Appendix PD-1

Description of Treatable Landscape Modeling

PD-1 ANALYSIS ASSUMPTIONS AND METHODS

PD-1.1 SPATIAL MODELING FOR THE CALIFORNIA VEGETATION TREATMENT PROGRAM (CALVTP)

This Appendix provides the specific data and modeling information that was used to determine the areas of California where vegetation treatment activities under the California Vegetation Treatment Program (CalVTP) may be implemented (the treatable landscape) as described in Chapter 2, "Program Description."

PD-1.1.1 Overview

The proposed CalVTP will occur within the 31-million-acre State Responsibility Area (SRA). More than 90 percent of the SRA is on private, non-federal jurisdictions lands, where land use ranges from wildland-urban interface (WUI) areas, to commercial timber production, to sparsely populated ranches or non-commercial private lands.

Not all eligible wildland acres are in equal need of, or would equally benefit from, vegetation treatment under the program. Under this PEIR three treatable fuel types (Tree, Shrub, Grass) were identified, along with three treatments types (WUI fuel reduction, fuel breaks, and ecological restoration).

In support of the PEIR, three separate Geographic Information System (GIS) based analyses were preformed to map areas eligible for treatments under each of the three treatment types and within the three treatable fuel types. The first analysis provided possible treatment areas within the SRA and identified WUI areas. The second analysis provided possible treatment areas for fuel breaks along ridgelines and along roadways in the SRA and Local Responsibility Areas (LRA). The third analysis provided possible treatment areas for ecological restoration, which were identified by selecting all of the SRA, excluding any area identified as WUI, and identifying areas that are Condition Class 2 or 3. All three analyses where overlaid with the three treatable fuel types to produce the approximate treatable landscape under the CalVTP, approximately 20.3 million acres.

PD-1.1.2 State of California Responsibility Areas

The State of California is divided into three different types of responsibility areas: Federal Responsibility Areas (FRA), SRA, and LRA. SRA is defined in Public Resources Code (PRC) 4126:

> *The board shall include within state responsibility areas all of the following lands:*
>
> *(a) Lands covered wholly or in part by forests or by trees producing or capable of producing forest products.*
>
> *(b) Lands covered wholly or in part by timber, brush, undergrowth, or grass, whether of commercial value or not, which protect the soil from excessive erosion, retard runoff of water or accelerate water percolation, if such lands are sources of water which is available for irrigation or for domestic or industrial use.*
>
> *(c) Lands in areas which are principally used or useful for range or forage purposes, which are contiguous to the lands described in subdivisions (a) and (b).*

These lands are defined "…for the purpose of determining areas in which the financial responsibility of preventing and suppressing fires is primarily the responsibility of the state" (PRC 4125). PRC 4127 specifically defines land that shall *not* be included in SRA:

> *The board shall not include within state responsibility areas any of the following lands:*
>
> *(a) Lands owned or controlled by the federal government or any agency of the federal government.*

(b) Lands within the exterior boundaries of any city, except a city and county with a population of less than 25,000 if, at the time the city and county government is established, the county contains no municipal corporations.

(c) Any other lands within the state which do not come within any of the classes which are described in Section 4126.

The methodology for determining FRA, SRA, and LRA within California is described in the California Department of Forestry and Fire Protection (CAL FIRE) State Responsibility Area Classification System (Figure PD-1-1).[1] The land classified as SRA is reviewed every 5 years to determine if it still meets the qualifications for SRA; this PEIR uses data from the most recent 2018 review. This PEIR primarily applies to the SRA and only applies to LRA as it applies to fuel breaks, FRA is excluded in its entirety.

PD-1.1.3 Fuel Types

The CalVTP identified treatable fuel types, within both SRA and LRA. The treatable fuel types (tree, brush, grass) were assembled by their respective California Wildlife Habitat Relationship (CWHR) name and extracted out of the FVEG15_1[2] to create the CalVTP fuel type layer (Figure PD-1-2). Section 2.4.1 in Chapter 2, "Program Description," discusses the rationale for grouping fuel types into three treatable fuel types.

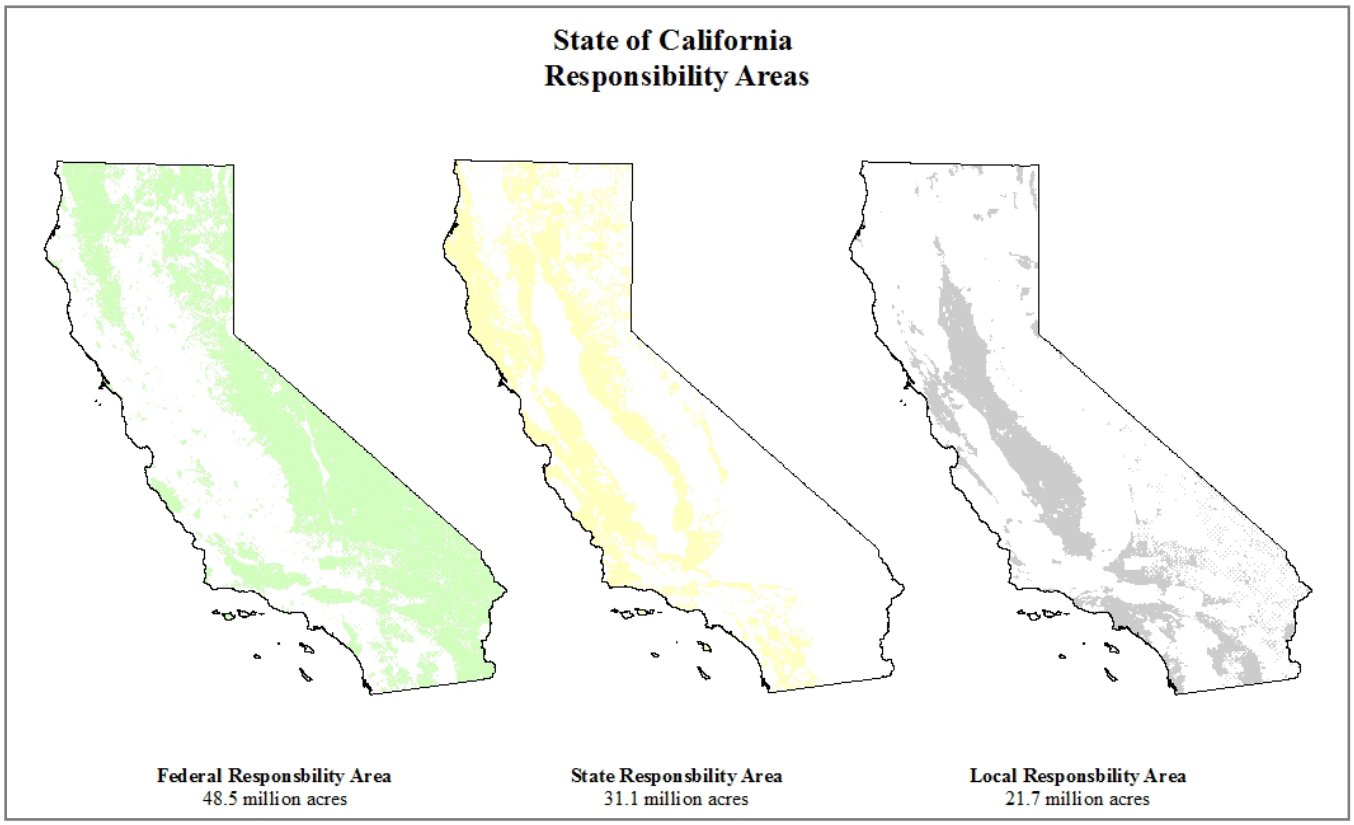


Figure PD-1-1 Responsibility areas within the State of California.

[1] Available at http://frap.fire.ca.gov/projects/sra_review/downloads/2015_SRA_Review/SRA_Classification_System_Update.pdf
[2] Available at http://frap.fire.ca.gov/data/frapgisdata-sw-fveg_download.php.

FVEG15_1 was initially created by CAL FIRE Fire Resource and Assessment Program (FRAP) to compile the "best available" land cover data into a single data layer to support the legislatively mandated Forest and Rangeland Assessment. CAL FIRE, in cooperation with California Department of Fish, Wildlife VegCamp program, and extensive use of the USDA Forest Region 5 Remote Sensing Laboratory data, compiled the "best available" land cover data available for California into single comprehensive statewide data set. The data spans a period from approximately 1990 to 2014. Typically, the most current, detailed and consistent data were collected for various regions of the state. Decision rules were developed that controlled which layers were given priority in areas of overlap. Cross-walks were used to compile the various sources into the common classification scheme, the CWHR system. Approximately 57 percent of the state was mapped from USDA USFS CALVEG data, and 29 percent was mapped from VegCamp Manual of California Vegetation Classification system (MCV) data using crosswalks supplied by VegCamp staff. The remaining 14 percent comes from mostly federal sources that were used to identify urban areas (NLCD), Agriculture (NASS), and LANDFIRE to fill in desert lands that had not been mapped by any California efforts. Both the CALVEG and MCV are more detailed classifications then the CWHR data, so specific CALVEG or MCV types often get lumped into CWHR types. For example, CALVEG types Coastal Live Oak (QA), California Bay (QB), madrone (QH), Engleman Oak (QN), California Walnut (QV), and Interior Live Oak (QW) CALVEG types all crosswalk into the CWHR type Coastal Oak Woodland (COW). Similar crosswalks were used for migrating MCV data to CWHR.

PD-1.1.4 Program Treatments

The proposed CalVTP includes three different treatments types: WUI fuel reduction, fuel breaks, and ecological restoration. Each requires a different analysis to determine which areas of the SRA are appropriate for potential later activities under each treatment type. See Table PD-1-1 for a summary of the analysis performed for each treatment type.

Table PD-1-1 CalVTP Treatment Analysis

	WUI Fuel Reduction	Fuel Breaks		Ecological Restoration
Base Layer	WUI Zones	Ridgelines	Roads	SRA
Overlays	SRA	SRA & LRA	SRA & LRA Condition Class 2 & 3 WUI	Condition Class 2 & 3
Exclusions	Non-WUI			WUI
Proximity		150 foot buffer	150 foot buffer	

WILDLAND URBAN INTERFACE

The A.1.4.1 Wildland Urban Interface (WUI) Treatment Area was derived from WUI12_2[3] and SRA18_2.[4] WUI was identified and extracted from WUI12_2. SRA was identified and extracted from SRA18_2. WUI and SRA were then overlaid with each other and areas of overlap create the WUI fuel reduction treatment area for the CalVTP.

The methodology for the original creation of WUI03_1 can be found in *Characterizing the Fire Threat to Wildland-Urban Interface Areas in California*, included in this appendix. The mythology for WUI03_1 and WUI12_2 is foundationally the same, but WUI12_2 utilizes updated and more precise datasets to further refine the modeled wildland urban interface.

[3] Available at http://frap.fire.ca.gov/data/frapgisdata-sw-wui.php
[4] Available at http://frap.fire.ca.gov/data/frapgisdata-sw-sra_download

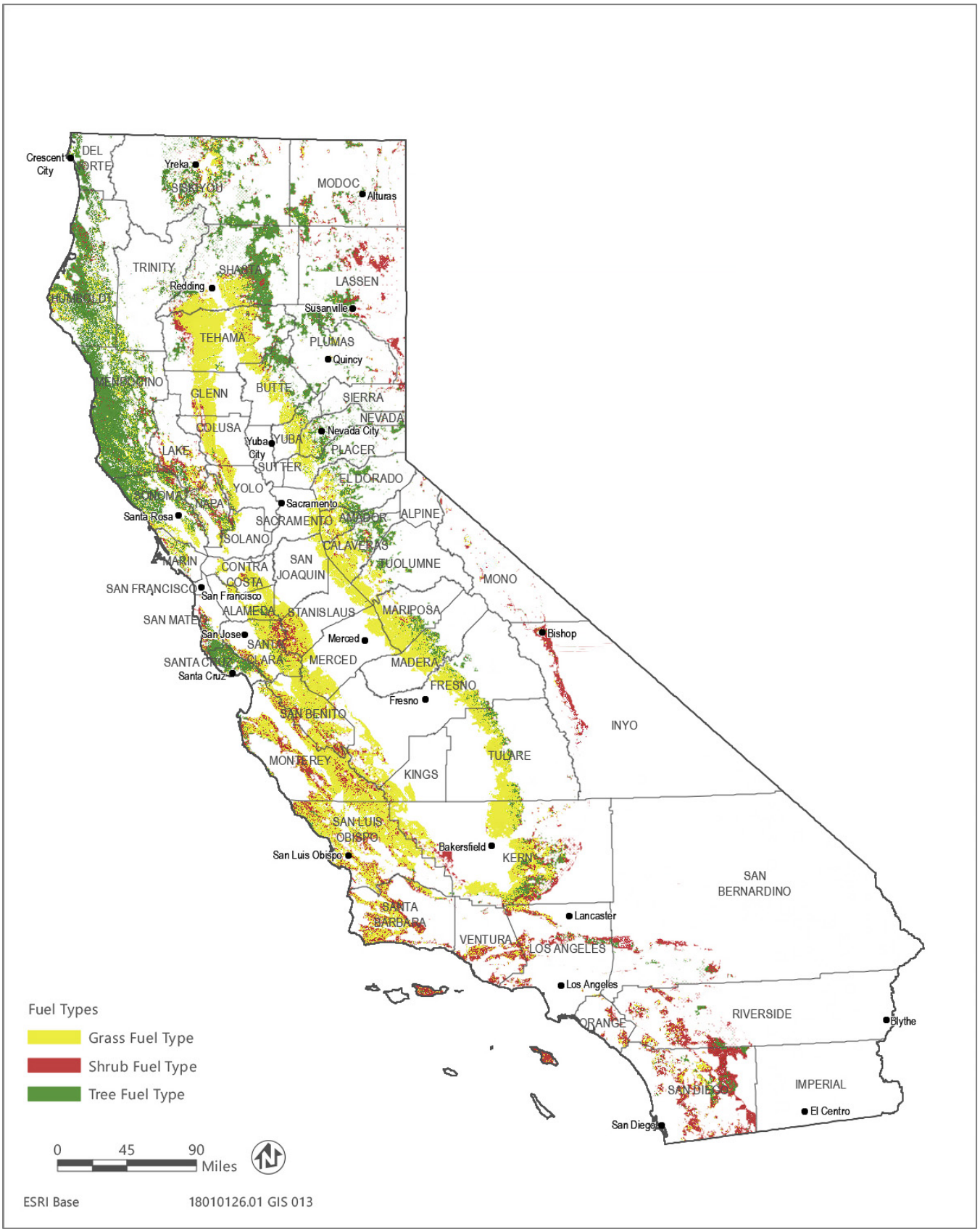


Figure PD-1-2 Fuel Types in the Treatable Landscape.

Spatial Modeling for WUI

In 2001 CAL FIRE FRAP, in conjunction with the California Fire Alliance, undertook the task of spatially modeling the WUI. The modeling process combines three main factors: fire threat, human asset exposure, and proximity.

Using these three building blocks, maps were developed that defined a WUI footprint and contained specific information that supports the development of strategies to prioritize mitigation efforts to achieve efficient results. All three components contribute to a risk assessment of potential loss from wildfire. The larger the hazard, the more assets exposed, and the closer these components are to one another, the higher the risk of loss.

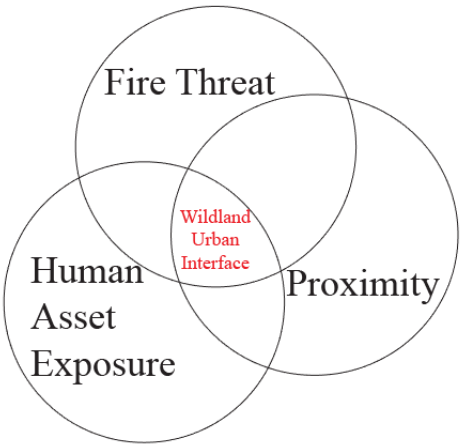
Wildland Fire Hazards

Wildland fire hazards is a combination of defining the fuel hazard and identifying the probability of burning.

Defining The Fuel Hazard

CAL FIRE FRAP began the process of modeling the WUI fuel reduction treatment area by defining the fuel hazard. This was achieved by first developing a comprehensive fuel type map consisting of fuel composition and structure information. The comprehensive fuel type map was then joined to the Fire Behavior Prediction System (FBPS) fuel models, a similar method to the one utilized in the Sierra Nevada Ecosystem Project. Recent large fires were then captured in the data with appropriate burn and growth models applied. This information was converted to a fire hazard map by calculating the expected fire behavior for unique combination of slope and fuels under average bad fire weather conditions. Each fuel-by-slope-class combination received a surface hazard rank.

A final fuel hazard product was created by gridding the state into approximately 450-acre squares and assigning a hazard rank to each grid cell based on its slope class, fuel model, and the presence of ladder and crown fuels. The assigned values consisted of Very High, High, and Moderate.



Probability Of Burning

The probability of fire burning in a given location is based on a variety of factors including vegetative fuel condition, weather, ignition sources, fire suppression response (FRAP 2003). Through the utilization of 47 years of fire history, fire perimeters, and the comprehensive fuel type map described above, an annual likelihood that a large damaging fire would occur in a particular fuel type was developed. This probability matrix is referred to as Probability of Burning ("PFIRE"), where:

- Very High is the probability of fire 1 percent per year or greater,
- High is the probability of fire 0.33 percent - 1 percent per year, and
- Moderate is the probability of fire is less than 0.33 percent per year.

These values relate to fire frequency equivalents of less than 100 years, 100-300 years, and greater than 300 years, respectively.

Assesing Fire Threat

The fire threat is derived by combining Fuel Hazard ("Hazard Rank") and PFIRE into Table PD-1-2, which determines areas of high, moderate, and low fire threat. The creation of the fire threat in the modeling process is an important building block when identifying the WUI fuel reduction treatment area geospatially.

Table PD-1-2 Fire Threat Matrix

PFIRE	Hazard Rank		
	Very High	High	Moderate
Very High	HIGH	HIGH	HIGH
High	HIGH	HIGH	MODERATE
Moderate	HIGH	MODERATE	LOW

Human Asset Exposure

Human asset exposure was defined by identifying categories in the interface:

- Urban – 1+ house per ½ acre,
- Intermix – 1 house per ½ acre to 1 house per 5 acres,
- Rural – 1+ house per 5 acres to 1 house per 40 acres, and
- Wildland – less than 1 house per 40 acres.

Census block data was used to determine the number of structures per acre. Census blocks are typically designed to represent 400 people, leading to wide variation in block size. Census blocks do not distinguish restricted development areas (federal lands), from unrestricted developed areas (private lands). Therefore, to accurately capture housing densities, FRAP spatially redistributed the populations off restricted development lands. All federal lands were considered restricted development lands for the analysis. For example, if a census block had 400 people over 20 acres, but 10 of those acres were restricted development lands, the population would be adjusted from 20 houses per acre up to 40 houses per acre for unrestricted lands.

The identification of interface categories creates a measure of human asset exposure, completing another building block of defining the WUI fuel reduction treatment area geospatially.

Proximity

Proximity can be described as areas where human assets and the vicinity of a fire threat intersect. Vicinity is defined, in accordance with 2001 California Fire Alliance research, as all areas within 1.5 miles of a fire threat. The 1.5-mile distance is the approximate distance embers and flaming material (firebrands) can be carried from a wildland fire to the roof or other part of a structure. All Intermix and Rural areas (established via the human asset exposure modeling described on the previous page) within 1.5 miles of a fire threat (established via the wildfire hazard modeling described above) were labeled with the highest threat rank, while urban areas were labeled with the highest threat rank if they were within 0.25-mile of a fire threat. This includes more urban, developed areas in close proximity to wildland areas in the defined WUI, while excluding the urbanized areas in the central parts of cities. By identifying the proximity of human assets to a fire threat, a geospatial representation of the WUI fuel reduction treatment area emerges.

Two zones also emerge within the model: the defense zone and the threat zone. These two zones are sometimes referred to as the WUI Zone of Influence. The defense zone is the immediate 0.25-mile distance extending from the urbanized area, while the threat zone is the 1.25-mile further extending from that 0.25-mile buffer towards the wildlands. These zones of influence represent the proximal lands where different types of treatments would likely influence risk to people, property, and other infrastructure. These zones can assist in the prioritization of subsequent activities.

FUEL BREAKS

Identifying the potential treatment areas for fuel breaks for analysis purposes for the CalVTP combined two linear geospatial features: ridgelines and roadways. Although actual fuel break treatment widths will depend on specific fuel

types and terrain, a 150-foot buffer on each side of the linear feature was created for the purposes of conducting a consistent environmental analysis.

The fuel break treatment area was derived through an analysis of ridgelines and roadways. There is no standard dataset for California that identifies ridgelines within the state. A ridgeline model was created from a 30-meter USGS Digital Elevation Model (DEM) of California; the hydrological toolset within Environmental Systems Research Institute (ESRI's) ArcMap was reversed to acquire ridgelines instead of steams. More information about that process can be found at ESRI's website.[5]

Ridgelines

While the ridgelines created an accurate model for a large majority of the state, issues occurred when modeling mesa areas in southern California and Modoc, therefore some areas within the southern California and Modoc areas may show slightly higher treatable acres than what is truly available under the fuel break treatment type. The identified ridgelines were given a 150-foot rounded buffer and then overlaid with SRA and LRA. Areas were extracted where the two layers intersected to create the ridgeline features of the fuel break treatment area.

Roadways

Multiple statewide road datasets exist with varying degrees of accuracy and extensiveness. Within CAL FIRE there is no single statewide road dataset, but instead multiple micro datasets encompassing each CAL FIRE Unit's sphere of influence within their Computer Aided Dispatch (CAD) system, so a generic ESRI road dataset was utilized that encompassed all of California. Roads that were within the FRA were excluded from analysis and a 150-foot buffer was applied to each side of the remaining roadways, as was applied to ridgelines. Roadways were further narrowed down to include only those in the defined WUI fuel reduction and areas designated as Condition Classes 2 and 3.

Fuel Break Treatment Areas

For analysis, the ridgelines and roadways datasets were combined and any areas of redundancy between the two datasets were removed. This combined dataset provided the basis to analyze the environmental effects of the fuel break treatment type in this document. However, it is unrealistic and unlikely that all the ridgelines and roadways modeled in this analysis will be treated under the CalVTP.

ECOLOGICAL RESTORATION

The ecological restoration treatment area was derived from SRA18_2, CAFRCC03_2, and WUI12_2. SRA, Condition Class 2 or 3, and Non-WUI were overlaid and overlapping areas were identified to create the Ecological Restoration Treatment Area for analysis within the VTP.

Spatial Modeling

Spatially, acres eligible for ecological restoration treatments under the CalVTP were identified by excluding the modeled WUI fuel reduction treatment area, then determining where areas of Condition Class 2 or 3 (discussed below) existed in the remaining landscape.

Condition Class

Condition class is defined as the "relative risk of losing key components that define an ecosystem" (Hardy et al. 2001). Conditional classes identified as 2 (Moderate) or 3 (High) are areas where fire behavior is uncharacteristic and vegetation composition is altered due to the loss of the key components of an ecosystem. These areas have vegetation structures and fire frequencies that have deviated from historical levels and pose a moderate or high-risk threat to ecosystem health.

While modeling the proximity of fire threats to human assets between 2001 and 2003, FRAP also undertook spatial modeling to define and describe the fire-related risks to ecosystems. FRAP analyzed expected fires in comparison to historic fire regimes with respect to fire frequency, size, patchiness, and effects on key ecosystem elements and

[5] Available at http://support.esri.com/cn/knowledgebase/techarticles/detail/39093

processes (FRAP 2003). Condition classes were assigned based on current vegetation type and structure, an understanding of pre-settlement fire regime, and current conditions regarding expected fire frequency and potential fire behavior. The conceptual basis is that for fire-adapted ecosystems, much of their ecological structure and processes are driven by fire and disruption of fire regimes leads to changes in plant composition and structure, uncharacteristic fire behavior, opportunities for pests, altered hydrologic processes, and increased smoke production (**Error! Reference source not found.**).

Table PD-1-3 Condition Class Definitions

Condition Class	Departure from Natural Regime	Vegetation Composition, Structure, Fuels	Fire Behavior, Severity, Pattern	Disturbance Agents, Native Species, Hydrologic Functions	Increased Smoke Production
Low (Condition Class 1)	None, minimal	Similar to natural	Similar to natural	Within natural range of variation	Low
Moderate (Condition Class 2)	Moderate	Moderately altered	Uncharacteristic	Outside historic range	Moderate
High (Condition Class 3)	High	Substantially Different than natural	Highly uncharacteristic	Substantially outside historic range	High

Approximately 15.5 million acres within the SRA are ecologically at risk from fire (Moderate and High condition classes), with almost 6 million acres in High/Condition Class 3. A regional assessment of fire risk to ecosystems uses the total amount of area in the Moderate and High condition classes compared to the total SRA. This regional summary also reveals the diverse types of habitats that fire threatens across California.

Condition class provides a parameter for prioritizing projects under ecological restoration treatments. All fuel types eligible for treatment in Condition Class 2 or 3 that are outside the defined WUI are eligible for ecological restoration activities under the CalVTP. Condition class, however, does not distinguish between a negative and positive deviation from the fire return interval; an evaluation of the existing conditions of the specific activity area needs to be conducted to establish the most appropriate action for moving forward on a site-specific basis.