html

Kern River Valley Community Fire Safe Plan, www.krvfiresafecouncil.com/resources.htm

Lake Tahoe Basin CWPP, www.trpa.org/documents/docdwnlds/Fire_Plan/basinwide.pdf

Lake Valley Fire Protection District, www.trpa.org/documents/docdwnlds/Fire_Plan/lake_valley.pdf

Lassen-Modoc CAL FIRE Unit Plan, cdfdata.fire.ca.gov/fire_er/fpp_planning_plans_details?plan_id=81

Meeks Bay Fire Protection District, www.trpa.org/documents/docdwnlds/Fire_Plan/meeks_bay.pdf

Nevada County Fire Plan, docs.co.nevada.ca.us/dsweb/Get/Document-85868/

Placer County Fire Plan, www.sedd.org (SEDD Publications, Fire Safe Plans)

Plumas County Fire Plan, plumasfiresafe.org/fire_plan.htm

Ponderosa Fire Safe Council, www.firesafecouncil.org/find/view_council.cfm?c=172

Shasta County CWPP, www.shastacountyfiresafecouncil.org/Wildfire_CPP.html

Sierra County FSC and Community Fire Safe Plan, www.sedd.org (SEDD Publications, Fire Safe Plans)

Tahoe Basin Fire Plans, www.trpa.org/default.aspx?tabindex=3&tabid=127

Tuolumne-Calaveras CAL FIRE Unit Fire Plan,
cdfdata.fire.ca.gov/fire_er/fpp_planning_plans_details?plan_id=67

Yosemite West CWPP (draft), www.yosemitewest.org/wfa50225.htm